

Workshop Manual

Audi A1 2011 ➤ , Audi A3 2013 ➤ ,
Audi A3 Cabriolet 2015 ➤ ,
Audi A3 Limousine 2014 ➤ ,
Audi A3 Limousine China 2014 ➤ ,
Audi A3 Sportback 2013 ➤ ,
Audi A3 Sportback China 2014 ➤ ,
Audi A4 2015 ➤ , Audi A4 Avant 2015 ➤ ,
Audi A5 Cabriolet 2009 ➤ ,
Audi A5 Coupé 2008 ➤ ,
Audi A5 Sportback 2010 ➤ ,
Audi A6 2011 ➤ , Audi A6 China 2012 ➤ ,
Audi A7 Sportback 2011 ➤ ,
Audi A8 2010 ➤ , Audi Q3 2012 ➤ ,
Audi Q3 China 2013 ➤ , Audi Q5 2008 ➤ ,
Audi Q5 China 2010 ➤ , Audi Q7 2016 ➤ ,
Audi R8 2015 ➤ , Audi TT 2015 ➤

Air conditioners with refrigerant R1234yf - General information

Edition 06.2016

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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 precautions

(ARL002444; Edition 06.2016)

⇒ [“1.1 Safety precautions when working on air conditioners”, page 1](#)

⇒ [“1.2 Safety precautions when handling refrigerants”, page 1](#)

⇒ [“1.3 Safety precautions for working on vehicles with start/stop system”, page 2](#)

⇒ [“1.4 Safety precautions for handling air conditioner service stations”, page 2](#)

⇒ [“1.5 Safety precautions when working on vehicles with high-voltage system”, page 3](#)

⇒ [“1.6 Safety precautions when working in the vicinity of high-voltage components”, page 4](#)

⇒ [“1.7 Safety precautions when handling pressure vessels”, page 4](#)

1.1 Safety precautions when working on air conditioners

Danger to life and risk of explosion due to ignition sources

Danger to life and risk of explosion if ignition sources are in proximity to air conditioners and refrigerant vessels. Escaping refrigerant can ignite and cause an explosion. Danger of severe or fatal injuries due to explosion.

- Never bring ignition sources close to air conditioners or refrigerant vessels.
- Avoid electrostatic discharge, sparks from the striking of tools and hot surfaces.

Risk of irreparable damage to refrigerant lines

A torn inner film can cause irreparable damage to refrigerant lines.

- Never bend refrigerant lines with a radius less than $r = 100$ mm.

1.2 Safety precautions when handling refrigerants

Risk of asphyxiation and poisoning from refrigerants

Refrigerant fumes can cause a dry cough, nausea and even asphyxiation or poisoning.

- Never inhale refrigerant fumes.
- Only work on the refrigerant circuit and keep refrigerant vessels in well ventilated rooms.
- Never work in proximity to cellar entrances or other underground areas.

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- Switch on the extraction system.



Danger of frostbite from refrigerant

Refrigerant can escape under pressure during work on the air conditioner. The skin and other parts of the body can suffer frostbite.

- Wear protective gloves.
- Wear safety goggles.
- Extract the refrigerant and immediately open the refrigerant circuit.
- Extract the refrigerant again if more than 10 min have passed since initial extraction and the refrigerant circuit has not been opened. Renewed evaporation leads to the build-up of pressure in the refrigerant circuit.

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

Risk of injury from engine starting unexpectedly

The engine can start unexpectedly if the vehicle's start/stop system is activated. A message in the instrument cluster indicates whether the start/stop system is activated.

- To deactivate start/stop system: Switch off ignition.

1.4 Safety precautions for handling air conditioner service stations

- Before connecting the charging system to the air conditioning system, ensure that the shut-off valves are closed.
- Before disconnecting the air conditioner service station from the air conditioner, make sure that the process is complete, so that the least possible, technically unavoidable, amount of refrigerant is released into the atmosphere.
- After the cleaned refrigerant has been filled into an external compressed gas cylinder by the air conditioner service station /extraction system, close the manual shut-off valves on the cylinder and on the charging system.
- Do not expose the air conditioner service station , extraction and charging system to moisture and do not use in a damp environment.
- Disconnect the power supply before performing work on the air conditioner service station , extraction and charging system.
- To reduce the danger of fire, avoid using an extension cable. If this is however necessary, use an extension cable with a cross-sectional area of min. 2.5 mm².
- In case of fire, remove the external cylinder.
- If oil from the suction accumulator of the air conditioner service station is siphoned out of the air conditioner into the supplied measurement vessel, ensure that it is poured into a sealable

container afterwards, as this oil contains a small quantity of refrigerant, which must not be released into the environment.

- When positioning the air conditioner service station , secure it so it cannot roll away.

Only position and use the air conditioner service station with refrigerant R1234yf in cool, well ventilated places

- Protect from heat and direct sunlight and do not position and use in areas with temperatures above 50 °C.
- Do not position and use in proximity to cellars or other underground areas
- Only position and use in areas with adequate fresh air and ventilation (complete air exchange at least once an hour in the workshop area and three times an hour in low-lying areas (e.g. in assembly groups).

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1.5 Safety precautions when working on vehicles with high-voltage system

High voltage can cause fatal injury

The voltage levels in the high-voltage system constitute a safety hazard. Danger of severe or fatal injuries from electric shock.

- Persons with life-preserving or other electronic medical devices in or on their body must not perform any work on the high-voltage system. Such medical devices include internal analgesic pumps, implanted defibrillators, pacemakers, insulin pumps and hearing aids.
- The high-voltage system must be de-energised by a suitably qualified person.

Risk of injury from engine starting unexpectedly

It is difficult to determine whether the drive system of an electric vehicle or hybrid vehicle is active. Moving parts can trap or draw in parts of the body.

- Switch off ignition.
- Place ignition key outside vehicle.

Risk of damage to high-voltage wiring

Incorrect handling may result in damage to the insulation for high-voltage wires or high-voltage connectors.

- Never use high-voltage wiring or high-voltage connectors as a support.
- Never prop tools against high-voltage wiring or high-voltage connectors.
- Never bend or kink high-voltage wiring.
- Pay attention to coding when connecting high-voltage connections.



Risk of injury when auxiliary air conditioning is activated

The auxiliary air conditioning can be switched on inadvertently in electric and hybrid vehicles with activated auxiliary air conditioning. Radiator fans starting automatically can trap or draw in parts of the body.

- Deactivate the auxiliary air conditioning.

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

High voltage can cause fatal injury

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The voltage levels in the high-voltage system constitute a safety hazard. Danger of severe or fatal injuries from electric shock if high-voltage components or high-voltage wiring are damaged.

- Carry out visual check of high-voltage components and high-voltage wiring.
- Never use cutting/forming tools or other sharp-edged implements.
- Never weld, solder, or use hot air or thermal bonding equipment.

1.7 Safety precautions when handling pressure vessels

Danger to life and risk of explosion due to ignition sources

Danger to life and risk of explosion if ignition sources are in proximity to air conditioners and refrigerant vessels. Escaping refrigerant can ignite and cause an explosion. Danger of severe or fatal injuries due to explosion.

- Never bring ignition sources close to air conditioners or refrigerant vessels.
- Avoid electrostatic discharge, sparks from the striking of tools and hot surfaces.

2 Laws and regulations

⇒ [“2.1 Legal stipulations and directives”, page 5](#)

⇒ [“2.2 Charging the refrigerant circuit with other refrigerants”, page 6](#)

⇒ [“2.3 Occupational Health & Safety”, page 6](#)

2.1 Legal stipulations and directives



Note

- ◆ *The laws and regulations below apply to the Federal Republic of Germany; different or additional laws or regulations may apply in other countries.*
- ◆ *Nowadays the effects of climate change can be seen throughout the world. Climate protection is thus one of the most important problems to be tackled. Solving this problem does however represent an enormous challenge for everybody.*
- ◆ *The Kyoto Protocol defines global objectives for protecting the climate. This protocol contains reduction targets both for carbon dioxide and fluorinated greenhouse gases, e.g. for the refrigerant R134a on account of the high greenhouse potential.*
- ◆ *Vehicles that were already type-tested before 2011 may only be introduced onto the road with refrigerant R134a until 31.12.2016 (this applies to EU countries, other regulations may apply in countries outside the EU). As of 01.01.2017, only vehicles with refrigerant with a GWP of less than 150 may be introduced onto the road in EU countries. Refrigerant R1234yf satisfies the stipulations of Regulation (EC) No. 706/2007.*

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For vehicle trade and repairs, numerous relevant laws have been passed, e.g. at European level. At national level - in the Federal Republic of Germany, for example - a new Chemical Climate Protection Regulation also came into force on 1 August 2008, to further clarify the European legislation.

Various regulations have been issued in the European Community for the handling of refrigerants, e.g.:

- ◆ 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

Additional regulations have been issued in the Federal Republic of Germany for refrigerants, e.g.:

- ◆ Chemical Climate Protection Regulation, Closed Substance Cycle and Waste Management Act.
- ◆ TRG (Technical Regulations for Compressed Gases)



Note

Refrigerant R1234yf is currently not yet named in the various laws and regulations. However, due to its chemical composition the assumption is that it will be included when the relevant laws and regulations are revised. Therefore, the laws and regulations that apply to refrigerant R134a must also be noted and complied with when handling refrigerant 1234yf.

Maintenance and repair work on air conditioner refrigerant circuits

Only persons who can prove the relevant technical expertise in accordance with Regulation (EC) No. 307/2008 may carry out repairs and service work on the refrigerant circuit of the air conditioner (applies to countries in which this regulation is valid; different regulations or laws may apply in other countries).

The following is however generally applicable:

Operation, maintenance, shutdown, obligation to accept return

- ◆ With regard to the operation, repair and shutdown of items containing refrigerants, it is prohibited to contravene the state of the art by allowing the substances contained in these to escape into the atmosphere.
- ◆ Records should be kept about the quantity used during operation and maintenance work, so that proof of use can be submitted to the relevant authority if so requested. Following a regulation by the European Parliament in 2005, a record sheet no longer needs to be kept in the EC. Other regulations may apply in countries not belonging to the EC.
- ◆ Distributors of the substances and preparations listed in the above-mentioned regulations are obliged to take back such substances and preparations after use or to ensure that these are taken back by a third party appointed by the distributor.
- ◆ The maintenance and shutdown of items containing refrigerants listed in the regulations mentioned as well as the return of the substances and preparations may only be performed by persons with the required expertise and technical equipment.

Closed Substance Cycle and Waste Management Law and the processing and disposal of contaminated refrigerant and refrigerant oil

Please note the applicable rules and regulations of the country in question.

2.2 Charging the refrigerant circuit with other refrigerants

Air conditioners that have been developed and designed for refrigerant R1234yf must not be charged with other refrigerants, e.g. R134a.



Note

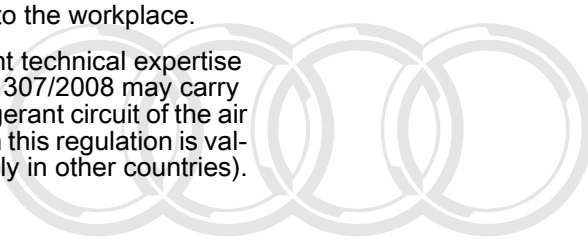
As legislation currently stands, refrigerant R134a must not be used in vehicles that were type-tested with refrigerant R1234yf.

2.3 Occupational Health & Safety

- ◆ Regulations for general occupational health & safety according to the VBG (Federation of Commercial Trade Associations), e.g. VGB 20 Accident Prevention Regulations (UVV) for "Air Conditioners, Heat Pumps and Cooling Devices" and VGB

1 General Regulations “General Regulations and Obligations for the Company” and “Obligations for Insured Parties”.

- ◆ Note the operating instructions specific to the workplace.
- ◆ Only persons who can prove the relevant technical expertise in accordance with Regulation (EC) No. 307/2008 may carry out repairs and service work on the refrigerant circuit of the air conditioner (applies to countries in which this regulation is valid; different regulations or laws may apply in other countries).




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3 Repair instructions

⇒ [“3.1 Rules on cleanliness”, page 8](#)

⇒ [“3.2 Seals for the refrigerant circuit”, page 8](#)

⇒ [“3.3 Refrigerant and refrigerant oil”, page 10](#)

⇒ [“3.4 Handling pressure vessels”, page 12](#)

⇒ [“3.5 Handling refrigerant”, page 13](#)

3.1 Rules on cleanliness

Even minor impurities can lead to defects, therefore observe the following rules on cleanliness when working on the air conditioner:

- ◆ Seal off open lines and connections immediately with clean plugs, for example from engine bung set - VAS 6122- .
- ◆ Place removed parts on a clean surface and cover, using lint-free cloths.
- ◆ Carefully cover or seal opened components, if repairs cannot be performed immediately.
- ◆ Only install clean components: Replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been stored out of their packaging (e.g. in toolboxes).
- ◆ Do not work with compressed air when the system is open.
- ◆ Protect unplugged electrical connectors from dirt and damp and only connect if dry.

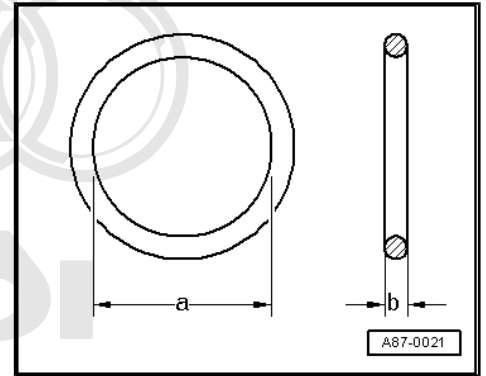
3.2 Seals for the refrigerant circuit

- ◆ Only use seals that are resistant to refrigerant R1234yf and associated refrigerant oils. Seals are no longer colour-coded. Black and coloured seals are used. Therefore, only use seals that can be clearly assigned ⇒ Electronic parts catalogue .
- ◆ Seals that were developed for refrigerant R134a are not always suitable for refrigerant R1234yf. Therefore, only use seals that can be clearly assigned ⇒ Electronic parts catalogue .
- ◆ Seals are only to be used once.
- ◆ Replace sealing rings after removal.
- ◆ Coat sealing rings with refrigerant oil before installation.
- ◆ Make sure that sealing rings are correctly seated on the pipe or in the groove.
- ◆ Ensure absolute cleanliness when working. Even the slightest contamination, e.g. a hair, can cause leakage.
- ◆ Only install sealing rings that are resistant to refrigerant R1234yf and the associated refrigerant oil. These sealing rings can be colour-coded to eliminate any confusion ⇒ Electronic parts catalogue .

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Dimensions -a- and -b- vary depending on the fitting location of the sealing ring ⇒ Electronic parts catalogue .

Further information and notes: ⇒ ["1.2.15 Seals", page 54](#)



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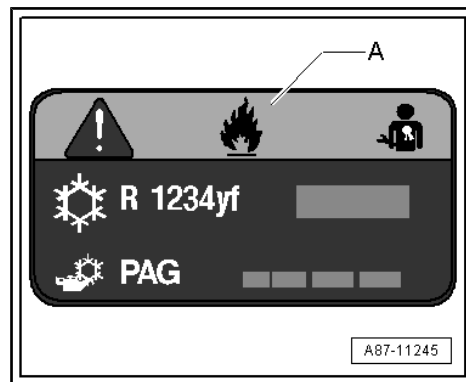
3.3 Refrigerant and refrigerant oil

⇒ [“3.3.1 Important repair instructions for refrigerant and refrigerant oil”, page 10](#)

⇒ [“3.3.2 Refrigerant oil”, page 10](#)

3.3.1 Important repair instructions for refrigerant and refrigerant oil

- Do not add refrigerant R134a to air conditioners for refrigerant R1234yf.
- Do not add refrigerant R1234yf to air conditioners for refrigerant R134a.
- The refrigerant oils that have been specially developed for refrigerant circuits with refrigerant R1234yf and R134a may only be used in a refrigerant circuit charged with an alternative refrigerant if the relevant approval has been granted ⇒ Electronic parts catalogue and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).
- Air conditioner service stations that come into contact with refrigerant may only be used for the intended refrigerant.
- A label -A- stating which refrigerant is used is affixed to the lock carrier or in the plenum chamber in the engine compartment.
- Different refrigerants are never to be mixed.
- Depending on the version and production period, possibly stating the GWP (Global Warming Potential) of the refrigerant used.
- To make sure that only refrigerant R1234yf with a particular purity is drawn into the R1234yf- air conditioner service station , perform a gas analysis before draining the refrigerant circuit
⇒ [“2.3 Performing a gas analysis on the refrigerant”, page 143](#) .



Note

If the gas analysis reveals that refrigerant R1234yf is contaminated with another gas, this must be extracted from the refrigerant circuit and analysed, treated or disposed of, as a gas of unknown composition, in accordance with legal provisions ⇒ VW/Audi ServiceNet ,

⇒ [“2.3 Performing a gas analysis on the refrigerant”, page 143](#)

and

⇒ [“6.2.17 Returning contaminated refrigerant R1234yf for analysis, treatment or disposal”, page 27](#) .

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3.3.2 Refrigerant oil



CAUTION

Danger of acid burns from atomised refrigerant oil. Risk of injury to eyes and other parts of the body.

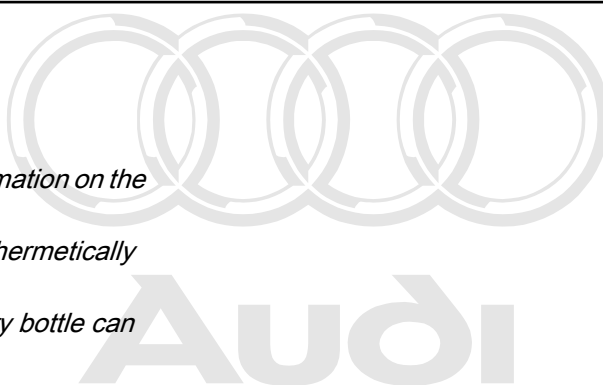
- Wear protective gloves.
- Wear safety goggles.
- Never inhale atomised refrigerant oil.

- ◆ Refrigerant oil mixes (approx. 10 - 40 % depending on type of compressor and quantity of refrigerant) with the refrigerant, continually circulates in the circuit and lubricates moving parts.
- ◆ In R1234yf air conditioners, special synthetic refrigerant oils, e.g. polyalkylene glycol (PAG) oil, are used with certain additives specially adapted to the refrigerant. This is necessary because mineral oil does not mix with R1234yf, for example and unwanted reactions with the refrigerant or refrigerant circuit components may occur if this additive is missing. Furthermore, if the mixture flows through the refrigerant circuit under pressure or at high temperatures, or the lubricating film in the air conditioner compressor breaks down, the components of the R1234yf air conditioner may be damaged. The use of non-approved oils can lead to air conditioner failure. Therefore, only charge system with approved refrigerant oils ⇒ Electronic parts catalogue .
- ◆ Oil grade for refrigerant R1234yf in vehicles: PAG oil with certain additives (polyalkylene glycol with certain additives) that are specially adapted to refrigerant R1234yf.
- ◆ The most important properties are a high degree of solubility with refrigerant, good lubricity, absence of acid and minimal water content. For this reason, only very special oils may be used; see list of approved refrigerant oils and capacities ⇒ Electronic parts catalogue and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).
- ◆ PAG oils suitable for refrigerant R1234yf are very hygroscopic and cannot always be mixed with other oils. Therefore, only use approved refrigerant oils.
- ◆ Moisture and acids promote the ageing of refrigerant oil, causing it to become dark, viscous and corrosive towards metals. Therefore, keep containers of refrigerant oil closed to protect against the ingress of moisture. Reseal open containers immediately.
- ◆ On account of its chemical properties, the refrigerant oil is not to be disposed of together with engine or gear oil. Refrigerant oil must be disposed of as used oil of unknown origin (note local regulations) ⇒ VW/Audi ServiceNet .
- ◆ For refrigerant circuits with refrigerant R1234yf, only use oil approved for this refrigerant and the installed air conditioner compressor ⇒ Electronic parts catalogue and .
- ◆ Refrigerant oil that was developed for refrigerant R134a is unsuitable for refrigerant circuits with refrigerant R1234yf (certain additives are missing). Therefore, ensure the correct type, ⇒ Electronic parts catalogue and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).
- ◆ Refrigerant oil that was developed for refrigerant R1234yf may also be suitable for refrigerant circuits with refrigerant R134a. Pay attention to notes⇒ Electronic parts catalogue and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).
- ◆ **Do not use ester oils (POE oils).** These are currently only intended for larger systems with different operating conditions (not for automotive air conditioners).
- ◆ Do not store refrigerant oil open as it is extremely hygroscopic (attracts water).
- ◆ Always keep the refrigerant circuit and containers of refrigerant oil closed.



Note

- ◆ *The delivery bottle of refrigerant oil contains information on the use-by date of the refrigerant oil it contains.*
- ◆ *This date can be ignored if the delivery bottle is hermetically sealed.*
- ◆ *Refrigerant oil from a hermetically sealed delivery bottle can also be used after the time stated on the bottle.*



3.4 Handling pressure vessels

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Store hermetically sealed containers in a cool, well ventilated place.

Refrigerant is heavier than air. If gas escapes it will predominantly be in the area of the floor.

Protect from heat and direct sunlight, do not store in areas with temperatures above 50 °C.

Do not store in or close to cellars or other low-lying areas.

Only use in areas with adequate fresh air ventilation.

Keep containers away from ignition sources!

Do not smoke in areas containing refrigerant R1234yf. In addition, take precautions against electrostatic charging.

Secure vessels to prevent them falling over.

Secure upright cylinders to stop them falling over and cylinders lying flat to stop them rolling away.

Vessels are never to be thrown.

If containers fall they may be so strongly deformed that they crack. The refrigerant evaporates immediately, liberating considerable force. Flying fragments of cylinders can cause severe injuries.

To protect the cylinder valves, cylinders are only to be transported with the protective cap screwed on.

Cylinder valves may break off if not properly transported.

Never store in the vicinity of radiators,

as high temperatures may occur in these areas. High temperatures are also accompanied by high pressures and the maximum permissible vessel pressure may be exceeded.

Never heat to above 50 °C

To eliminate any danger, the Pressure Vessel Directive stipulates that vessels of refrigerant must not be heated above 50 °C.

Do not heat in an uncontrolled manner

Do not heat with a naked flame under any circumstances. Localised overheating can cause structural changes in the vessel material, which then reduce its ability to withstand pressure. There is also a danger of the refrigerant decomposing due to localised overheating.

Seal empty vessels

Empty refrigerant containers must always be closed to prevent the penetration of moisture. Moisture causes steel containers to rust. Rust weakens the container walls. In addition, rust particles escaping from containers and entering the refrigerant circuit can cause damage there.

3.5 Handling refrigerant



Note

- ◆ *Refrigerant is virtually odourless and as such is mostly imperceptible.*
 - ◆ *Refrigerant gas is heavier than air; it accumulates in low-lying areas such as inspection pits, cellars and hollows, where it forces out the ambient air and therefore the oxygen. Staying in areas low in oxygen can be potentially fatal.*
 - ◆ *If liquid refrigerant escapes, e.g. due to a leak, it evaporates at around -29.4 °C at an ambient pressure of approx. 1 bar. If refrigerant evaporates on the skin, this leads to frostbite or cold burns. Sensitive parts of the body such as the cornea and the mucous membranes are particularly at risk here. Larger cold burns can be potentially fatal.*
 - ◆ *Refrigerant is flammable. Electrostatic discharge, sparks from the striking of tools, hot surfaces and open flames can ignite a mixture of refrigerant R1234yf and ambient air. However, refrigerant only burns with the support of a flame, or in proximity to a hot surface. The refrigerant flame is extinguished if the supporting flame or other trigger is no longer present.*
 - ◆ *Refrigerant decomposes in contact with a flame or hot surface. Danger of intoxication if toxic breakdown products are inhaled. If a pungent odour is present, decomposition products have already occurred. Avoid inhaling these substances under all circumstances, as otherwise the airways, lungs and other organs could be damaged.*
 - ◆ *Please see the safety data sheets for the specific risks of the refrigerant, the material data, etc. Safety data sheets on the refrigerant, refrigerant oil, etc. can be found in the ⇒ VW/Audi ServiceNet .*
- Welding, brazing and soldering operations are not to be performed on air conditioner components when filled. This also applies to vehicle welding and soldering work if there is a danger of air conditioner components becoming hot. When performing paintwork repairs, the temperature in the drying booth or preheating zone must not exceed 80 °C.

Reason:

As the system heats up there is a severe build-up of overpressure, which can cause the system's high-pressure safety valve to open.

Corrective action:

- Drain refrigerant circuit with air conditioner service station
⇒ [page 138](#) .



Note

Damaged or leaking parts of the air conditioner must not be repaired by welding or soldering, but must be replaced.

Vessels (e.g. charging cylinders of the air conditioner service station) containing refrigerant must never be overfilled, excessively heated or exposed to direct sunlight.

Reason:

Refrigerant expands when heated.

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Remedy:

- Observe existing regulations, technical rules and laws when charging and storing compressed gas cylinders (returnable cylinders, recycling cylinders, etc.).
- Vessels must never be completely filled with liquid refrigerant. Without sufficient space to expand (gas cushion), vessels can burst at increased temperatures, with devastating consequences ⇒ [“6.2 Physical properties”, page 21](#) .

Refrigerant should never be poured into systems or vessels containing any air.

Remedy:

- Evacuate systems and vessels before charging with refrigerant ⇒ [page 138](#) .



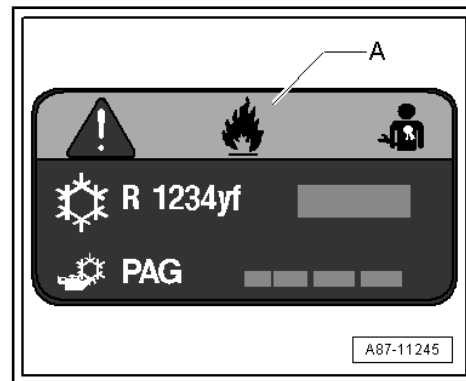
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4 Identification

⇒ ["4.1 Label for refrigerant circuit", page 15](#)

4.1 Label for refrigerant circuit

- ◆ The label -A- provides information about the type of refrigerant used, the quantity of refrigerant filled during production and the amount of refrigerant oil.
- ◆ Symbols on label -A- refer to the risks that can arise when handling refrigerant and when working on the refrigerant circuit.
- ◆ In addition, it may contain standards, such as the SAE standards applicable in the USA. SAE J639 describes the safety precautions for car air conditioners. SAE J842 states that only components and materials approved for refrigerant R1234yf may be used and SAE J2845 stipulates that repair and service work on the air conditioner refrigerant circuit may only be performed by trained and certified persons.
- ◆ Depending on the version and production period, it may possibly state the GWP (Global Warming Potential) of the refrigerant used.
- ◆ The capacities and type of refrigerant oil indicated on label -A- show the status at the time the vehicle was produced. Always refer to the relevant vehicle-specific Workshop Manual for the currently applicable values ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).



Note

Irrespective of the information on label -A-, applicable national laws, regulations and standards must always be complied with. In the European Union, e.g. the valid EC Regulations
⇒ ["2 Laws and regulations", page 5](#)

With information on the type of refrigerant and intended capacity
⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).



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5 Technical data

⇒ [“5.1 Refrigerant capacities”, page 16](#)

⇒ [“5.2 Refrigerant oil capacities”, page 16](#)

⇒ [“5.3 Safety data sheets”, page 17](#)

5.1 Refrigerant capacities

The capacities for refrigerant R1234yf can be found in the vehicle-specific Workshop Manual ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Capacities for refrigerant R1234yf .



Note

- ◆ *When charging refrigerant circuits on the high-pressure end, always fill as far as the upper tolerance limit (liquid refrigerant remains in the charging hoses).*
- ◆ *When charging the refrigerant circuit, make sure that the air conditioner service station is at the same level as the vehicle, the refrigerant circuit of which you wish to charge (maximum difference 50 cm). Depending on the version of air conditioner service station , an excessive difference in height can lead to deviations between the displayed and the actual filled quantity of refrigerant. The charging accuracy of the air conditioner service station can change.*

5.2 Refrigerant oil capacities

⇒ [“5.2.1 Approved refrigerant oils”, page 16](#)

⇒ [“5.2.2 Refrigerant oil capacities”, page 17](#)

5.2.1 Approved refrigerant oils

- ◆ The special refrigerant oil to be used exclusively for refrigerant circuits with refrigerant R1234yf is no longer available on the refrigerant oil market. Refrigerant oils specially designed for refrigerant R1234yf and the respective air conditioner compressor are therefore sold in the spare parts range ⇒ Electronic parts catalogue
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Using different refrigerant oils can lead to failure of the air conditioner. The stability and chemical behaviour of other refrigerant oils that are not designed for refrigerant R1234yf and the air conditioner compressor (which have not been tested and approved) can result in damages to the refrigerant circuit. For example, unsuitable refrigerant oil can age prematurely during air conditioner operation and unknown residues in the oil or missing additives can damage components of the refrigerant circuit. In addition, it may not mix or circulate properly with refrigerant R1234yf for lubricating the air conditioner compressor in the refrigerant circuit.
- ◆ Depending on the manufacturer of the air conditioner compressor, different refrigerant oils may be approved for the respective air conditioner compressor. Therefore, ensure the correct assignment ⇒ Electronic parts catalogue
- ◆ Audi currently uses the following refrigerant oils: For vehicles with an air conditioner compressor from manufacturer “Sanden” or “Delphi/Mahle”, refrigerant oil part number G 052 535 M2 (external designation SP A2). For vehicles with an air conditioning compressor from manufacturer “Denso”, refrigerant oil part number G 055 535 M2 (external designation ND 12)⇒ Electronic parts catalogue .

- ◆ Further information can be found in the vehicle-specific Workshop Manual ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).



Note

- ◆ *The delivery bottle of refrigerant oil contains information on the use-by date of the refrigerant oil it contains.*
- ◆ *This date can be ignored if the delivery bottle is hermetically sealed.*
- ◆ *Refrigerant oil from a hermetically sealed delivery bottle can also be used after the time stated on the bottle.*

5.2.2 Refrigerant oil capacities

Refrigerant capacities can be found in the vehicle-specific Workshop Manual ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil .

5.3 Safety data sheets

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Safety data sheets are currently stored in the ⇒ VW/Audi ServiceNet .

6 Basic technical and physical principles

⇒ [“6.1 Basics of air conditioning technology”, page 18](#)

⇒ [“6.2 Physical properties”, page 21](#)

⇒ [“6.3 Product properties”, page 28](#)

⇒ [“6.4 Function and task of the air conditioner”, page 28](#)

⇒ [“6.5 Further information resources”, page 30](#)

6.1 Basics of air conditioning technology

⇒ [“6.1.1 Basic physical principles of the air conditioner”, page 18](#)

⇒ [“6.1.2 Refrigerant pressure and boiling point”, page 19](#)

⇒ [“6.1.3 Vapour pressure table for refrigerant”, page 19](#)

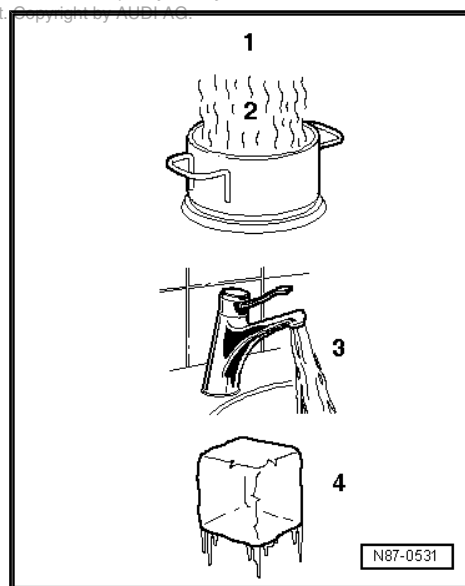
⇒ [“6.2 Physical properties”, page 21](#)

6.1.1 Basic physical principles of the air conditioner

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The four known aggregate states of water also exist for air conditioner refrigerants.

- 1 - Gas (invisible)
- 2 - Vapour
- 3 - Liquid
- 4 - Solid



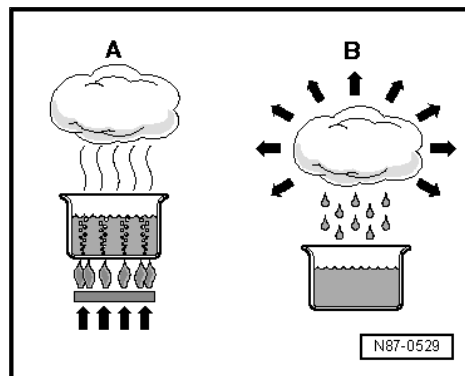
When water is heated in a vessel (heat absorption), water vapour can be seen to rise. If the vapour is further heated through heat absorption, the visible vapour turns into invisible gas. The process is reversible. If heat is extracted from gaseous water -A-, it changes first to vapour -B-, then to water and finally to ice.

A - Heat absorption

B - Heat emission

Heat always flows from a warmer to a colder substance

Every substance consists of a mass of moving molecules. The rapidly moving molecules of a warmer substance give part of their energy to slower molecules with less heat. This slows the molecular motion of the warmer substance, while the colder one is accelerated. This process continues until the molecules of both substances are moving at the same speed. They then have the same temperature and no further heat exchange takes place.



6.1.2 Refrigerant pressure and boiling point

The liquid boiling point stated in tables is always based on atmospheric pressure (1 bar absolute pressure). If the pressure acting on a fluid changes, its boiling point also changes.



Note

Pressure is stated in different units, 1 MPa (megapascal) equals 10 bar overpressure or 145 psi, 1 bar absolute pressure equals 0 bar overpressure, or roughly ambient pressure (atmospheric pressure).

For example, the lower the pressure, the lower the temperature at which water boils.

Vapour pressure curves for water and refrigerant R1234yf tell us, for example, that the steam becomes liquid due to falling temperatures at constant pressure (in the condenser), or that a reduction in pressure causes the refrigerant to change from the liquid to the vapour state (in the evaporator).

Vapour pressure curve for water

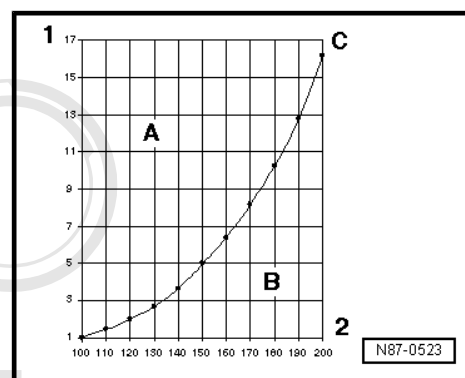
A - Liquid

B - Gas

C - Vapour pressure curve for water

1 - Pressure acting on liquid in bar (absolute)

2 - Temperature in °C



Vapour pressure curve for refrigerant R1234yf

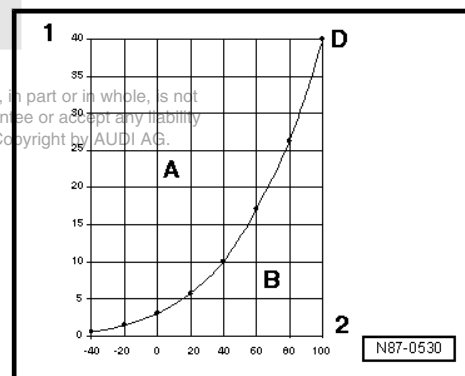
A - Liquid

B - Gas

D - Vapour pressure curve for refrigerant R1234yf

1 - Pressure acting on liquid in bar (absolute)

2 - Temperature in °C



Note

The vapour pressure curves of refrigerants R1234yf and R134a are very similar over a wide temperature range. The difference in pressure between the two refrigerants in the temperature range from 0 °C to +50 °C is only approx. 0.2 bar, for example; therefore no distinction can be made between the two on this basis

⇒ "6.1.3 Vapour pressure table for refrigerant", page 19 and ⇒ Air conditioner with refrigerant R134a; Rep. gr. 87; General notes on air conditioning systems (Air conditioner with refrigerant R134a, General notes on air conditioning systems). A distinction can only be made using suitable sensors that can analyse the chemical composition of the refrigerants
⇒ "6.2.16 Analysis of refrigerant R1234yf", page 26 .

6.1.3 Vapour pressure table for refrigerant

The literature provides a vapour pressure table for every refrigerant for refrigeration engineers. This table makes it possible to

determine the vapour pressure acting on the column of liquid in a vessel if the temperature of the vessel is known.

Since a unique, characteristic vapour pressure table is known for each refrigerant, for refrigerants with a vapour pressure that differs above a certain temperature range (this does not apply to the distinction between R1234yf and R134a, their vapour pressure values are too close together

⇒ ["6.1.2 Refrigerant pressure and boiling point", page 19](#)), we can use pressure and temperature measurements to determine which refrigerant we are dealing with.



Note

- ◆ *Making such a distinction is only possible for pure refrigerants with vapour pressures that differ to a sufficient extent. If different refrigerants are mixed to form a new one (e.g. three different refrigerants make up refrigerant R407C), the resulting vapour pressure will reflect those of the individual refrigerants and their proportion in this mixture.*
- ◆ *At absolute pressure, "0 bar" is an absolute vacuum. Normal atmospheric pressure corresponds to "1 bar" absolute pressure. On the scale of most pressure gauges, "0 bar" equals an absolute pressure of one bar (identifiable by the figure "-1 bar" below "0").*
- ◆ *Pressure is stated in different units, 1 MPa (megapascal) equals 10 bar overpressure or 145 psi, 1 bar absolute pressure equals 0 bar overpressure, or roughly ambient pressure (atmospheric pressure).*
- ◆ *The vapour pressures of the two refrigerants R1234yf and R134a are very similar over a wide temperature range, which is why this method cannot be used to distinguish the two refrigerants*
⇒ ["6.1.3 Vapour pressure table for refrigerant", page 19](#) and
⇒ *Air conditioner with refrigerant R134a; Rep. gr. 87; General notes on air conditioning systems . A distinction can only be made using suitable sensors that can analyse the chemical composition of the refrigerants*
⇒ ["6.2.16 Analysis of 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

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Temperature in °C	Pressure in bar (overpressure) R1234yf
45	10.52
50	12.01
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

⇒ [“6.2.1 Refrigerant R1234yf”, page 21](#)

⇒ [“6.2.2 Possible dangers of refrigerant R1234yf”, page 22](#)

⇒ [“6.2.3 Physical and chemical properties of refrigerant R1234yf”, page 22](#)

⇒ [“6.2.4 Critical point”, page 22](#)

⇒ [“6.2.5 Environmental aspects of refrigerant R1234yf”, page 23](#)

⇒ [“6.2.6 Trade names and designations of refrigerant R1234yf”, page 23](#)

⇒ [“6.2.7 Colour and odour of refrigerant R1234yf”, page 24](#)

⇒ [“6.2.8 Vapour pressure of refrigerant R1234yf”, page 24](#)

⇒ [“6.2.9 Physical properties of refrigerant R1234yf”, page 24](#)

⇒ [“6.2.10 Behaviour of refrigerant R1234yf with metal and plastic”, page 24](#)

⇒ [“6.2.11 Critical temperature/critical pressure of refrigerant R1234yf”, page 25](#)

⇒ [“6.2.12 Water content of refrigerant R1234yf”, page 25](#)

⇒ [“6.2.13 Flammability/decomposition of refrigerant R1234yf”, page 25](#)

⇒ [“6.2.14 Filling factor of refrigerant R1234yf”, page 25](#)

⇒ [“6.2.15 Testing for leaks in a refrigerant circuit with refrigerant R1234yf”, page 26](#)

⇒ [“6.2.16 Analysis of refrigerant R1234yf”, page 26](#)

⇒ [“6.2.17 Returning contaminated refrigerant R1234yf for analysis, treatment or disposal”, page 27](#)

6.2.1 Refrigerant R1234yf

- ◆ Vehicle air conditioning systems make use of the vaporisation and condensation process. Here, a substance (refrigerant) moves in a circle in a closed system.
- ◆ The substance has a low boiling point and is known as refrigerant – R1234yf in this case.
- ◆ Refrigerant R1234yf is known under various brand names (e.g. HFO 1234yf, Opteon 1234yf, etc.).

- ◆ Only approved refrigerant with the required purity may be used for the air conditioner
⇒ ["6.2.16 Analysis of refrigerant R1234yf", page 26](#) .
- ◆ Refrigerant R1234yf is a halogenated hydrocarbon with the chemical designation "2,3,3,3-tetrafluoroprop-1-ene", which boils at -29.4 °C under a vapour pressure of "1 bar" (atmospheric pressure).

6.2.2 Possible dangers of refrigerant R1234yf

- ◆ Refrigerant is flammable in a certain mixture ratio with ambient air
⇒ ["6.2.3 Physical and chemical properties of refrigerant R1234yf", page 22](#) and
⇒ ["6.2.13 Flammability/decomposition of refrigerant R1234yf", page 25](#) .
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- ◆ Rapidly evaporating liquid can cause frostbite
- ◆ High vapour concentrations can trigger headaches, dizziness, light-headedness, drowsiness and nausea and even lead to a loss of consciousness.

6.2.3 Physical and chemical properties of refrigerant R1234yf

The most important properties and safety precautions for refrigerant R1234yf are described below. In-depth information can be found in the respective safety data sheets ⇒ VW/Audi Service-Net .

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

6.2.4 Critical point

The critical point (critical temperature and critical pressure) is that above which there is no longer a boundary between liquid and gas.

A substance is always gaseous above its critical point.

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

As long as there is still gas in the vessel along with the liquid, the pressure depends on the ambient temperature

⇒ [“6.1.3 Vapour pressure table for refrigerant”, page 19](#) .



Note

- ◆ *Refrigerants used in vehicles must not be mixed together. Exclusive use is to be made of the refrigerant specified for the respective air conditioning system.*
- ◆ *The vapour pressures of the two refrigerants R1234yf and R134a are very similar over a wide temperature range, which is why this method cannot be used to distinguish the two refrigerants*
⇒ [“6.1.3 Vapour pressure table for refrigerant”, page 19](#) and
⇒ *Air conditioner with refrigerant R134a; Rep. gr. 87; General notes on air conditioning systems . A distinction can only be made using suitable sensors that can analyse the chemical composition of the refrigerants*
⇒ [“6.2.16 Analysis of refrigerant R1234yf”, page 26](#) .

6.2.5 Environmental aspects of refrigerant R1234yf

- ◆ R1234yf is a hydrofluorocarbon (HFC) and does not contain chlorine.
- ◆ R1234yf has a lower atmospheric lifetime than refrigerants R12 and R134a and therefore a lower greenhouse effect.
- ◆ R1234yf does not attack the ozone layer, its ozone depletion potential is zero (as with R134a).
- ◆ The global warming potential (GWP) of R1234yf is 4 (GWP of carbon dioxide = 1).
- ◆ The contribution of R1234yf to the greenhouse effect is lower than that of refrigerant R134a by a factor of approximately “350” (GWP of R134a is around 1400).



Note

The greenhouse effect of substances is calculated based on its effect over a period of 100 years using different methods; therefore there are different results (e.g. a GWP between 1300 and 1450 for R134a).

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6.2.6 Trade names and designations of refrigerant R1234yf

Refrigerant R1234yf is currently available under the following trade names:

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



Note

- ◆ *Different trade names may be used in other countries.*
- ◆ *Of the wide range of refrigerants available, this is the only one which may be used for vehicles. The names Frigen and Freon are trade names. This also applies to refrigerants that must not be used for motor vehicles.*

6.2.7 Colour and odour of refrigerant R1234yf

- ◆ Refrigerant is colourless like water both as a vapour and a liquid. Gas is invisible. Only the boundary layer between gas and liquid is visible (liquid level in indicator tube of charging cylinder or bubbles in sight glass). The liquid of refrigerant R1234yf may appear coloured (milky) in a sight glass. This cloudiness is caused by partially dissolved refrigerant oil and does not indicate a fault.

- ◆ Refrigerant is almost odourless; if refrigerant R1234yf escapes, a slight smell of ether may be perceived, depending on ambient conditions.

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6.2.8 Vapour pressure of refrigerant R1234yf

In an incompletely filled, sealed vessel, refrigerant evaporates at the surface in the same quantity as it reforms to liquid when combining with vapour particles. This state of equilibrium occurs under the influence of pressure and is often called vapour pressure. The vapour pressure is dependent on temperature

⇒ ["6.1.3 Vapour pressure table for refrigerant", page 19](#) .

6.2.9 Physical properties of refrigerant R1234yf

- ◆ The vapour pressures curves of the two refrigerants R1234yf and R134a are very similar over a wide temperature range, which is why this method cannot be used to distinguish the two refrigerants
⇒ ["6.1.3 Vapour pressure table for refrigerant", page 19](#) and
⇒ Air conditioner with refrigerant R134a; Rep. gr. 87 ; General notes on air conditioning systems . A distinction can only be made using suitable sensors that can analyse the chemical composition of the refrigerants
⇒ ["6.2.16 Analysis of refrigerant R1234yf", page 26](#)
- ◆ With R1234yf, the air conditioner compressor is lubricated by special, synthetic refrigerant oils, e.g. PAG oil (polyalkylene glycol oils), with certain additives adapted for refrigerant R1234yf, the air conditioner compressor and the operating conditions.

6.2.10 Behaviour of refrigerant R1234yf with metal and plastic

- ◆ In its pure state, refrigerant R1234yf is chemically stable and does not attack iron, aluminium or appropriately engineered and therefore suitable plastics.
- ◆ However, impurities in the refrigerant can cause components of the refrigerant circuit to be attacked and irreparably damaged.
- ◆ Unsuitable materials (e.g. seals and hoses that were not developed for use with refrigerant R1234yf and the refrigerant oil used) may also be attacked and damaged by pure refrigerant R1234yf or refrigerant oil.

- ◆ Impurities in the refrigerant, e.g. chlorine compounds, or the influence of UV light, can cause damage to metals and even plastics engineered and tested for use with this refrigerant and the associated refrigerant oil. This can result in blockage, leaks or deposits at the air conditioner compressor piston.
- ◆ Certain metals can react to refrigerant R1234yf (e.g. finely dispersed aluminium, zinc, magnesium)

6.2.11 Critical temperature/critical pressure of refrigerant R1234yf

Up to a gas pressure of 32.82 bar overpressure (equating to a temperature of 94.7 °C), refrigerant evaporates at the surface in a quantity that reforms to liquid on combination with vapour particles. Above this temperature/pressure, there is no longer a separating surface between the liquid and the gas.

6.2.12 Water content of refrigerant R1234yf

- ◆ Only very small amounts of water are soluble in liquid refrigerant. On the other hand, refrigerant vapour and water vapour mix in any ratio.
- ◆ If the dryer in the liquid or collection reservoir is saturated (has already absorbed approx. 7 grams of water), any water present in the refrigerant circuit is transported through the system. This water flows as far as the expansion valve nozzle or the restrictor and turns to ice. The air conditioner no longer provides any cooling effect.
- ◆ If the water turns to ice at the regulating valve of the air conditioner compressor, various problems may arise depending on the design of the compressor (either the air conditioner stops cooling, or it cools to such an extent that the evaporator ices up).
- ◆ Water causes irreparable damage to the air conditioner, because when other impurities are also present, acid can arise under high pressures and temperatures.

6.2.13 Flammability/decomposition of refrigerant R1234yf

- ◆ Refrigerant R1234yf is flammable in ambient air within a certain concentration range.
- ◆ Refrigerant R1234yf decomposes under exposure to flames and glowing or hot surfaces. Refrigerant is also split by UV light (which is a component of normal sunlight; it also arises during electrical welding, for example). This gives rise to toxic decomposition products that must not be inhaled. However, these chemicals irritate the mucous membranes, giving adequate warning of their presence.
- ◆ Decomposition can produce certain hazardous products such as carbon monoxide, hydrogen fluoride and/or hydrogen halide.

6.2.14 Filling factor of refrigerant R1234yf

- ◆ Observe existing regulations, technical rules and laws when charging compressed gas vessels (returnable cylinders, recycling cylinders, etc.).
- ◆ The overfilling of compressed gas vessels (returnable cylinders, recycling cylinders, etc.) must be prevented in all cases. In overfilled compressed gas vessels, the gas cushion is too small to withstand the expansion of liquid caused by exposure to heat. There is a risk of rupturing.



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- ◆ For your own safety, only use compressed gas vessels with a built-in safety valve.
- ◆ Returnable and recycling cylinders must be weighed on calibrated scales during the charging process, or charging must be measured by volume, to ensure that the permitted charging weight stated on the vessel is not exceeded. The maximum permitted capacity is 80 % of the maximum refrigerant capacity of the charging weight stated on the returnable or recycling cylinder or 70 % of the maximum charging volume (charging factor: the lowest value always applies). Reason: It is impossible to exclude the possibility that refrigerant oil may be poured into the returnable or recycling cylinder along with refrigerant.
- ◆ A vessel must have space for vapour as well as liquid. As the temperature rises, the liquid expands. The vapour-filled space becomes smaller. At a certain point, there will only be liquid in the vessel. Beyond this, even a slight increase in temperature causes great pressure to build up in the vessel as the liquid attempts to continue expanding despite the absence of the necessary space. The resultant force is sufficient to rupture the vessel. To stop vessels being overfilled, regulations governing the storage of compressed gases specify the number of kilograms of refrigerant with which a vessel may be filled per litre of internal vessel volume. The product of multiplying this charge factor by the internal volume of the vessel is the permissible capacity. The figure for the refrigerant used in motor vehicles is 1.15 kg/litre.
- ◆ Since contaminated refrigerant can have a different density to that of pure refrigerant R1234yf, always observe the maximum permitted charging factor.

6.2.15 Testing for leaks in a refrigerant circuit with refrigerant R1234yf

- ◆ The refrigerant circuit can start leaking due to external damage, by the use of unsuitable or contaminated refrigerant, or the use of non-approved materials in unsuitable components, for example.
- ◆ The small quantity of refrigerant escaping from minor leaks can be detected for example using an electronic leak detector or by introducing a leak detection additive into the refrigerant circuit. Electronic leak detectors are capable of registering leaks with refrigerant losses of less than 5 g per year.



Note

Use must be made for the various refrigerants of leak detectors designed for the composition of the refrigerant concerned. Leak detectors for refrigerant R12, for example, are unsuitable for R1234yf, as they do not always respond. Leak detectors suitable only for refrigerant R134a are also unsuitable for R1234yf, because the latter has a different chemical composition to R134a, with the result that these leak detectors react only when there are higher concentrations of refrigerant in the air, or not at all ⇒ Electronic parts catalogue .

6.2.16 Analysis of refrigerant R1234yf

The refrigerant used must have a certain purity for air conditioner operation.



Note

- ◆ *Incorrect gas analysis is possible due to air in refrigerant hoses or non-compliance with the gas analysis procedure stated in the Operating Manual.*
- ◆ *Pay close attention to Operating Manual of gas analyser/ air conditioner service station .*
- ◆ *Evacuate coolant hoses of air conditioner service station with refrigerant R1234yf before connecting service couplings to refrigerant circuit/a gas cylinder (see operating instructions for gas analyser/ air conditioner service station
⇒ [“2.3 Performing a gas analysis on the refrigerant”](#), page 143 .*

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

Contaminated refrigerant must be analysed and then treated (or disposed of) as a gas of unknown composition, in accordance with legal provisions

⇒ [“2.3 Performing a gas analysis on the refrigerant”](#), page 143 .



Note

*Return contaminated refrigerant R1234yf to your refrigerant supplier for analysis. If you need to know exactly what contaminants the refrigerant contains due to damage to the refrigerant circuit, which have already occurred or are expected, please make a request to this effect and ask for the results of the analysis
⇒ [“6.2.17 Returning contaminated refrigerant R1234yf for analysis, treatment or disposal”](#), page 27 .*

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During gas analysis, the following limit values apply to clean refrigerant R1234yf:

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



Note

To prevent liquid elements (e.g. drops of refrigerant oil) in the extracted refrigerant gas from leading to an incorrect gas analysis result, the gas analyser contains separators (filters) that separate these droplets of liquid. Replace separators in accordance with the Operating Manual belonging to the gas analyser or air conditioner service station ⇒ Gas analyser Operating Manual or ⇒ Operating Manual of air conditioner service station .

6.2.17 Returning contaminated refrigerant R1234yf for analysis, treatment or disposal

- ◆ Please note the legal provisions governing the return of contaminated refrigerant for analysis or treatment or the return of refrigerant that is no longer to be used for disposal
⇒ [“2 Laws and regulations”](#), page 5 and ⇒ VW/Audi Service-Net .

- ◆ Please note the legal provisions governing the disposal of refrigerant oil that is no longer suitable for use
⇒ ["2 Laws and regulations", page 5](#) and ⇒ VW/Audi Service-Net .
- ◆ Refrigerant must never be released into the atmosphere for reasons of environmental protection
⇒ ["2 Laws and regulations", page 5](#) .
- ◆ If the gas analysis reveals that refrigerant R1234yf is contaminated with another gas, this must be extracted from the refrigerant circuit and returned to your gas supplier for analysis, treatment or disposal as a gas of unknown composition, in accordance with legal provisions ⇒ VW/Audi ServiceNet and
⇒ ["2.13 Filling contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal", page 170](#) .



Note

Return contaminated refrigerant R1234yf to your refrigerant supplier for analysis. If you need to know exactly what contaminants the refrigerant contains due to damage to the refrigerant circuit, which have already occurred or are expected, please make a request to this effect and ask for the results of the analysis
⇒ ["2.4 Draining the refrigerant circuit", page 146](#) .

6.3 Product properties

Refrigerant R1234yf, which is used for automotive air conditioners, belongs to the new generation of refrigerants based on chlorine-free, partially fluorinated hydrocarbons.

With regard to their physical properties, these are refrigerants which have been liquified under pressure. They are subject to the Pressure Vessel Directive and may only be placed in approved and labelled compressed gas vessels.

Certain conditions govern their safe and expert use and these must be complied with ⇒ ["1 Safety precautions", page 1](#) .

6.4 Function and task of the air conditioner

⇒ ["6.4.1 Method of operation", page 28](#)

⇒ ["6.4.2 Comfort", page 29](#)

⇒ ["6.4.3 Environmental aspects", page 29](#)

6.4.1 Method of operation

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- ◆ The temperature in the passenger compartment depends on the amount of heat radiated through the windows and conducted by the metal parts of the body. In hot weather some of the heat must be pumped off to achieve a more comfortable temperature for the occupants.
- ◆ As heat spreads into cooler areas, the passenger compartment is fitted with a unit for generating low temperatures in which refrigerant is constantly evaporated. The heat required for this is extracted from the air flowing through the evaporator.
- ◆ After absorbing heat, the refrigerant is pumped off through the air conditioner compressor. The work of compression of the air conditioner compressor increases the heat content and temperature of the refrigerant. This is now considerably higher than the temperature of the ambient air.
- ◆ The hot refrigerant flows with its heat content to the condenser, where the refrigerant emits its heat via the condenser into the

ambient air due to the temperature drop between the refrigerant (condenser surface) and the ambient air.

- ◆ The refrigerant thus acts as a heat transfer medium. As it is re-used, the refrigerant is returned to the evaporator.
- ◆ For this reason all air conditioning systems are based on the refrigerant circulation principle. There are differences in the composition of the systems
⇒ ["1.1 System overview - Refrigerant circuit", page 31](#) .

6.4.2 Comfort

- ◆ A basic requirement for concentrated and safe driving is a feeling of comfort in the passenger compartment. Especially when it is hot and humid, comfort can only be attained through the use of air conditioning. Of course, open windows, an open sunroof or a higher air throughput can all improve comfort. However, these entail disadvantages for the passenger compartment, e.g. additional noise, draughts, exhaust fumes, ingress of pollen (disagreeable for allergy sufferers).
- ◆ A regulated air conditioner combined with a well designed heating and ventilation system can enhance feelings of well-being and comfort by regulating the passenger compartment temperature, air humidity and air movement, in accordance with outside conditions, with the vehicle both stationary and moving.

Other important advantages of air conditioning are:

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- ◆ Drying of the air in the passenger compartment (the air humidity condenses on the cold evaporator and is discharged as condensate. The air is then heated back to a preset temperature on the heat exchanger for the heating, which lowers the proportion of water in the air and reduces absolute and relative air humidity).
- ◆ Additional cleaning of air fed into the passenger compartment (the damp blades of the evaporator wash out dust and pollen that may have overcome the dust and pollen filter and discharge it with the condensate).
- ◆ Temperatures in a mid-range car (example: after a short drive, outside temperature 30 °C in the shade and vehicle exposed to sunlight).

	With air conditioning	Without air conditioning
At head height	23 °C	42 °C
At chest level	24 °C	40 °C
In footwell	30 °C	35 °C

6.4.3 Environmental aspects

- ◆ Until about 1992, the air conditioning systems were equipped with refrigerant R12. Due to its chlorine atoms, this CFC had a high ozone depletion potential and also a very high potential for aggravating the greenhouse effect.
- ◆ From 1992, air conditioners in newly produced cars were gradually converted from refrigerant R12 to refrigerant R134a. This refrigerant contains no chlorine and therefore does not deplete the ozone layer. However, due to its high global warming potential (GWP) of approx. 1400, as of 2011 it may no longer be used in new, type approved vehicles. Vehicles that were already type tested before 2011 may still be introduced onto the road with refrigerant R134a until 31.12.2016 (this applies to EU countries, other regulations may apply in countries outside the EU).

- ◆ As of 01.01.2011, vehicles only gain type approval if the air conditioner refrigerant circuit is charged with refrigerant with a GWP of less than 150. Refrigerant R1234yf has a GWP of approx. 4 and is therefore considerably below the stipulated value.
- ◆ As of 2011, air conditioners in newly produced cars were gradually converted from refrigerant R134a to refrigerant R1234yf. This refrigerant has a global warming potential of approx. 4, (carbon dioxide GWP = 1), so that it has a dramatically smaller influence on the earth's atmosphere than refrigerant R134a.
- ◆ Retrofit ranges were developed and offered for existing old systems charged with ozone-damaging refrigerant R12. Permitted by copyright. Reprinting for private or commercial purposes, in part or in whole, is not permitted unless authorized by Audi AG. Audi AG does not guarantee or accept any liability for the use of the information in this document. Copyright by Audi AG.
Workshop manual for air conditioners with refrigerant R12 (this Workshop Manual is only available as a paper version).
- ◆ As legislation currently stands, refrigerant R134a may continue to be used in vehicles that were type tested with refrigerant R134a (or vehicles converted from refrigerant R12 to R134a) until the end of life of these vehicles. Therefore, there are currently no plans to convert air conditioners from refrigerant R134a to refrigerant R1234yf ⇒ Air conditioner with refrigerant R134a; Rep. gr. 87 ; Capacities for refrigerant R134a, refrigerant oil and approved refrigerant oils .
- ◆ Refrigerant must never be released into the atmosphere for reasons of environmental protection
⇒ ["2 Laws and regulations", page 5](#) .
- ◆ Refrigerant R1234yf is chemically stable in the closed system. In the earth's atmosphere, however, it decomposes in a short time when exposed to UV light (within approx. 14 days) into compounds that are damaging to the earth's atmosphere (hence its GWP of 4).

6.5 Further information resources

- ◆ Workshop manual for type-based repair work ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual) and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
- ◆ Technical Service Manual with measures for remedying commonly occurring faults
- ◆ Self-study programs, video programs for company training and VW/Audi TV articles on the air conditioner.
- ◆ Please see the safety data sheets for the specific risks of the refrigerant, the material data, etc. Safety data sheets on refrigerant, refrigerant oil, etc. ⇒ VW/Audi ServiceNet .
- ◆ List of intended special tools and equipment for repairing the air conditioner ⇒ Electronic parts catalogue (Tools; Equipment/tools; Air conditioner/heating).
- ◆ Notes on the disposal of refrigerant oil and contaminated refrigerant can be found in ⇒ VW/Audi ServiceNet .
- ◆ For vehicles with a refrigerant circuit charged with refrigerant R134a (vehicles with a type approval that was granted before 31.12.2010 and were or will be introduced onto the road for the first time by 31.12.2016
⇒ ["2 Laws and regulations", page 5](#) .

87 – Air conditioning system

1 Refrigerant circuit

⇒ [“1.1 System overview - Refrigerant circuit”, page 31](#)

⇒ [“1.2 General description - Refrigerant circuit components”, page 37](#)

⇒ [“1.3 Possible problems”, page 65](#)

⇒ [“1.4 Locating leaks”, page 69](#)

⇒ [“1.5 Replacing components”, page 78](#)

⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#)

⇒ [“1.7 Check pressure values with a pressure gauge”, page 135](#)

1.1 System overview - Refrigerant circuit

⇒ [“1.1.1 System overview - Refrigerant circuit with expansion valve and receiver”, page 31](#)

⇒ [“1.1.2 System overview - Refrigerant circuit with restrictor and receiver”, page 33](#)

⇒ [“1.1.3 System overview - Refrigerant circuit with electrically driven air conditioner compressor \(with and without battery cooling module\)”, page 34](#)

1.1.1 System overview - Refrigerant circuit with expansion valve and receiver



Note

- ◆ *The arrows indicate the direction of refrigerant flow.*
- ◆ *The diagram below shows a refrigerant circuit with two evaporators and an internal heat exchanger as an example.*
- ◆ *The design of the refrigerant circuit is vehicle-specific ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

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HP = High-pressure side

LP = Low-pressure side

1 - Air conditioner compressor regulating valve - N280-

2 - Air conditioner compressor

3 - Pulley

- ☐ Depending on the version, an air conditioner magnetic clutch - N25- may be installed in the pulley ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ☐ Depending on the version, a drive unit may be installed instead of the pulley ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

4 - High-pressure safety valve

5 - Refrigerant pressure sender

- ☐ Vehicle-specific versions ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit .

6 - Condenser (with receiver)

7 - Receiver

- ☐ Installed on or in condenser ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ☐ With desiccant cartridge

8 - Service connection (high-pressure side)

- ☐ With cap

9 - Refrigerant line with internal heat exchanger

10 - Front expansion valve

11 - Front evaporator

- ☐ Evaporator in front heater and air conditioning unit (fitted beneath dash panel)

12 - Service connection (low-pressure side)

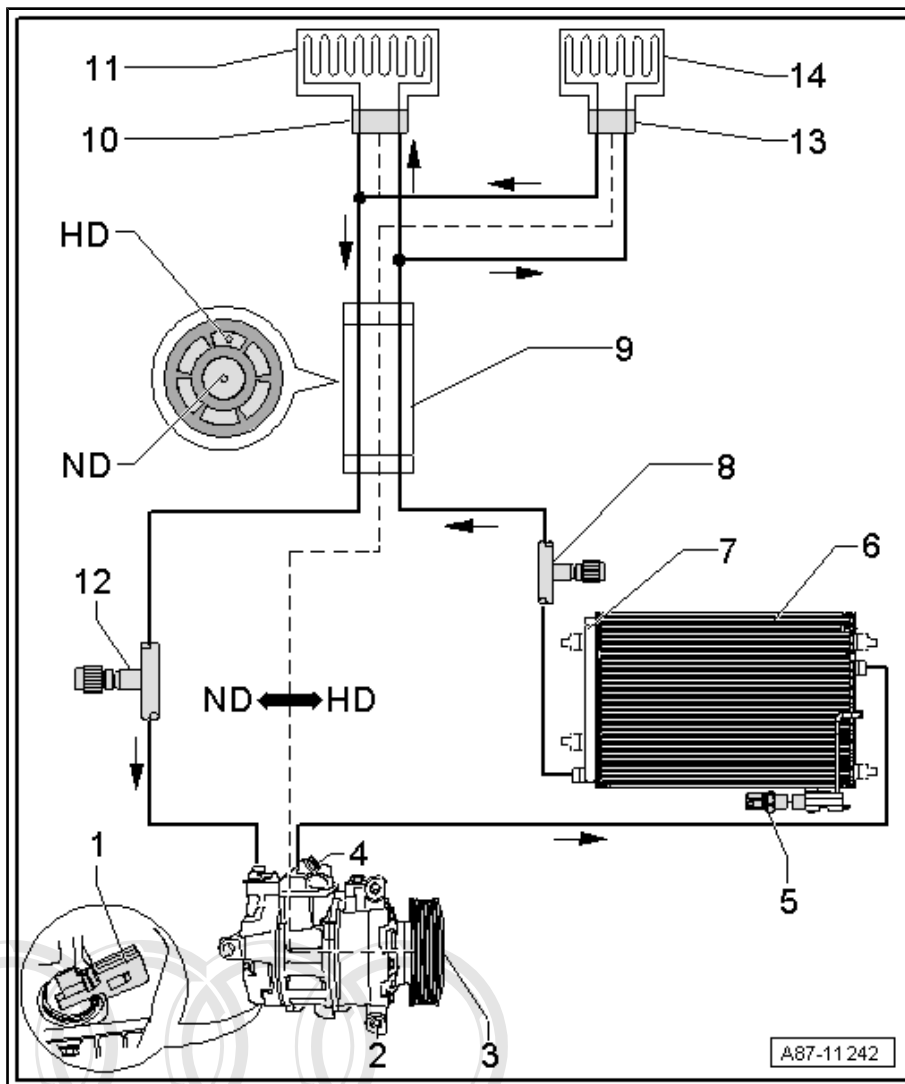
- ☐ With cap

13 - Rear expansion valve

- ☐ Only available in vehicles with rear air conditioning unit (optional extra)

14 - Rear evaporator

- ☐ Only available in vehicles with rear air conditioning unit (optional extra)



1.1.2 System overview - Refrigerant circuit with restrictor and receiver

Note

- ◆ The arrows indicate the direction of refrigerant flow.
- ◆ The diagram below shows a refrigerant circuit with one evaporator as an example.
- ◆ Use of this design of refrigerant circuit is currently not planned for VW/Audi.
- ◆ The design of the refrigerant circuit is vehicle-specific ➔ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

HP = High-pressure side

LP = Low-pressure side

1 - Air conditioner compressor regulating valve - N280-

2 - Air conditioner compressor

3 - Pulley

- ☐ Depending on the version, an air conditioner magnetic clutch - N25- may be installed in the pulley ➔ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ☐ Depending on the version, a drive unit may be installed instead of the pulley ➔ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

4 - High-pressure safety valve

5 - Condenser

6 - Refrigerant pressure sender

- ☐ Vehicle-specific versions ➔ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

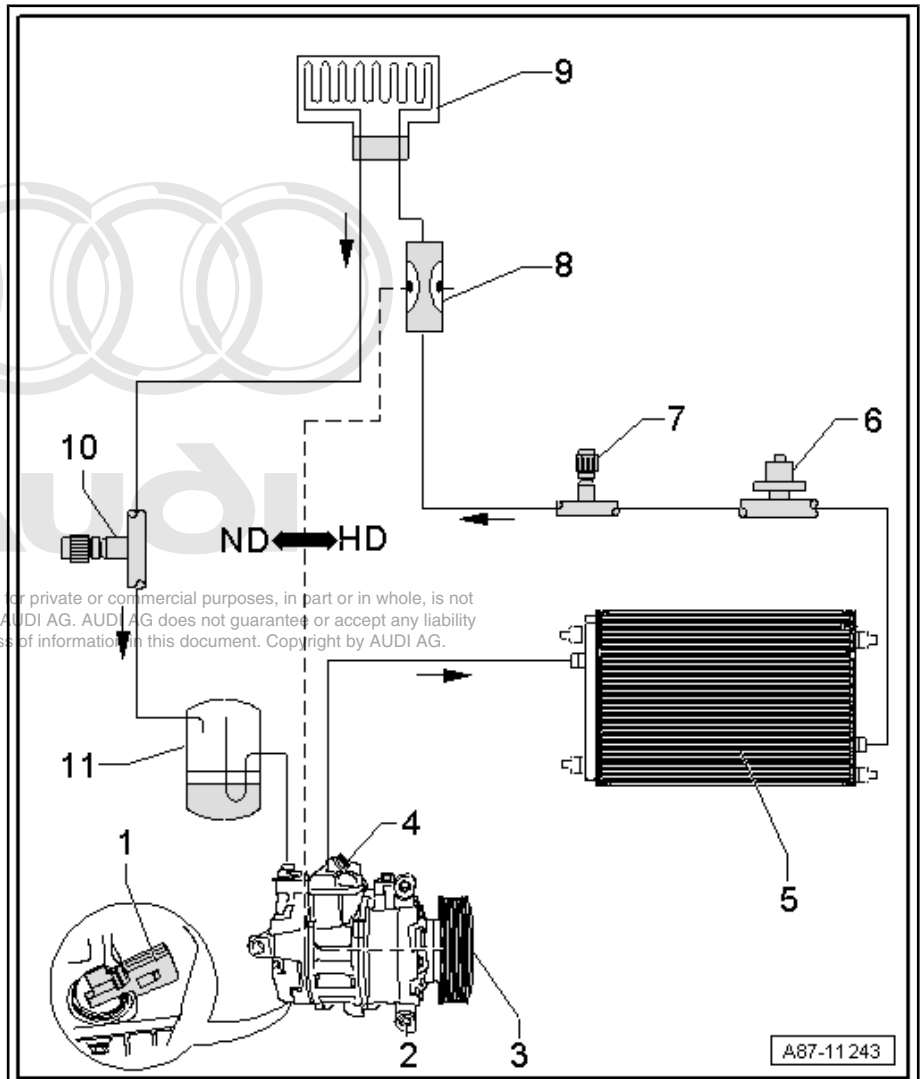
7 - Service connection (high-pressure side)

- ☐ With cap

8 - Restrictor

9 - Evaporator

- ☐ Evaporator in front heater and air conditioning unit (fitted beneath dash panel)





10 - Service connection (low-pressure side)

- ☐ With cap

11 - Reservoir

- ☐ With desiccant cartridge

1.1.3 System overview - Refrigerant circuit with electrically driven air conditioner compressor (with and without battery cooling module)



Note

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- ◆ *The arrows indicate the direction of refrigerant flow.*
- ◆ *The diagram below shows a refrigerant circuit with expansion valve, a second evaporator for battery cooling and an internal heat exchanger as an example.*
- ◆ *The design of the refrigerant circuit is vehicle-specific ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

HP = High-pressure side

LP = Low-pressure side

1 - Electrically driven air conditioner compressor

- ☐ With air conditioner compressor control unit - J842- and electric air conditioner compressor - V470- ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

2 - High-pressure safety valve

3 - Condenser

- ☐ With receiver and desiccant cartridge.

4 - Receiver

- ☐ Here part of the condenser.

5 - Refrigerant pressure sender

- ☐ Vehicle-specific versions ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

6 - Service connection on high-pressure side

- ☐ With cap.

7 - Refrigerant line with internal heat exchanger

8 - Refrigerant shut-off valve

- ☐ Different designations ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ☐ Only on vehicles with battery cooling module for hybrid battery unit - AX1-



Note

The refrigerant shut-off valve is actuated, for example, if battery cooling is necessary and passenger compartment cooling is not desired (open when not actuated).

9 - Expansion valve

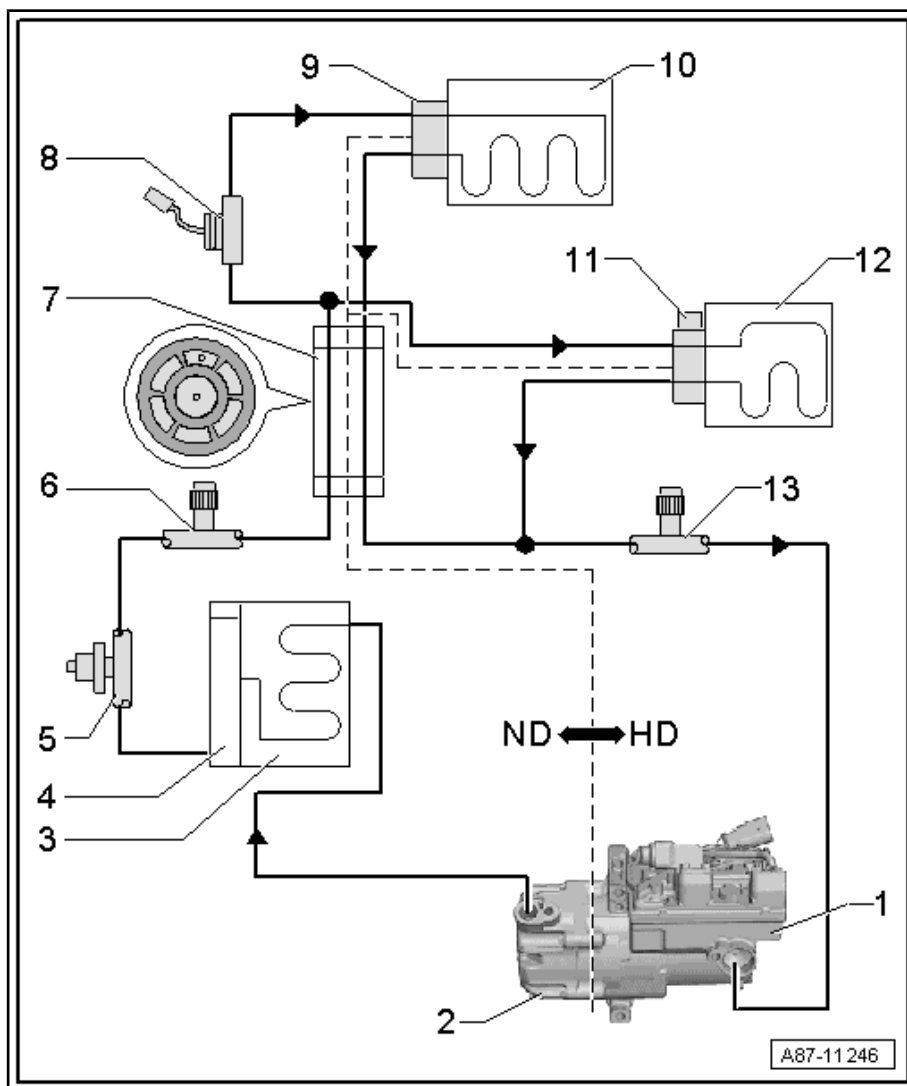
- ☐ On evaporator in heater and air conditioning unit

10 - Front evaporator

- ☐ Evaporator in heater and air conditioning unit

11 - -Expansionsventil mit Absperrventil-

- ☐ Different designations ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ☐ On evaporator in battery cooling module
- ☐ Only on vehicles with battery cooling module for hybrid battery unit - AX1-



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Note

The -Expansionsventil mit Absperr-ventil- is actuated when battery cooling is necessary (closed when not actuated).

12 - Evaporator

- ☐ Evaporator in battery cooling module
- ☐ Only on vehicles with battery cooling module for hybrid battery unit - AX1-

13 - Service connection on low-pressure side

- ☐ With cap



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1.2 General description - Refrigerant circuit components

⇒ [“1.2.1 Layout and function of the refrigerant circuit”, page 37](#)

⇒ [“1.2.2 Mechanically driven air conditioner compressor”, page 39](#)

⇒ [“1.2.3 Electrically driven air conditioner compressor”, page 41](#)

⇒ [“1.2.4 Condenser”, page 44](#)

⇒ [“1.2.5 Evaporator”, page 44](#)

⇒ [“1.2.6 Reservoir”, page 45](#)

⇒ [“1.2.7 Heat exchanger for heat pump operation”, page 46](#)

⇒ [“1.2.8 Liquid collector”, page 46](#)

⇒ [“1.2.9 Restrictor”, page 47](#)

⇒ [“1.2.10 Receiver”, page 48](#)

⇒ [“1.2.11 Expansion valve \(with and without shut-off valve\)”, page 49](#)

⇒ [“1.2.12 Refrigerant shut-off valves”, page 51](#)

⇒ [“1.2.13 Refrigerant line with internal heat exchanger”, page 52](#)

⇒ [“1.2.14 Refrigerant line quick-release coupling connections”, page 53](#)

⇒ [“1.2.15 Seals”, page 54](#)

⇒ [“1.2.16 Refrigerant circuit pipes and hoses”, page 54](#)

⇒ [“1.2.17 Pressure relief valve”, page 54](#)

⇒ [“1.2.18 Non-return valves”, page 55](#)

⇒ [“1.2.19 Connections for quick-release couplings in the refrigerant circuit”, page 56](#)

⇒ [“1.2.20 Connections with valve for switches in refrigerant circuit”, page 60](#)

⇒ [“1.2.21 Refrigerant circuit pressure senders and switches”, page 60](#)

⇒ [“1.2.22 Refrigerant pressure and temperature senders”, page 61](#)

⇒ [“1.2.23 Air conditioner compressor regulating valve N280”, page 64](#)

⇒ [“1.2.24 Refrigerant temperature sender”, page 64](#)

1.2.1 Layout and function of the refrigerant circuit

- ◆ The condenser and receiver are on the high-pressure side, while the restrictor or expansion valve separate the high-pressure side (HP liquid side) from the low-pressure side (LP liquid side).
- ◆ High pressure results from the restrictor or expansion valve forming a constriction and causing the refrigerant to accumulate, thus leading to an increase in pressure and temperature.
- ◆ Excessive pressure occurs when too much refrigerant or refrigerant oil is filled in the system, the condenser is clogged,

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the radiator fan is faulty, there is a blockage in the system or humidity in the refrigerant circuit (icing of restrictor or expansion valve).

- ◆ The evaporator and evaporator temperature sensor are on the low-pressure side, while the air conditioner compressor separates the low-pressure side (LP gas side) from the high-pressure side (HP gas side).
- ◆ The system can suffer a drop in pressure due to loss of refrigerant, a faulty or clogged restrictor or expansion valve (constrictions), a faulty air conditioner compressor or an iced up evaporator.



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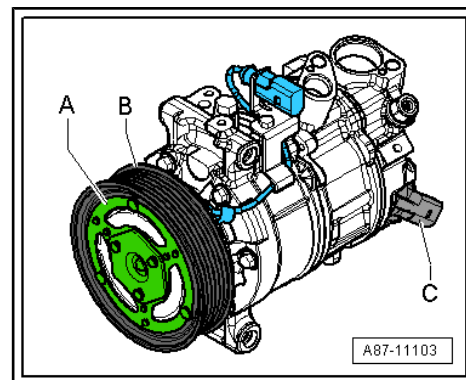
1.2.2 Mechanically driven air conditioner compressor

The vehicle engine drives the air conditioner compressor via a poly V-belt -B- or a drive shaft.

Air conditioner compressor with air conditioning system magnetic clutch - N25- :

An electromagnetic clutch -A- attached to the air conditioner compressor provides the power link between the pulley -B- and the compressor crankshaft when the air conditioning system is switched on.

An overload protection device installed on the clutch plate or solenoid of the air conditioner compressor is triggered when the compressor cannot rotate freely and protects the belt drive or drive unit from overload.



Note

- ◆ *To prevent the air conditioner compressor from suffering damage if the refrigerant circuit is empty, the air conditioner compressor regulating valve - N280- and possibly the air conditioner magnetic clutch - N25- is no longer actuated (the air conditioner compressor only runs at idle with the engine if the -N25- is esteuert actuated).*
- ◆ *An air conditioner compressor with -N25- (without -N280-) is not actuated and therefore not driven when the refrigerant circuit is empty.*

Air conditioner compressor without air conditioning system magnetic clutch - N25- :

- ◆ An overload protection device installed on the pulley -B- or in the drive unit of the air conditioner compressor is triggered when the compressor cannot rotate freely and protects the belt drive or drive unit from overload.
- ◆ A valve switches an air conditioner compressor with air conditioner compressor regulating valve - N280- (without -N25-) to internal lubrication if the refrigerant circuit is empty.

Note

- ◆ *In air conditioner compressors without air conditioner magnetic clutch - N25- , the engine can only be started when the refrigerant circuit has been fully assembled.*
- ◆ *To prevent the air conditioner compressor from suffering damage if the refrigerant circuit is empty, the air conditioner compressor regulating valve - N280- is no longer actuated (the air conditioner compressor runs at idle with the engine).*

All air conditioner compressors

The air conditioner compressor extracts refrigerant gas out of the evaporator, compresses it and conveys it to the condenser.

**Note**

- ◆ *The air conditioner compressor contains refrigerant oil, which can be mixed with refrigerant R1234yf at all temperatures.*
- ◆ *The type plate states which refrigerant the air conditioner compressor is designed for. A regulating valve regulates the pressure on the low-pressure side within the specified tolerance range (regulatory curve) ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *The air conditioner compressor is filled with different refrigerant oils, depending the compressor version. Refrigerant oils that were developed solely for refrigerant R134a must not be used for refrigerant R1234yf werden ⇒ Heating, air conditioner; Rep. gr. 00; Technical data; Refrigerant oil.*
- ◆ *Air conditioner compressors with or without air conditioner magnetic clutch - N25- are currently actuated from outside via an air conditioner compressor regulating valve - N280- -C- ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *The type plate states which refrigerant the air conditioner compressor is designed for. An air conditioner compressor regulating valve - N280- regulates the pressure on the low-pressure side within the specified tolerance range (regulatory curve) ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *The air conditioner compressor regulating valve - N280- is actuated externally ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode for the air conditioner.*
- ◆ *In vehicles with an air conditioner compressor without air conditioner magnetic clutch - N25-, the engine must not be started if there is low pressure in the refrigerant circuit (e.g. during evacuation) ⇒ [page 138](#).*
- ◆ *In vehicles with an air conditioner compressor without air conditioner magnetic clutch - N25-, the engine can only be started when the refrigerant circuit has been fully assembled.*
- ◆ *To prevent the air conditioner compressor from suffering damage if the refrigerant circuit is empty, the air conditioner compressor regulating valve, air conditioner - N280- is no longer actuated (the air conditioner compressor runs at idle with the engine) if the pressure in the refrigerant circuit is too low (less than approx. 2 bar).*
- ◆ *A valve switches air conditioner compressors with air conditioner compressor regulating valve, air conditioner - N280- to internal lubrication if the refrigerant circuit is empty.*
- ◆ *Depending on the version of the air conditioner compressor, the high-pressure end of the air conditioner compressor may be fitted with a valve to prevent the backflow of liquid refrigerant into the compressor after switching off the air conditioning system. If an air conditioner compressor with this valve is fitted on a vehicle with a refrigerant circuit with an expansion valve, a relatively long period may elapse before the pressure on the high-pressure end decreases (the expansion valve is cold and the pressure on the low-pressure end increases rapidly after switch-off, the expansion valve closes and the refrigerant can only flow slowly to the low-pressure end). If the air conditioner compressor is switched on, the pressure on the low-pressure end decreases, the expansion valve opens and the refrigerant can flow to the low-pressure end.*

- ◆ *In air conditioner compressors with electromagnetic clutch -A- and regulating valve -C-, the electromagnetic clutch -A- is mostly only actuated if the regulating valve -C- is also actuated
⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit
(vehicle-specific Workshop Manual).*

1.2.3 Electrically driven air conditioner compressor

Vehicles with high-voltage system (hybrid vehicles)

If work is necessary in proximity to components of the high-voltage system, “visually inspect the high-voltage components and lines for damage” ⇒ [page 4](#) and ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .

If work on components of the high-voltage system is required, disconnect the high-voltage system from mains voltage ⇒ Rep. gr. 93 ; Disconnecting high-voltage system from mains voltage .

Disconnecting the high-voltage system from mains voltage and putting the high-voltage system back into operation ⇒ Rep. gr. 93 ; Disconnecting the high-voltage system from mains voltage

- To minimise the number of automatic engine starts with READY active during checking and measurement work, the vehicle batteries must be charged, e.g. with the battery charger, 60 A - VAS 5904- in battery back-up mode ⇒ Electrical system; Rep. gr. 27 ; Battery; Charging battery and ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .



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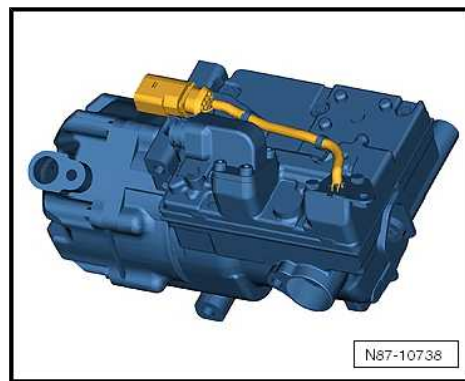
- For checking and measurement work that requires the vehicle's drive system to be active (READY) or the ignition to be switched on, move the selector lever to position "P", activate the parking brake and and take care to keep well clear of the engine when it is running. Set up any tools needed so that they cannot come into contact with moving parts.

Electrically driven air conditioner compressor

NOTICE

Risk of irreparable damage to electrically driven air conditioner compressor due to short circuit.

- **Never touch the air conditioner compressor when switching on the ignition or starting the drive units.**
- ◆ The air conditioner compressor extracts refrigerant gas out of the evaporator, compresses it and conveys it to the condenser.
- ◆ The electric motor of the air conditioner compressor is supplied with voltage, e.g. by the power and control electronics for electrical system - JX1- ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ The air conditioner compressor control unit - J842- integrated in the air conditioner compressor regulates the speed and therefore the output of the air conditioner compressor electric air conditioner compressor - V470-), based on the request received via the data bus ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode for air conditioner and battery regulation
- ◆ No air conditioner compressor regulating valve - N280- is installed in electrically driven air conditioner compressors
- ◆ Prior to installation, check the attachment points of the air conditioner compressor and bracket. The contact surfaces must be clean and free from rust and grease. If they are not, treat the contact surfaces with the contact surface cleaning set - VAS 6410- ⇒ Electrical system; General information; Rep. gr. 97 ; Wiring harness and connector repair and ⇒ Electrical system; General information; Rep. gr. 97 ; Contact surface cleaning set VAS 6410 .



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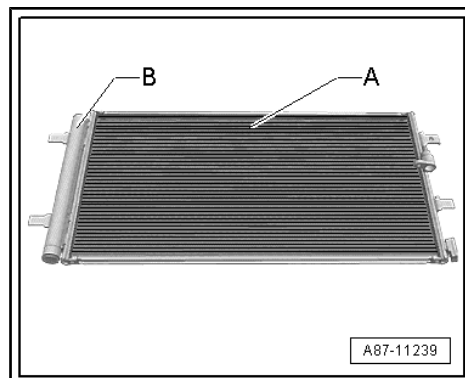


Note

- ◆ *If the air conditioner compressor control unit - J842- is faulty, adjust the quantity of refrigerant oil in the new air conditioner compressor. The refrigerant circuit does not always have to be cleaned (flushed) with R1234yf.*
- ◆ *The air conditioner compressor control unit - J842- and electric air conditioner compressor - V470- are one module and currently not separable.*
- ◆ *No -N280- is installed in the electrically driven air conditioner compressor. The output of the air conditioner compressor is regulated externally via the speed of the compressor ⇒ Current flow diagrams, Electrical fault finding and Fitting locations and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode for air conditioner and battery regulation.*
- ◆ *The electrically driven air conditioner compressor currently works on the principle of a scroll-type supercharger (similar to a G-Lader).*
- ◆ *The air conditioner compressor contains refrigerant oil, which can be mixed with refrigerant R1234yf at all temperatures.*
- ◆ *The type plate states which refrigerant the air conditioner compressor is designed for.*
- ◆ *The integrated electronics regulates the air conditioner compressor output (and therefore the pressure on the low-pressure side) via its speed within the set tolerance range (regulatory curve).*
- ◆ *The engine may only be started if the refrigerant circuit is fully assembled.*
- ◆ *To prevent any damage to the air conditioner compressor when the refrigerant circuit is empty, it is equipped with a secure oil supply. This means that approx. 40 to 50 cm³ refrigerant oil remains in the air conditioner compressor.*
- ◆ *Like its mechanically driven counterpart, the electrically driven air conditioner compressor features a pressure relief valve.*
- ◆ *In vehicles with battery cooling, electric or hybrid drive is only possible with a full air conditioner with no stored faults ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode for air conditioner and battery regulation.*
- ◆ *After installing the electrically driven air conditioner compressor and then charging the refrigerant circuit, first start up the compressor by way of the "Compressor run-in" function of the basic setting routine. Otherwise, the air conditioner compressor may be damaged if refrigerant oil has accumulated in the compression chamber of the air conditioner compressor due to inappropriate storage prior to installation ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode for air conditioner and battery regulation.*
- ◆ *Electrically driven air conditioner compressors may only be activated when the refrigerant circuit is charged. Running the air conditioner compressor with the refrigerant circuit empty could lead to compressor damage ⇒ Vehicle diagnostic tester in " Guided Fault Finding "mode.*

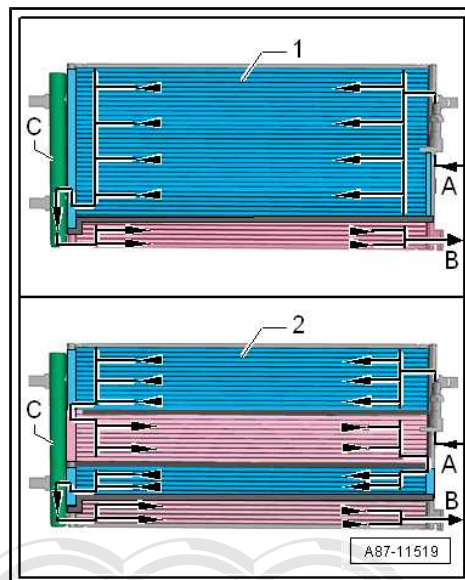
1.2.4 Condenser

- ◆ The condenser -A- conveys heat from the compressed refrigerant gas into the ambient air.
- ◆ In this process, the refrigerant gas condenses to form liquid.



Note

- ◆ Depending on the refrigerant circuit design, the receiver may be mounted on the condenser or integrated in the condenser ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .
- ◆ The condenser is available in different versions, which can only be distinguished externally by means of the part number. In version -1-, the condenser is divided into two zones "2-pass condenser". In version -2-, the condenser is divided into four zones "4-pass condenser".
- ◆ This diagram shows a condenser with mounted receiver -C-.
- ◆ The gaseous refrigerant enters the condenser via connection -A-, where it is cooled and therefore liquefies.
- ◆ The liquid refrigerant collects in the receiver -C- (with dryer) and flows via the lower cooling zone to connection -B-.
- ◆ Depending on the condenser design (interior volume, flow, etc.), the capacity of refrigerant in a refrigerant circuit may differ. Therefore, always ensure the correct version and assignment of the condenser ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .



1.2.5 Evaporator

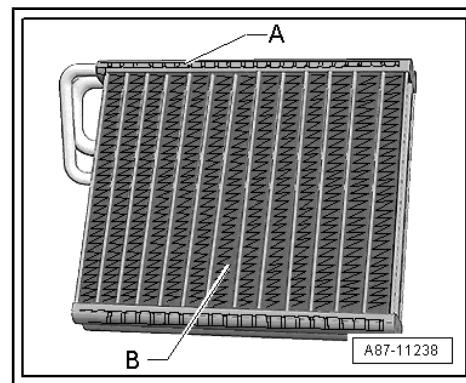
Different evaporator versions are available. Depending on their design and function, the heat energy required to evaporate the refrigerant is drawn from the flow of air (e.g. with an evaporator in the heater and air conditioner unit or battery cooling module) or from the flow of coolant (e.g. with a heat exchanger for high-voltage battery) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Note

Two evaporator versions are described below.

Evaporator in heater and air conditioner unit (or in battery cooling module)

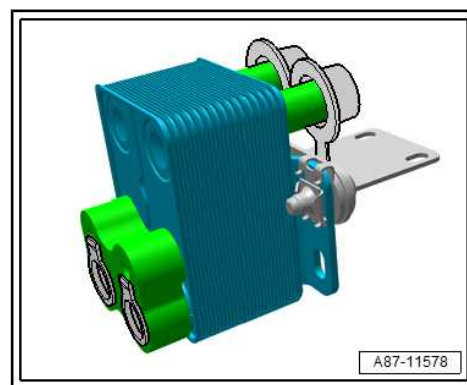
- ◆ The liquid refrigerant evaporates in the pipes of the evaporator -A-. The required heat is drawn from the air skimming past the -B-. The air cools down. The refrigerant evaporates and is extracted from the air conditioner compressor with the absorbed heat
- ◆ A defined quantity of refrigerant is supplied to the evaporator via an expansion valve (restrictor). In systems with an expansion valve the flow rate is regulated such that only gaseous refrigerant emerges at the evaporator outlet.
- ◆ On the introduction of refrigerant R1234yf, the evaporators were adapted accordingly. Therefore, make sure you have the correct version⇒ Electronic parts catalogue .



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

The liquid refrigerant evaporates in the evaporator (heat exchanger). The heat required for this is drawn from the coolant flowing through the evaporator. The coolant cools, the refrigerant evaporates and is extracted from the air conditioner compressor with the absorbed heat.

A defined quantity of refrigerant is supplied to the evaporator via a restrictor (or an expansion valve) and a shut-off valve. The throughput of refrigerant (or coolant) is regulated to ensure that only gaseous refrigerant exits the evaporator outlet ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).



1.2.6 Reservoir



Note

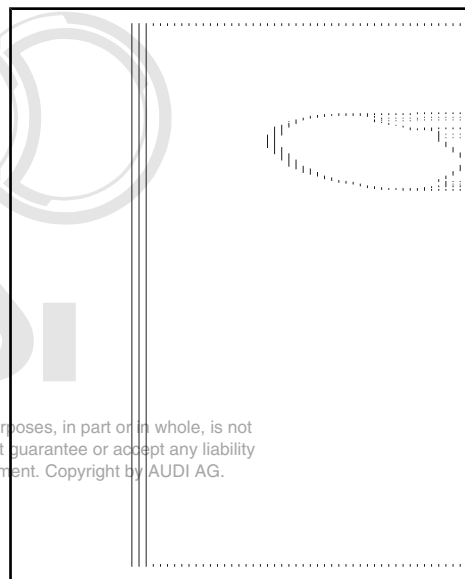
Only installed in air conditioners with a restrictor; this type of air conditioner is currently not installed.

- ◆ To ensure that the air conditioner compressor draws in only gaseous refrigerant, the reservoir collects the mixture of vapour and gas coming from the evaporator. The vapour becomes gaseous refrigerant.
- ◆ Refrigerant oil entrained in the circuit does not remain in the reservoir as an oil extraction hole is provided.
- ◆ Any moisture ingressing into the refrigerant circuit during assembly is trapped by a filter (desiccant bag) in the reservoir.
- ◆ Gaseous refrigerant with oil is drawn in by the air conditioner compressor.



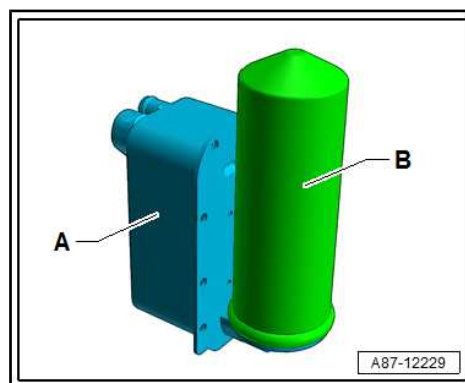
Note

- ◆ *Replace the reservoir if the refrigerant circuit was open for a longer period and moisture entered, or it is stipulated in response to a particular problem ➔ [page 78](#).*
- ◆ *Do not remove the sealing plugs -A- and -B- until immediately prior to installation.*
- ◆ *If the reservoir is not sealed, the desiccant bag soon becomes saturated with moisture and thus unusable.*
- ◆ *When installing, observe arrow indicating direction of flow if applicable.*



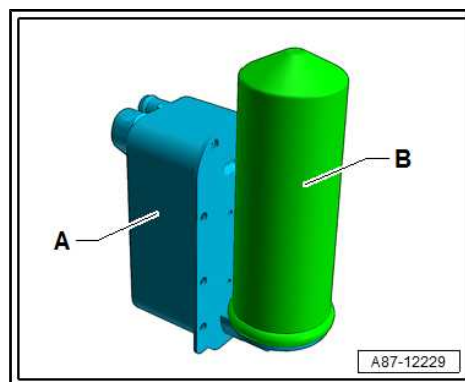
1.2.7 Heat exchanger for heat pump operation

The gaseous or vaporous refrigerant compressed by the air conditioner compressor liquefies in the heat exchanger -A-, the heat released during this process is transferred into the flow of coolant ➔ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).



1.2.8 Liquid collector

In certain operating states (e.g. heat pump mode), the receiver (e.g. on the condenser) is not integrated in the refrigerant circuit. The liquid collector -B- collects the refrigerant, temporarily stores any quantity of refrigerant that is not needed, then conveys it to the expansion valve in an uninterrupted flow (upstream of the evaporator in the heater and air conditioning unit), or to the heat exchanger in the coolant circuit of the high-voltage system ➔ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).



1.2.9 Restrictor

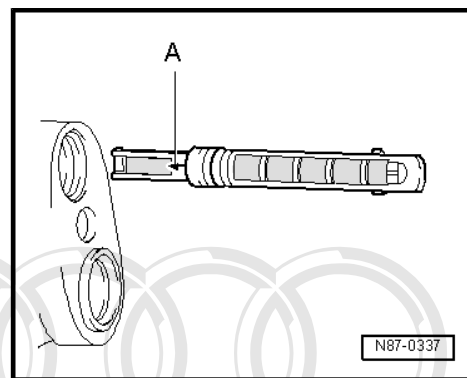
Restrictor upstream of evaporator



Note

No air conditioner with a restrictor upstream of the evaporator is currently installed.

- ◆ The restrictor creates a constriction. This constriction restricts the flow, thus separating the refrigerant circuit into a high and low-pressure end. Upstream of the restrictor, the refrigerant is warm due to the high pressure. Downstream of the restrictor, the refrigerant is cold due to the low pressure. Upstream of the narrow point is a strainer to catch dirt and downstream of the narrow point is a strainer to atomise the refrigerant before it enters the evaporator.



Note

- ◆ Arrow -A- on restrictor faces evaporator.
- ◆ Replace each time the refrigerant circuit has been opened.
- ◆ For different versions, refer to the various customer service information documents ⇒ *Electronic parts catalogue*.

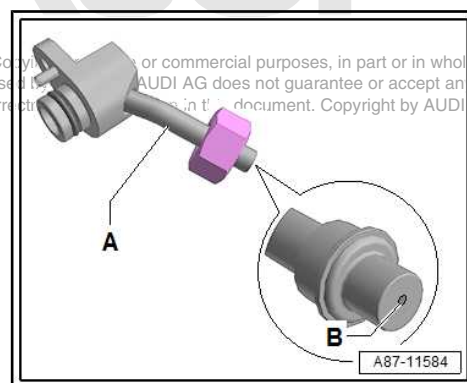
Restrictor upstream of heat exchanger for high-voltage battery (chiller)

The restrictor creates a constriction. This constriction restricts the flow and therefore separates the refrigerant circuit into a high-pressure and a low-pressure side. Upstream of the restrictor, the refrigerant is hot under high pressure. Downstream of the restrictor, the refrigerant is cold under low pressure.



Note

- ◆ This diagram shows a refrigerant line -A- with a permanently installed restrictor -B- (without screen).
- ◆ The restrictor hole -B- has a diameter of approx. 0.7 mm. Depending on the refrigerant line version, this constriction is either permanently installed or just inserted in the refrigerant line. With the inserted version, a screen may be installed to separate suspended bodies that could clog the restrictor hole.
- ◆ Inspect for dirt before installation and clean or replace if necessary.
- ◆ Pay attention to different versions ⇒ *Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual)* and ⇒ *Electronic parts catalogue*.



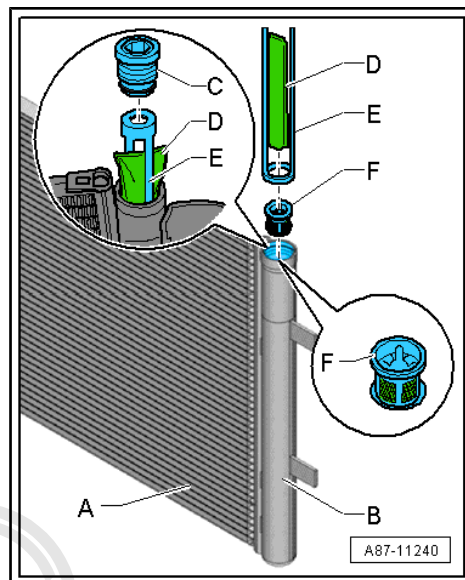
1.2.10 Receiver

- ◆ The receiver -B- collects the drops of liquid and conveys them in an uninterrupted flow to the expansion valve. Moisture that has penetrated the refrigerant circuit during assembly, is collected in the receiver -B- by a dryer -D-.
- ◆ Depending on the refrigerant circuit design and condenser -A- version, the receiver -B- may be mounted on the condenser -A- or integrated in the condenser -A- ➔ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ➔ Electronic parts catalogue .
- ◆ The receiver -B- contains a dryer (e.g. a desiccant bag -D-) and a screen -F- (which retains smaller impurities).



Note

- ◆ *The receiver -B- is available in different versions and designs ➔ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ➔ Electronic parts catalogue .*
- ◆ *Replace the receiver -B- or plastic bolt (with seals) -C-, desiccant cartridge -D-, filter carrier -E- and screen -F- if the refrigerant circuit was open for a longer period and moisture has penetrated, or if stipulated in response to a particular problem ➔ [page 78](#) .*
- ◆ *Only remove the plugs of the receiver shortly before installation. In an open receiver, the desiccant bag becomes saturated with moisture and unusable after just a short time.*
- ◆ *Keep the hermetically sealed delivery bag containing the desiccant cartridge sealed for as long as possible. Only open the delivery bag immediately before inserting the desiccant cartridge -D- in the receiver -B- of the condenser. Once the delivery bag is opened, the desiccant cartridge is saturated with moisture from the ambient air and is therefore unusable, after a short time.*
- ◆ *When installing, observe arrow indicating direction of flow if applicable.*
- ◆ *Depending on the version of receiver/desiccant cartridge, different procedure is required in the event of problems. If, for example, the receiver is attached to the condenser, it can be replaced together with the dryer cartridge. If, for example, the receiver is integrated into the condenser, it is usually possible to replace the dryer cartridge and any additional filter element separately. If the receiver is integrated in the condenser and therefore there is no possibility of replacing the receiver or desiccant cartridge individually, the complete condenser must be replaced if necessary ➔ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ➔ Electronic parts catalogue .*
- ◆ *Depending on the refrigerant circuit design, the receiver (with desiccant bag or desiccant cartridge) may also be integrated in the refrigerant circuit (it does not always have to be installed on or in the condenser) ➔ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ➔ Electronic parts catalogue .*



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

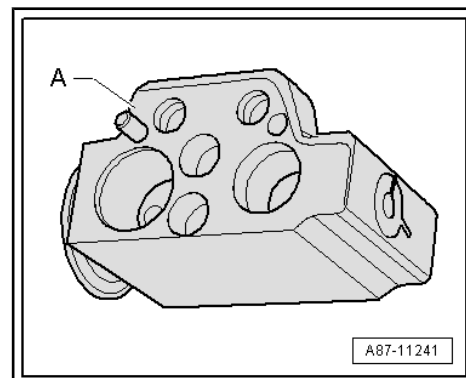
Expansion valve without shut-off function

The expansion valve -A- atomises the incoming flow of refrigerant and regulates the flow rate in such a way that the vapour only becomes gaseous at the evaporator outlet.



Note

- ◆ With the introduction of refrigerant R1234yf, the expansion valves were adapted to the refrigerant (different characteristic curves). Therefore, make sure you have the correct version ⇒ *Electronic parts catalogue*.
- ◆ Different versions for the expansion valve due to different characteristic curves, which are adapted to the refrigerant circuit in question ⇒ *Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue*.
- ◆ Ensure the correct part number when replacing the expansion valve ⇒ *Electronic parts catalogue*.
- ◆ Depending on the air conditioner compressor version, a valve may be installed on the high-pressure side of the air conditioner compressor, which prevents liquid refrigerant from flowing back into the compressor after the air conditioner has been switched off. If an air conditioner compressor with this valve is installed in a vehicle with a refrigerant circuit featuring an expansion valve, it can take a relatively long time for the pressure on the high-pressure side to fall (the expansion valve is cold and the pressure on the low-pressure side rises quickly when the air conditioner is switched off; the expansion valve closes and the refrigerant can only flow to the low-pressure side slowly). When the air conditioner 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.



Expansion valve with refrigerant shut-off valve

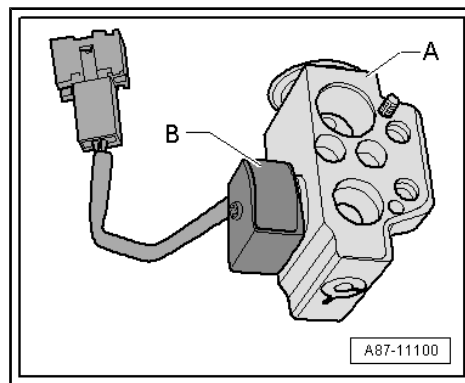


Note

There are different versions of shut-off valves, with different functions and designations ⇒ *Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual)*.

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- ◆ The expansion valve -A- with shut-off valve -B- atomises the incoming flow of refrigerant and regulates the flow rate of refrigerant to the evaporator in the battery cooling module (e.g. the hybrid battery unit) in such a way that the vapour only becomes gaseous at the evaporator outlet.
- ◆ When the shut-off valve -B- is actuated by the electronics, it is open and allows refrigerant to flow to the expansion valve -A-.
- ◆ When the shut-off valve -B- is open and the expansion valve -A- lets refrigerant to flow to the evaporator or heat exchanger in accordance with its regulatory curve ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ The solenoid -B- fitted to the expansion valve -A- is actuated by different control units, depending on the vehicle ⇒ Current flow diagrams, Electrical fault finding and Fitting locations and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ In a vehicle with two evaporators (one in the heater and air conditioning unit and one in the battery cooling module, e.g. in the Audi Q5 Hybrid), the measured temperature matches or is below the specified value on one evaporator, while on the other the required value is not reached, the control system behaves as follows: The control unit in question (e.g. the battery regulation control unit - J840-) actuates the electric air conditioner compressor (e.g. via the power and control electronics for electric drive - JX1- and the air conditioner compressor control unit - J842-) at a higher speed (this increases the cooling output of the air conditioner and the pressure on the low-pressure side and the evaporator temperature fall). If one evaporator then falls below the specified temperature, the relevant control unit actuates the respective shut-off valve (e.g. -J840- the refrigerant shut-off valve 1 - N516- or refrigerant shut-off valve 2 - N517-) in such a way that refrigerant no longer flows through the evaporator that is too cold ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.

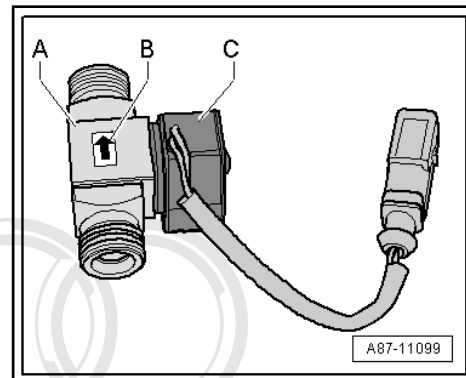



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1.2.12 Refrigerant shut-off valves

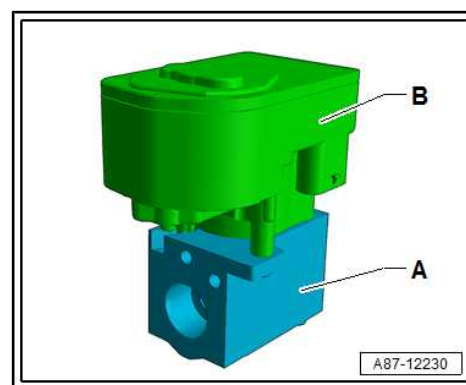
Shut-off valves with two switching states (open or closed)

- ◆ There are different versions of shut-off valves, with different functions and designations ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ When the shut-off valve -A- is not actuated by the electronics, it is open and allows refrigerant to flow through.
- ◆ The shut-off valve -A- is installed e.g. in vehicles with high-voltage system. It is actuated when air conditioning is not required for the passenger compartment, but battery cooling is needed for the hybrid battery unit - AX1- .
- ◆ The arrow -B- on the shut-off valve -A- shows the direction of flow of the refrigerant (from the condenser to the evaporator in the heater and air conditioning unit), please observe.
- ◆ The solenoid -C- fitted to the shut-off valve -A- is actuated by different control units, depending on the vehicle ⇒ Current flow diagrams, Electrical fault finding and Fitting locations and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of air conditioner and battery regulation.
- ◆ In a vehicle with two evaporators (one in the heater and air conditioning unit and one in the battery cooling module, e.g. in the Audi Q5 Hybrid), the measured temperature matches or is below the specified value on one evaporator, while on the other the required value is not reached, the control system behaves as follows: The control unit in question actuates the electric air conditioner compressor at a higher speed (this increases the cooling output of the air conditioner and the pressure on the low-pressure side and the evaporator temperature fall). If one evaporator then falls below the specified temperature, the relevant control unit actuates the respective shut-off valve in such a way that refrigerant no longer flows through the evaporator that is too cold ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.



Shut-off valves that are regulated via curves

- ◆ The relevant control unit actuates (opens or closes) the shut-off valve -A- via curves by means of a control motor -B-.
- ◆ If the shut-off valve is acting as a regulating valve (e.g. as refrigerant expansion valve 1 - N636- in the Audi Q7), it is only opened just far enough to ensure that the required heat exchanger temperature is reached ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Shut-off valves actuated by control motors have no preset rest position. Therefore, they must be moved to a certain position (open or closed) before any work is performed on the refrigerant circuit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Depending on the refrigerant circuit design, several shut-off valves may be combined in a valve block (e.g. in the e-Golf or Audi Q7 e-tron) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ The appropriate control unit programmes and actuates the control motor via data lines (LIN bus), in accordance with its fitting location ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.



1.2.13 Refrigerant line with internal heat exchanger

- ◆ In this refrigerant line, the hot liquid refrigerant flowing on the high-pressure side supplies energy to the cold gaseous or vaporous refrigerant flowing on the low-pressure side, enhancing the efficiency of the air conditioner.



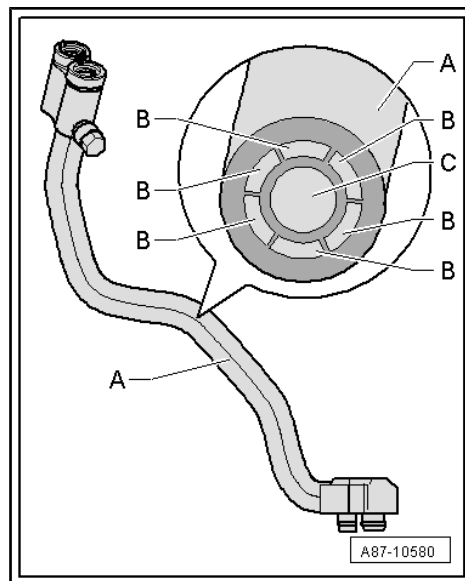
Note

This diagram shows a refrigerant line with internal heat exchanger, as is installed e.g. in the Golf 7, Audi A4 2008 > and the Audi A5 Coupé 2008 > ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

A - Refrigerant line with internal heat exchanger

B - Channels in the refrigerant line in which the hot liquid refrigerant flows to the evaporator (high-pressure end of the refrigerant circuit).

C - Channel in the refrigerant line in which the cold refrigerant gas or vapour flows to the air conditioner compressor (low-pressure end of the refrigerant circuit).



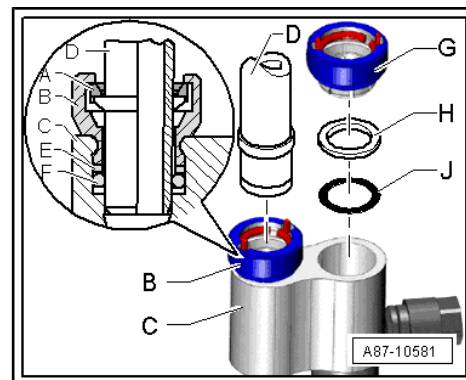
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1.2.14 Refrigerant line quick-release coupling connections



Note

- ◆ This diagram shows the quick-release couplings with a refrigerant line with internal heat exchanger, as is installed e.g. in the Audi A4 2008 ➤ and the Audi A5 Coupé 2008 ➤ ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ To remove the refrigerant line -D-, open the retaining ring -A- e.g. using the refrigerant line release tool (release tool - T40149- or dismantling tool - T40232-) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ After removing the refrigerant line, replace the quick-release couplings -B- and -G- together with the associated support ring -E- or -H- and seal -F- or -J- ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant line (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .



A - Retaining ring (in quick-release coupling connection on high-pressure end)

B - Quick-release coupling connection with retaining ring "high-pressure end"

C - Refrigerant line with an internal heat exchanger

D - Refrigerant line "high-pressure end"

E - Support ring "high-pressure end"

F - Seal on "high-pressure side"

G - Quick-release coupling connection with retaining ring "low-pressure end"

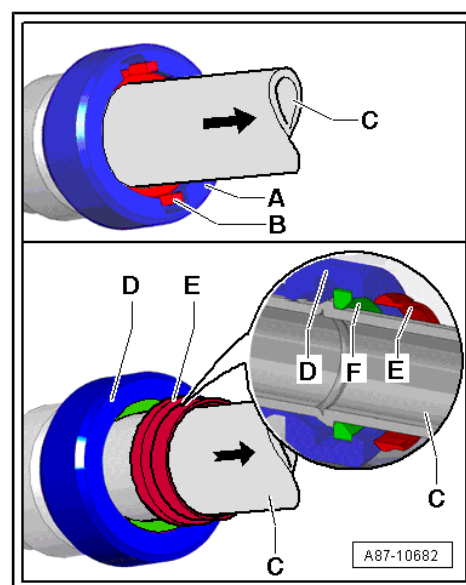
H - Support ring "low-pressure end"

J - Seal on "low-pressure side"



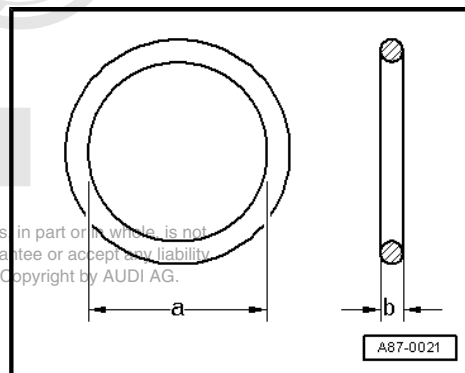
Note

- ◆ There are different versions -A- and -D- of the quick-release couplings. The refrigerant lines -C- can be released and removed, e.g. with the refrigerant line release tool -T40149/1- in the same way for both versions of these quick-release couplings ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ With quick-release coupling version -A-, when the refrigerant line -C- has been installed, the control pins -B- are visible when the locked refrigerant line -C- is pulled in the direction of the arrow.
- ◆ With quick-release coupling version -D-, the refrigerant line -C- is installed in the same way as with quick-release coupling -A-. If, with this version, the refrigerant line -C- is pulled in arrow direction following assembly, the snap ring -E- emerges from the quick-release coupling -D- to show that the retaining ring -F- and the refrigerant line -C- are fully locked. The snap ring -E- is then to be detached from the refrigerant line -C-.



1.2.15 Seals

- ◆ The seals prevent leaks where the individual components of the refrigerant circuit connect
⇒ ["3.2 Seals for the refrigerant circuit", page 8](#) .



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1.2.16 Refrigerant circuit pipes and hoses

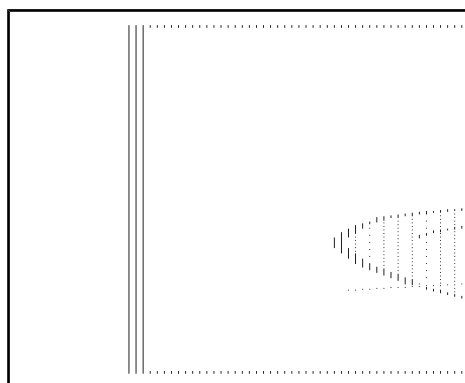
- ◆ In its pure state, refrigerant R1234yf is chemically stable and does not attack iron, aluminium or appropriately engineered and therefore suitable plastics. The mixture of refrigerant oil and refrigerant R1234yf can attack certain metals (e.g. copper alloys) and attack or dissolve certain hose materials and plastics. Therefore, only use genuine Audi spare parts ⇒ Electronic parts catalogue .
- ◆ Only use components that are resistant to refrigerant R1234yf and associated refrigerant oils. Do not use components (e.g. seals and hoses as these are made of plastic), which cannot be clearly assigned ⇒ Electronic parts catalogue .
- ◆ Pipes and hoses are held together with threaded couplings and/or special connections ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Replace sealing elements (e.g. seals) between components ⇒ Electronic parts catalogue .
- ◆ Pay attention to the specified torques for threaded connections and use the intended release tools for push-in connections ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

1.2.17 Pressure relief valve

The pressure relief valve is attached to the air conditioner compressor or receiver.

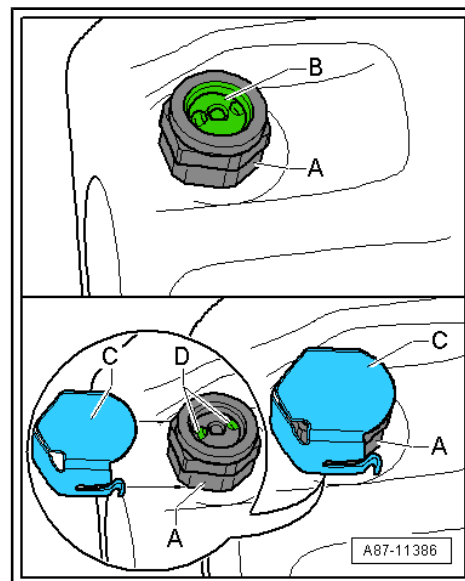
At a pressure of approx. 38 bar (overpressure), the valve opens and closes again once the pressure has abated (at approx. 35 bar).

Not all the refrigerant is lost from the system.



 Note

- ◆ Depending on the version, a transparent plastic disc -B- may be fitted to the high-pressure safety valve -A-, which ruptures as soon as the valve is triggered.
- ◆ Depending on the version of high-pressure safety valve -A-, a cover -C- may additionally be pushed onto the high-pressure safety valve -A-. If the pressure in the refrigerant circuit does actually rise above the opening pressure of the high-pressure safety valve -A- and the latter opens, the refrigerant does not exit in one direction, but is distributed between the openings -D- under the cover -C- as it exits.

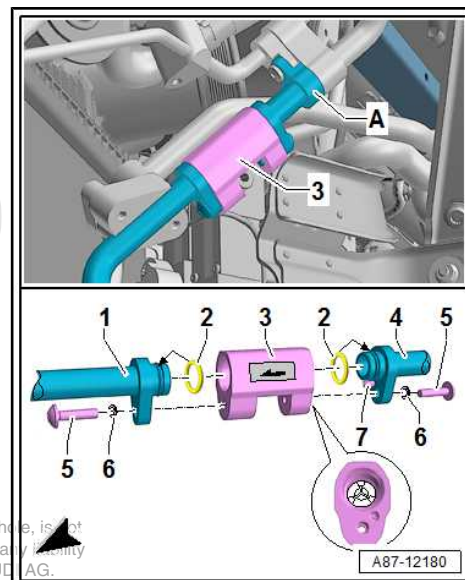


1.2.18 Non-return valves

Non-return valves divide the refrigerant circuit into different areas ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

 Note

- ◆ The non-return valve -3- shown is installed in the Audi Q7 e-tron, for example ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Non-return valves in the refrigerant circuit have a certain holding pressure in the flow direction (approx. 0.1 bar or 100 mbar). Therefore, all electrically actuated valves must be open in order for the refrigerant circuit to be fully evacuated (residual pressure less than 5 mbar).
- ◆ Depending on the version, the direction of flow may be indicated by a sticker.



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1.2.19 Connections for quick-release couplings in the refrigerant circuit

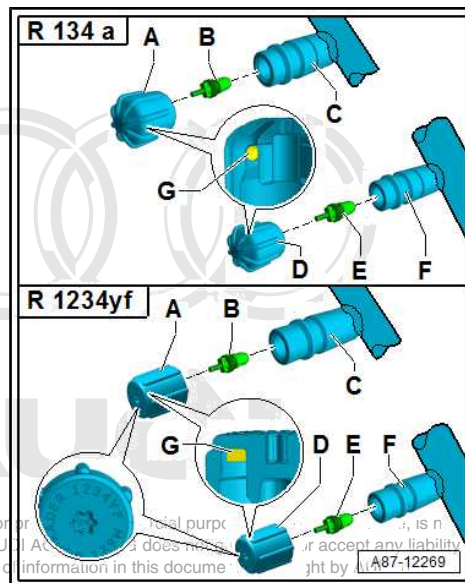
Service connections with Schrader valve (needle or push pin valve)

- ◆ Only valves and connections that are resistant to refrigerant R1234yf and associated refrigerant oils may be used.
- ◆ Service connections -C- and -F- on an R1234yf refrigerant circuit are designed in such a way that service couplings designed for the service connections of an R134a refrigerant circuit cannot be connected.
- ◆ Different connections (outer diameter) for the high-pressure and low-pressure side -C- and -F-.
- ◆ Drain the refrigerant circuit before removing the valves or valve inserts -B- and -E-.
- ◆ Always screw on caps -A- and -D- with seal -G-.

Position in the vehicle ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

– Extract refrigerant before unscrewing the valves.

- ◆ Service connection on low-pressure side -F-
- ◆ Service connection on high-pressure side -C-
- ◆ Valve insert (designation: Schrader or needle valve)
- ◆ Cap, service connection on low-pressure side with seal -A-
- ◆ Cap, service connection on high-pressure side with seal -D-





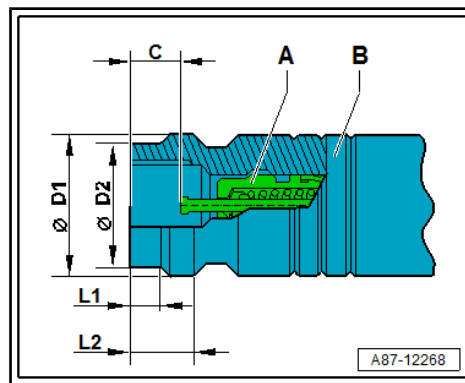
Note

- ◆ *Following connection, carefully screw the handwheel of the service coupling into the quick-release coupling adapter to the extent required to reliably open the valve in the service connection (observe the pressure gauge; take care not to open the valve too far).*
- ◆ *The service connections on an R1234yf refrigerant circuit are designed in such a way that the service couplings designed for the service connections of an R134a refrigerant circuit cannot be connected.*
- ◆ *The service connections may be soldered in a refrigerant line, for example and can therefore not be individually replaced.*
- ◆ *To remove and install the valve insert when the refrigerant circuit is drained, use an adapter from the socket attachment - T10364- , for example.*
- ◆ *Always use caution when tightening the valve insert as it has a low tightening torque.*
- ◆ *These valves are available in different versions and therefore the tightening torques differ. Valve insert -C- with a VG5 thread (5.2 x 0.7 mm, tyre valve) has a tightening torque of 0.4 Nm ± 0.1 Nm, while a valve insert with an M6 x 0.75 mm thread has a tightening torque of 0.9 Nm ± 0.1 Nm and one with a thread of M8 x 1.0 mm has a tightening torque of 2.0 Nm ± 0.2 Nm.*
- ◆ *These valve caps are available in different versions and therefore the tightening torques differ. 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 inserts and associated caps are available in different versions. Take care to ensure the correct version of valve insert and the correct assignment of the caps ⇒ Electronic parts catalogue .*

Service connection dimensions

- ◆ Valve insert -A- (different versions).
- ◆ Service connection -B- (different versions on the high and low-pressure side, depending on refrigerant)

Dimensions of service connections -B-	Service connection for refrigerant R134a		Service connection for 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	6.15 mm	9.0 mm	4.75 mm
Shoulder -L2-	8.16 mm	9.16 mm	12.5 mm	7.2 mm
Valve fitting location (not actuated) -C-	6.1 - 7.1 mm	6.1 - 7.1 mm	8.3 - 9.3 mm	8.3 - 9.3 mm



Service connections with primary sealing valve (ball valve)

- ◆ This type of service connection is currently not used in VW/Audi refrigerant circuits
- ◆ Only valves and connections that are resistant to refrigerant R1234yf and associated refrigerant oils may be used.
- ◆ The service connections on an R1234yf refrigerant circuit are designed in such a way that the service couplings designed for the service connections of an R134a refrigerant circuit cannot be connected.
- ◆ There are different connections (OD) for the high and low pressure ends.
- ◆ Discharge the refrigerant circuit before removing valves or valve inserts.
- ◆ Always screw on caps with a seal.

Position in the vehicle ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

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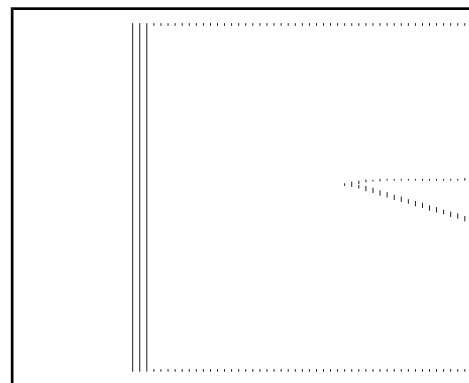
Connection with high-pressure valve

- 1 - Socket with internal thread (soldered in)
- 2 - Seal (version and identification: black or coloured ⇒ Electronic parts catalogue)
- 3 - Valve with outer thread and groove for seal (designation: ball valve)
- 4 - Seal for sealing cap
- 5 - Sealing cap



Note

- ◆ Following connection, carefully screw the handwheel of the service coupling into the quick-release coupling adapter to the extent required to reliably open the valve in the service connection (observe the pressure gauge; take care not to open the valve too far).
- ◆ To remove and install the valve -3- with the refrigerant circuit drained, make use of an adapter from the socket - T10364- for example.
- ◆ There are different versions of these valves (with internal or external thread) and the tightening torques may therefore also differ. In the valves -3- with outer thread M12 x 1.5 mm currently in use today, the tightening torque is $9 \text{ Nm} \pm 1 \text{ Nm}$.
- ◆ These valves and associated caps are available in different versions. Take care to ensure the correct version of valve insert and the correct assignment of the caps ⇒ Electronic parts catalogue .



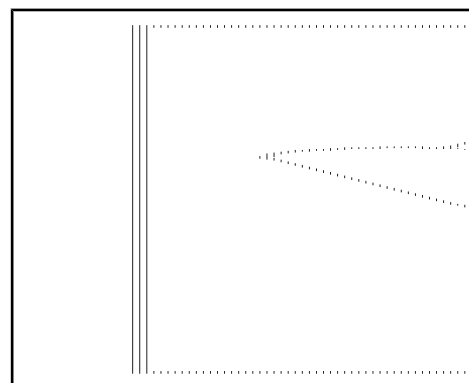
Connection with low-pressure valve

- 1 - Base with outer thread and groove for seal (soldered in)
- 2 - Seal (version and identification: black or coloured ⇒ Electronic parts catalogue)
- 3 - Valve with internal thread
- 4 - Seal for sealing cap
- 5 - Sealing cap



Note

- ◆ Carefully screw the handwheel of the service coupling into the quick-release coupling adapter to the extent required to reliably open the valve in the service connection (observe the pressure gauge; take care not to open the valve too far).
- ◆ To remove and install the valve -3- with the refrigerant circuit drained, make use of an adapter from the socket - T10364- for example.
- ◆ There are different versions of these valves (with internal or external thread) and the tightening torques may therefore also differ. In the valves -3- with internal thread M10 x 1.25 mm currently in use today, the tightening torque is $9 \text{ Nm} \pm 1 \text{ Nm}$.
- ◆ These valves and associated caps are available in different versions. Take care to ensure the correct version of valve insert and the correct assignment of the caps ⇒ Electronic parts catalogue .



1.2.20 Connections with valve for switches in refrigerant circuit



Note

For switching pressures, removing and installing switches and switch position and version, see vehicle-specific refrigerant circuit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

- There are different threads for switches on the high and low pressure ends.
- Only valves and seals that are resistant to refrigerant R1234yf and associated refrigerant oils may be used. ⇒ Electronic parts catalogue .

A - Connection (soldered in)

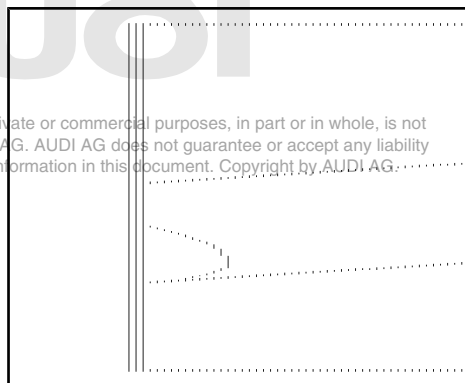
B - Seal

C - Valve (with seal)



Note

- ◆ To remove and install the valve insert -C- when the refrigerant circuit is drained, use an adapter from the socket attachment - T10364- , for example (tightening torque ⇒ [page 56](#)).
- ◆ These valves are available in different versions and therefore the tightening torques differ. Valve insert -C- with a VG5 thread (5.2 x 0.7 mm, tyre valve) has a tightening torque of 0.4 Nm ± 0.1 Nm, while a valve insert with an M6 x 0.75 mm thread has a tightening torque of 0.9 Nm ± 0.1 Nm and one with a thread of M8 x 1.0 mm has a tightening torque of 2.0 Nm ± 0.2 Nm.



1.2.21 Refrigerant circuit pressure senders and switches



Note

- ◆ There are different versions of pressure senders and switches, with different functions and designations ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Switching pressures, removing and installing switches and switch position and version ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

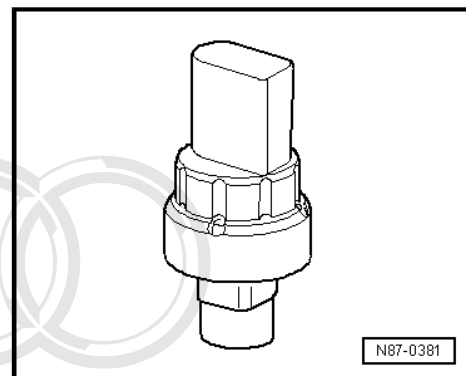
◆ The high-pressure sender shown is installed e.g. in the Golf 7 and Audi A3 ➤ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

◆ One version of the pressure sender generates a square wave signal when voltage is applied. This signal changes with the pressure in the system. The other pressure sender version exchanges information via the data bus (e.g. via the "LIN bus") with the respective control unit when voltage is applied ➤ Current flow diagrams, Electrical fault finding and Fitting locations and ➤ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner. Therefore, ensure you have the correct pressure sender version.

◆ Different versions of pressure sender are available. From the outside, different versions can be recognised only by part number; therefore ensure the correct assignment on replacement (part number ➤ Electronic parts catalogue). Reason: These senders emit different signals and the respective control units can only evaluate the signal for which they are designed ➤ Vehicle diagnostic tester in "Guided Fault Finding" of the air conditioner and ➤ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

◆ One version of the pressure sender only transmits the measured value for the refrigerant circuit pressure to the connected control unit. The other version transmits the measured value for the refrigerant circuit pressure and the measured temperature to the connected control unit, therefore ensure you have the correct version ➤ Electronic parts catalogue .

◆ With this signal, the downstream control units calculate the pressure in the refrigerant circuit and actuate the radiator fans and the motor, the refrigerant circuit magnetic clutch - N25- or change the actuation of the air conditioner compressor regulating valve - N280- ➤ Vehicle diagnostic tester in "Guided Fault Finding" of the air conditioner and ➤ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).



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1.2.22 Refrigerant pressure and temperature senders

CAUTION

**Danger of frostbite from refrigerant escaping under pressure.
The skin and other parts of the body can suffer frostbite.**

- Wear protective gloves.
- Wear safety goggles.
- Extract the refrigerant and immediately open the refrigerant circuit.
- Extract the refrigerant again if more than 10 min have passed since initial extraction and the refrigerant circuit has not been opened up. Renewed evaporation leads to the build-up of pressure in the refrigerant circuit.

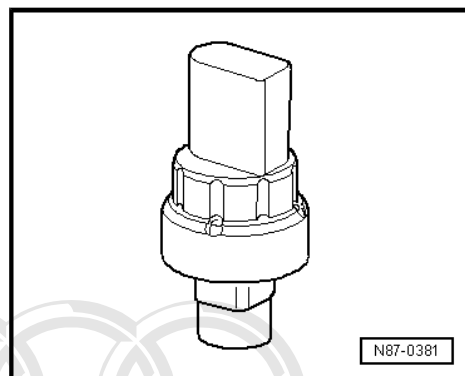
Sender for connecting to a valve on the refrigerant circuit



Note

- ◆ For switching pressures, removing and installing switches and switch position and version, see vehicle-specific refrigerant circuit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

- ◆ These senders are available in different versions, with different functions and designations. The refrigerant pressure and refrigerant temperature sender - G395- shown below is installed e.g. in the Golf GTE, Audi A4, Audi Q5 and Audi Q5 Hybrid ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).



- ◆ Before undoing the threaded joint of the sender, check which version it is ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

- ◆ With a sender for connecting to a refrigerant circuit without valve. Extract the refrigerant before undoing the threaded joint. If the sender is not removed within 10 minutes of extraction, pressure may build up in the refrigerant circuit due to renewed evaporation. Extract refrigerant again.

- ◆ Different designations depending on function and vehicle ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

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- ◆ The refrigerant pressure and refrigerant temperature sender is installed e.g. in place of the high-pressure sender or refrigerant circuit pressure sender ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual)

- ◆ There are different versions of the refrigerant pressure and refrigerant temperature sender, the refrigerant circuit pressure sender and the high-pressure sender. From the outside, these different versions can be recognised only by part number; therefore ensure the correct assignment on replacement (part number ⇒ Electronic parts catalogue). Reason: These senders emit different signals and the respective control units can only evaluate the signal for which they are designed ⇒ Vehicle diagnostic tester in "Guided Fault Finding" of the air conditioner or ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

- ◆ The refrigerant pressure and refrigerant temperature sender (and the refrigerant circuit pressure sender) exchange information via the data bus (e.g. via the "LIN bus") with the respective control unit when a voltage is applied. From this information, the control unit calculates the pressure (and the temperature) in the refrigerant circuit. Any detected errors are also reported to the control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.

- ◆ The refrigerant pressure and refrigerant temperature sender transmits the measured value for the refrigerant circuit pressure and the measured temperature to the connected control unit. The refrigerant circuit pressure sender only transmits the measured value for the refrigerant circuit pressure to the connected control unit. Even if only the pressure signal is evaluated in most vehicles, no other pressure sender may be installed in a vehicle intended to be equipped with a refrigerant pressure and refrigerant temperature sender ⇒ Electronic parts catalogue .

- ◆ The temperature measured by this refrigerant pressure and refrigerant temperature sender differs from the actual refrigerant temperature in the refrigerant circuit due to the sender version and fitting location. Therefore, it is currently not evaluated by all control units and used to regulate the air conditioner ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ With this information, the control units calculate the pressure in the refrigerant circuit and actuate downstream control units (radiator fan control unit, engine control unit, etc.) via the data bus. These control units then actuate e.g. the air conditioner magnetic clutch - N25-, radiator fans and motor accordingly ⇒ Vehicle diagnostic tester in "Guided Fault Finding" of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Sender for connection to the refrigerant circuit without valve



Note

- ◆ *These senders are available in different versions, with different functions and designations. The refrigerant pressure and refrigerant temperature sender shown below is installed e.g. in the Audi Q7 e-tron ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *Different designations depending on function and vehicle ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

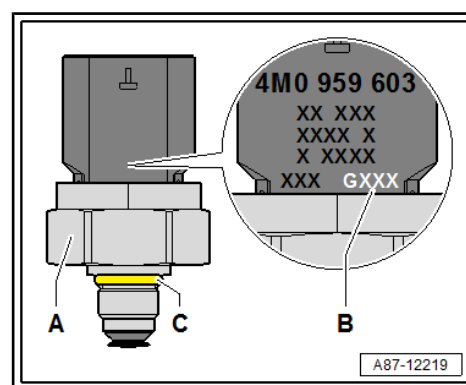
Possible designations for these senders

- ◆ Refrigerant pressure and refrigerant temperature sender - G395- (e.g. in the e-Golf, Audi Q7 e-tron)
- ◆ Refrigerant pressure and refrigerant temperature sender 2 - G826- (e.g. in the Audi Q7 e-tron)
- ◆ Refrigerant pressure and refrigerant temperature sender 3 - G827- (e.g. in the Audi Q7 e-tron)

These senders -A- are available in different versions, which currently only differ on the outside by their part number, or by the same part number on the stamped on designation -B-. Therefore, on replacement ensure the correct assignment, part number and designation ⇒ Electronic parts catalogue and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

These senders exchange information with the respective control unit via the data bus (e.g. via the "LIN bus") when a voltage is applied. From this information, the control unit calculates the pressure (and the temperature) in the refrigerant circuit. Any detected errors are also reported to the control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.

With this information, the control unit calculates the pressure in the refrigerant circuit and actuates the downstream control units or components (radiator fan control unit, pumps, valves, etc.) as required ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner ; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).



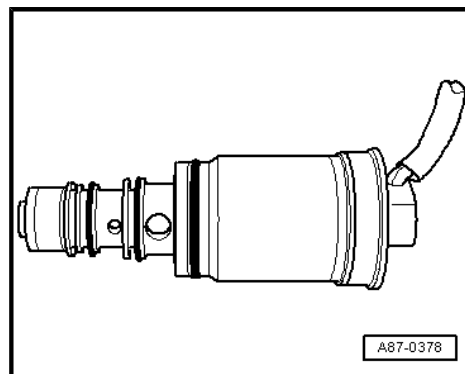
1.2.23 Air conditioner compressor regulating valve - N280-



Note

For switching pressures, removing and installing switches and switch position and version, see vehicle-specific refrigerant circuit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

- ◆ The regulating valve is installed in the air conditioner compressor. It is actuated e.g. by the air conditioner control unit - J301- , the air conditioner operating and display unit - E87- or the Climatronic control unit - J255- (possibly via the data bus and an additional control unit, depending on the vehicle) ⇒ Vehicle diagnostic tester in "Guided Fault finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ The pressure on the low-pressure end is influenced by the regulating valve, thus regulating the temperature in the evaporator.



Note

The air conditioner compressor regulating valve - N280- is part of the air conditioner compressor and cannot be replaced as an individual part in all air conditioner compressors ⇒ Electronic parts catalogue and ⇒ "1.5.9 Removing and installing, replacing the air conditioner compressor regulating valve N280", page 91 .

1.2.24 Refrigerant temperature sender



Note

- ◆ *A refrigerant temperature sender (a temperature sender without pressure evaluation) is currently not installed by Volkswagen/Audi.*
- ◆ *Switching pressures, removing and installing switches and switch position and version ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

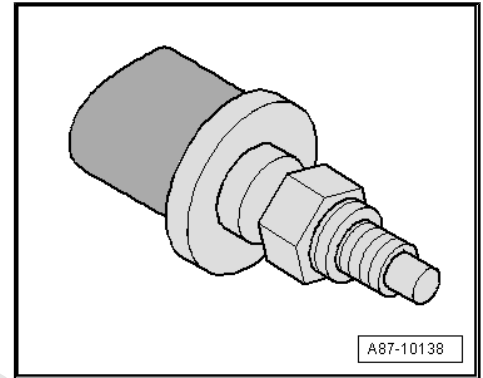
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- ◆ The refrigerant temperature sender (with a temperature-sensitive resistor) is installed, for example, in the high-pressure line next to the air conditioner compressor.
- ◆ There is a direct relationship between temperature and pressure in the refrigerant circuit. If there is too little refrigerant in the refrigerant circuit, when the air conditioner is in operation, the temperature in the circuit rises more than the specified value for this pressure on the high-pressure side.



Note

The relevant control units, e.g. the air conditioner operating and display unit - E87- or the Climatronic control unit - J255- evaluate the pressure and temperature in the refrigerant circuit and switch off the air conditioner compressor if the temperature rises above the value that was stored for this pressure ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).



1.3 Possible problems

⇒ **"1.3.1 Prerequisites for determining the cause of a problem", page 65**

⇒ **"1.3.2 Possible problems", page 65**

⇒ **"1.3.3 Smells from the heater and air conditioning unit", page 67**

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1.3.1 Prerequisites for determining the cause of a problem

- Fault finding in the electrical system, the vacuum system and the air ducts does not reveal any errors ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner (and battery regulation), ⇒ Current flow diagrams, Electrical fault finding and Fitting locations and ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (when the air conditioner is in operation).
- Self-diagnosis in "Guided Fault Finding" mode of the air conditioner (e.g. with the ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner) does not reveal any events for a problem.
- No cut-off criteria are shown for the air conditioner compressor in the measured values of the air conditioner control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.

1.3.2 Possible problems



Note

- ◆ *For all problems marked with **
⇒ **"2.14 Checking pressure values", page 177** .
- ◆ *If a problem occurs in only one evaporator in a vehicle with two evaporators, also check the refrigerant circuit pressure values* ⇒ **"2.14 Checking pressure values", page 177** .
- ◆ The cooling has completely failed.*
- ◆ Insufficient cooling output at all vehicle or engine speeds.*

- ◆ No or insufficient cooling after driving a few miles. *
- ◆ No or insufficient cooling in one or both evaporators (in vehicles with two heater and air conditioning unit/evaporators). *
- ◆ Actuation of the air conditioner compressor (via the air conditioner magnetic clutch - N25- or the air conditioner compressor regulating valve - N280-) is cut off by the relevant control unit (e.g. the air conditioner operating and display unit - E87- , the air conditioner control unit - J301- or the Climatronic control unit - J255-) due to excessively high or low pressure in the refrigerant circuit * ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.
- ◆ The electric air conditioner compressor - V470- is not actuated by the air conditioner compressor control unit - J842- due to excessively high or low pressure * ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation.
- ◆ No or greatly decreasing fresh air intake after driving a few kilometres (iced up evaporator) * ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.

In addition, the following problems may occur:

The air conditioner compressor is making noises.

- Tighten the bolts of the air conditioner compressor and air conditioner compressor bracket using a torque wrench ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Check the routing of refrigerant lines. They must not be in contact with other components and must be installed free of strain (re-position if necessary) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Noises occur immediately after the air conditioner is switched on and/or when cornering or braking (refrigerant liquid hammer):

- Drain, evacuate and recharge the refrigerant circuit (too much refrigerant or refrigerant oil in the circuit) ⇒ [page 138](#) and ⇒ ["2.14 Checking pressure values", page 177](#) .



Note

Too much refrigerant oil in the circuit can also lead to this problem (e.g. the quantity of refrigerant oil was not adjusted during air conditioner compressor replacement) ⇒ [page 78](#) .

Water sprays out of the vents (in the dash panel or footwell) with an otherwise perfectly functioning air conditioner:

- Check that the condensate drain is correctly routed, it must not be crushed or kinked ⇒ Heating, air conditioner; Rep. gr. 87 ; Front heater and air conditioning unit (vehicle-specific Workshop Manual).
- Check condensate drain valve, it must not be gummed up with wax or underseal and it must close properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Front heater and air conditioning unit (vehicle-specific Workshop Manual).
- Check the plenum chamber cover, it must not be damaged and must be installed correctly (no water may run into the evaporator) ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).

- Check plenum chamber water drains, they must not be blocked (e.g. due to fallen leaves) ⇒ Heating, air conditioner; Rep. gr. 87; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).



Note

Fitting location and further information on these components ⇒ Heating, air conditioner; Rep. gr. 87; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).

1.3.3 Smells from the heater and air conditioning unit

⇒ [page 67](#)

⇒ [page 68](#)

⇒ [page 68](#)

Is the smell coming from the evaporator or heat exchanger?

◆ Fishy smell

- Due to leaks in the engine cooling system or the heat exchanger in the heater and air conditioning unit.



Note

If the fishy smell becomes less when the set temperature is “cold” or stronger when it is “hot”, check the heat exchanger for leaks.

◆ Smell of burned clutch

◆ Vapour from floor mats, subsequently fitted protective covers for seats, etc.

◆ Rotting, musty smell

- Due to the accumulation and deposit of leaves, fir needles, etc. in the plenum chamber.



Note

Clean the plenum chamber.

- Due to water that cannot drain from the plenum chamber.



Note

Check plenum chamber water drains.

◆ Smell from the heater and air conditioning unit



Note

Smells that arise in the heater and air conditioning unit can be noticed both in fresh air and recirculation mode.

- Due to too much condensate in the heater and air conditioning unit



Note

Check the condensate drain.

- Due to an old or very dirty dust and pollen filter



Note

Check dust and pollen filter.

- Due to deposits on the evaporator blades



Note

Clean the evaporator with the ultrasonic air conditioner cleaning equipment ⇒ [page 68](#) or the pressure gun and suitable spray lance ⇒ [page 68](#) .

Ultrasonic air conditioner cleaning equipment

- The ultrasonic air conditioner cleaning equipment is placed in the passenger footwell and atomises the Aero-Clean agent, neutralises microbes and bacterial contamination in the heater and air conditioning unit ⇒ Heating, air conditioner; Rep. gr. 87 ; Front heater and air conditioning unit (vehicle-specific Workshop Manual).

Instructions for use are supplied with the equipment.

Current equipment ⇒ Electronic parts catalogue .

Spray wash the evaporator with the pressure gun and spray lance

Spray wash the evaporator directly with a cleaning agent using a spray lance (approx. 10 bar). This cleaning agent neutralises microbes and bacterial contamination directly on the evaporator.

Preparatory work and different spray lances are required in order to gain access to the evaporator ⇒ Heating, air conditioner; Rep. gr. 00 ; General information (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Front heater and air conditioning unit (vehicle-specific Workshop Manual).

Instructions for use are also supplied with the evaporator cleaning solution ⇒ Electronic parts catalogue .

1.4 Locating leaks

⇒ [“1.4.1 General information on locating leaks in the refrigerant circuit”, page 69](#)

⇒ [“1.4.2 Finding leaks in the refrigerant circuit using an electronic leak detector”, page 70](#) .

⇒ [“1.4.3 Finding leaks with the UV leak detector system”, page 72](#) .

⇒ [“1.4.4 Locating leaks via the vacuum test with the air conditioner service station or via the pressure test”, page 77](#)

1.4.1 General information on locating leaks in the refrigerant circuit



Note

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- ◆ *Minor leaks can be detected with an electronic leak detector or UV leak detector lamp for example.*
- ◆ *This Workshop Manual describes the search for leaks in the refrigerant circuit using two different methods. These have been tested and, when applied correctly for particular problems, lead to reliable results under various operating conditions.*
- ◆ *There are numerous systems available on the market for the detection of refrigerant circuit leaks. These methods do not always deliver clear results and, if not employed precisely as instructed, may also cause various components of the refrigerant circuit to be identified as leaking when they are not. In addition, certain methods may cause damage to or impair re-frigerant circuit components.*
- ◆ *Components that are found to be leaking must be replaced, not repaired.*
- ◆ *A leaking refrigerant circuit must not be charged with refrigerant. Therefore, evacuate drained refrigerant circuits before charging with refrigerant and also check it for leaks*
⇒ [“2.5 Evacuating the refrigerant circuit”, page 148](#) .



Note

- ◆ *VW/Volkswagen/Audi refrains from using chemicals (sealing additives) to seal leaks in the refrigerant circuit.*
- ◆ *Chemicals for sealing leaks form deposits in the refrigerant circuit which adversely affect the function of the air conditioner and lead to failure of the air conditioner (and your air conditioner service station).*
- ◆ *Chemicals (sealing additives) for sealing leaks in the refrigerant circuit mostly react with ambient air or humidity contained within it. Due to deposits in the refrigerant circuit (and in your air conditioner service station), these cause malfunctions in valves and other components with which they come into contact. These deposits cannot be completely removed from components (not even by cleaning/flushing). The refrigerant circuit can therefore only be repaired by replacing all the components which have come into contact with this substance.*

1.4.2 Finding leaks in the refrigerant circuit using an electronic leak detector

Special tools and workshop equipment required

- ◆ Electronic leak detector or commercially available



Note

- ◆ *Leaks in an R1234yf refrigerant circuit can only be located using electronic leak detectors that are designed for refrigerant R1234yf.*
- ◆ *Different refrigerants have a different molecular structure. The sensors of the electronic leak detectors are adapted in line with these molecules. If an electronic leak detector is used that is not specially designed for refrigerant R1234yf, it does not react to refrigerant R1234yf or only reacts when there is a larger concentration of refrigerant in the vicinity of the leak. Therefore, electronic leak detectors that are designed only for refrigerant R134a cannot be used to find leaks in an R1234yf refrigerant circuit.*
- ◆ *Depending on the version of heater and air conditioning unit, a leak in the evaporator can also be located by holding the probe tip of the leak detector in the heater and air conditioning unit via the glove box cooling connection, or holding the probe tip in the open condensate drain connection of the heater and air conditioning unit with the condensate drain hose removed.*

Performing a leak test on a completely empty refrigerant circuit due to leakage:



Note

To prevent more refrigerant than absolutely necessary for locating the leak in a completely empty refrigerant circuit from getting into the environment, proceed as follows:

- Evacuate refrigerant circuit with the air conditioner service station ⇒ [“2.5 Evacuating the refrigerant circuit”, page 148](#).



Note

- ◆ *If major leakage has already been discovered during evacuation, locate and eliminate this as described here ⇒ [“2.5 Evacuating the refrigerant circuit”, page 148](#).*
 - ◆ *If no leaks are found during evacuation, or a leak is discovered that is so minor that it cannot be located by means of a vacuum test, proceed as described below.*
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- If the refrigerant circuit is completely empty, fill with approx. 10 % of the refrigerant capacity and perform a leak test as for a refrigerant circuit filled with refrigerant ⇒ [page 70](#).

Performing a leak test on a refrigerant circuit charged with refrigerant:

- In vehicles with high-voltage system, switch off (deactivate) the “auxiliary air conditioning” function ⇒ Owner's Manual and ⇒ Infotainment/MMI Operating Manual.
- Switch off ignition.
- Start up the leak detector in line with the operating instructions.

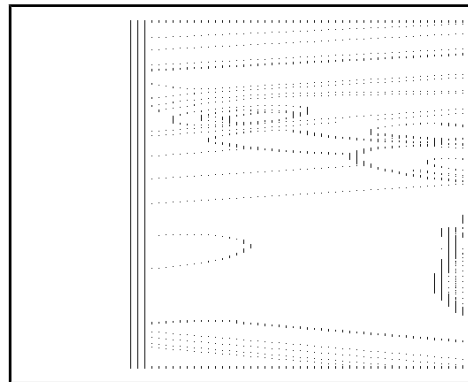
- Always hold the probe tip under the location of the suspected leak.

If the number of clicking noises increases or a wailing noise occurs, depending on the design, the leak has been found ⇒ Leak detector operating instructions .



Note

- ◆ *Refrigerant gas is quickly dispersed by the movement of air. Draughts must therefore be avoided during leak detection.*
- ◆ *Refrigerant gas is heavier than air and therefore sinks to a lower level at the exit location.*



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1.4.3 Finding leaks with the UV leak detector system



Note

- ◆ *Certain leaks are difficult or even impossible to locate using an electr. leak detector. To locate these leaks, the leak test can be performed with the leak detector system ⇒ Electronic parts catalogue .*
- ◆ *Refrigerant circuit leaks result in a loss of refrigerant oil together with the refrigerant. This oil generally remains in the vicinity of the leak location. Adding a small quantity of fluorescent fluid to the refrigerant circuit makes this oil visible under UV light. The fluid (PAG oil containing an additive which shows up under UV light) is poured into the refrigerant circuit and becomes distributed with the refrigerant oil when the air conditioner is switched on.*
- ◆ *The air conditioner must be operated for at least 60 min, in order that the additive poured in can distribute itself throughout the refrigerant circuit (the air conditioner compressor must run). Depending on the size of the leak, it may be visible in UV light even during this time.*
- ◆ *The refrigerant oil with the additive that glows in UV light can be poured directly into an open refrigerant circuit, or added via the service connection after draining the circuit with the air conditioner service station .*
- ◆ *If the leak detection additive is added to the refrigerant circuit via the service connection, a small quantity of it remains in the service connection. Thoroughly remove this residue, to avoid a "false positive" during a future leak test.*
- ◆ *If a component in a circuit that contained leak detection additive is replaced, thoroughly clean the joints to the other components after assembling the refrigerant circuit. Otherwise, the residual leak detection additive at the joint could be erroneously identified as a leakage location during subsequent leak localisation.*
- ◆ *When a refrigerant circuit is drained, refrigerant oil and therefore leak detection additive also gets into the air conditioner service station . The refrigerant oil is separated from the refrigerant in the oil separator of the air conditioner service station and removed from the air conditioner service station via the discharge device. The refrigerant oil drained off is not to be poured back in. It is to be replaced with fresh refrigerant oil.*
- ◆ *If leak detection fluid was already added to a refrigerant circuit during an earlier repair, note the following: Only pour in new leak detection fluid if the refrigerant oil is being changed. If only some of the refrigerant oil was replaced, only add a corresponding proportion of leak detection fluid. For example, if 100 ml of refrigerant oil was replaced in a vehicle with 250 ml, only add 1 ml (cm³) of leak detection additive.*
- ◆ *Certain materials and their compounds (e.g. oxidation products on aluminium components, anti-corrosion waxes) also show up under UV light.*
- ◆ *Depending on the version of your air conditioner service station , leak detection additive can also be added directly via this. To this end, please observe the notes in the operating instructions of your air conditioner service station ⇒ Operating instructions of air conditioner service station .*



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Leak test on an empty, leaking refrigerant circuit

- To prevent more refrigerant than absolutely necessary for locating the leak from getting into the environment, proceed as follows with a completely empty refrigerant circuit:
- Evacuate the refrigerant circuit with the air conditioner service station ⇒ [“2.5 Evacuating the refrigerant circuit”, page 148](#) .



Note

If major leakage has already been discovered during evacuation, locate and eliminate this as described here

*⇒ [“1.4.4 Locating leaks via the vacuum test with the air conditioner service station or via the pressure test”, page 77](#) and
⇒ [“2.5 Evacuating the refrigerant circuit”, page 148](#) .*

If no leaks are found during evacuation, or a leak is discovered that is so minor that it cannot be located during evacuation, proceed as follows:



Note

- ◆ *Only use UV leak detection additive that has been approved for refrigerant R1234yf ⇒ [Electronic parts catalogue](#) .*
- ◆ *UV leak detection additive consists predominantly of refrigerant oil. Since special refrigerant oils are required for refrigerant R1234yf, only use UV leak detection additives that use this oil as the carrier fluid. UV leak detection additives developed for refrigerant R134a are therefore not suitable.*
- ◆ *Different refrigerant oils (PAG oils) are used for refrigerant circuits with refrigerants R1234yf and R134a. Therefore ensure correct assignment of the leak detection additive (look out for PAG oil with an additive that glows in UV light).*
- ◆ *Add UV leak detection additive to the refrigerant circuit via the air conditioner service station ⇒ [page 73](#) .*

Add UV leak detection additive to the refrigerant circuit via the air conditioner service station

- Pour UV leak detection additive and the specified quantity of refrigerant in the refrigerant circuit via the air conditioner service station ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#) and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).



Note

- ◆ *The quantity of UV leak detection additive to be added to a refrigerant circuit with a refrigerant oil quantity of up to 150 cm³ is 3.0 ± 0.5 ml (cm³). If there is a greater quantity of refrigerant oil in the refrigerant circuit, more UV leak detection additive must therefore be added, e.g. 5.0 ± 0.5 ml (cm³) for a refrigerant circuit with a refrigerant oil quantity of 250 cm³. When adding UV leak detection additive via an air conditioner service station, the quantity to be set in your air conditioner service station may differ. Therefore, pay attention to the relevant operating instructions ⇒ **Operating instructions for air conditioner service station**.*
- ◆ *The appropriate quantity of refrigerant oil in the refrigerant circuit can be found in the vehicle-specific manual ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).*
- ◆ *If UV leak detection fluid was already added to a refrigerant circuit during an earlier repair, note the following: Only pour in new UV leak detection fluid if the refrigerant oil is being changed. If only some of the refrigerant oil was replaced, only add a corresponding proportion of UV leak detection additive. For example, if 50 ml of refrigerant oil was replaced in a vehicle with 150 ml, only add 1.0 ml (cm³) of UV leak detection additive.*

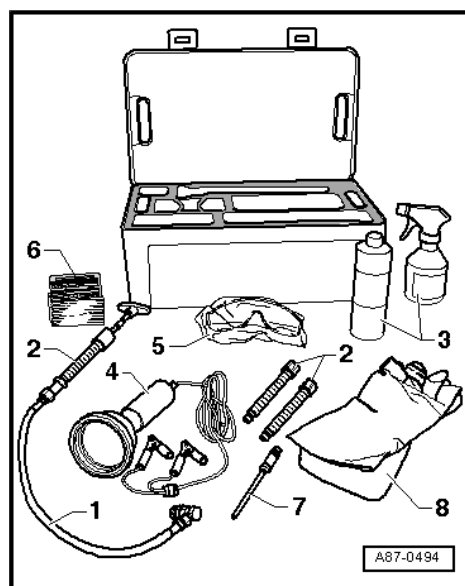
The leak detection system comprises the following components:

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



Note

Items -1-, -2- and -7- in the illustration can be disregarded.



Special tools and workshop equipment required

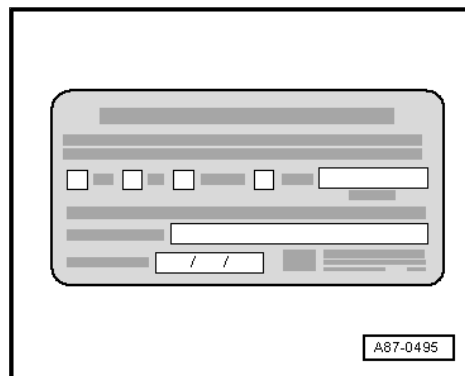
- ◆ Leak detection system ⇒ Electronic parts catalogue
- ◆ Air conditioner service station with a facility for adding UV leak detection additive to the refrigerant circuit ⇒ Electronic parts catalogue .
- ◆ Approved leak detection additive ⇒ Electronic parts catalogue .
- Evacuate refrigerant circuit as per instructions and fill with UV leak detection additive and refrigerant
⇒ [“2.5 Evacuating the refrigerant circuit”, page 148](#) and
⇒ [“2.6 Charging the refrigerant circuit”, page 155](#) .
- Wait until the pressure values on the high and low-pressure sides have equalised.

- Disconnect the air conditioner service station from the refrigerant circuit and switch off
⇒ "2.8 Switching off the air conditioner service station and disconnecting from the refrigerant circuit", page 160 .



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- Affix the sticker near to the service connections, stating that UV leak detection additive has been added to this refrigerant circuit.
- Remove residues of UV leak detection additive from the service connection, e.g. with absorbent paper and clean the surrounding area with the cleaning agent - VAS 6201/3- .
- Seal the service connection with the cap.
- Start up the air conditioner.
- Run the air conditioner for at least 60 min with the air conditioner compressor switched on.
- Search for leaks in the refrigerant circuit using the UV lamp
⇒ [page 76](#) .



Search for leaks in the refrigerant circuit using the UV lamp .

CAUTION

Damage to eyes from UV light.

- Wear safety goggles.
- Never look into the UV lamp.
- Never aim the UV lamp at other persons.

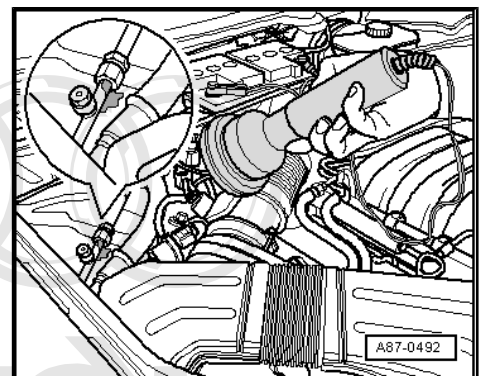
- In vehicles with high-voltage system, switch off (deactivate) the “auxiliary air conditioning” function ⇒ [Owner's Manual and Infotainment/MMI Operating Manual](#) .
- Switch off ignition.



Note

- ◆ *The air conditioner must be operated for at least 60 min, in order that the additive poured in can distribute itself throughout the refrigerant circuit (the air conditioner compressor must run). Depending on the size of the leak, it may be visible in UV light even during this time.*
- ◆ *Depending on the size and location of the leak, it may take several days until sufficient refrigerant oil with UV leak detection additive has escaped and the leak can be clearly located.*
- ◆ *In the event of leaks at the evaporator, the additive may be washed out with the condensate and emerge via the condensate drain. As considerable work is required on most vehicles to gain access to the evaporator, a check at the condensate drain for example can provide an indication of evaporator leakage. This does however require the additive to have been in the refrigerant circuit for a lengthy period (several days).*
- ◆ *The safety goggles not only protect the eyes - they also increase the glow of the UV leak detection additive in UV light.*
- ◆ *Depending on the accessibility of various refrigerant circuit components, it may be necessary to remove certain vehicle components (e.g. the bumper or air filter).*
- ◆ *Only a little refrigerant oil reaches certain points of the refrigerant circuit (e.g. a cap on top of a receiver mounted on the condenser). In the event of leakage at such locations, it may take longer for a sufficient amount of refrigerant with refrigerant oil and additive which shows up under ultraviolet light to emerge for leak detection. At these points, therefore, it may make sense to search for leaks using an electronic leak detector*
⇒ "1.4.2 Finding leaks in the refrigerant circuit using an electronic leak detector", page 70 .

- Position vehicle in a somewhat darker part of the workshop (the effect of the UV light is reduced in daylight or in strong lighting).
- Check that various refrigerant circuit components are accessible and remove parts in the vicinity of the refrigerant circuit that prevent you from having a view of the refrigerant circuit components (e.g. noise insulation and bumpers).
- Protect your eyes by putting on the safety goggles.
- Connect the UV lamp to a 12 V battery (vehicle battery). Ensure the connections have the correct polarity.
- Switch on the UV lamp and light up refrigerant circuit components. Light up with UV light (fluorescent) any points where refrigerant, refrigerant oil and therefore UV leak detection additive has escaped due to a leak.



1.4.4 Locating leaks via the vacuum test with the air conditioner service station or via the pressure test

- ◆ Locating leaks via the vacuum test with the air conditioner service station or via the pressure test
⇒ "2.5 Evacuating the refrigerant circuit", page 148

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Note

- ◆ *Smaller leaks in the refrigerant circuit (less than 100 g of refrigerant loss per year) can mostly not be located using the vacuum test or pressure test. The quantity of air entering or the escaping quantity of nitrogen is too small to detect the faulty point due to noise.*
- ◆ *In addition, leaks in the refrigerant circuit with a loss of more than 100 g of refrigerant a year can not always be detected with the vacuum test or pressure test, depending on the ambient conditions (ambient noises, location of leaks, etc.). The quantity of air entering or the quantity of nitrogen exiting may be too small to produce a noise enabling the faulty point to be detected.*
- ◆ *Depending on the ambient conditions, larger leaks in the refrigerant circuit (e.g. stone impact to the condenser, loss of refrigerant more than 100 g a day) may be detected during the vacuum test or pressure test, e.g. due to noises occurring at the faulty points during these tests*
⇒ *[“2.5 Evacuating the refrigerant circuit”, page 148](#).*

– Perform a vacuum or pressure test ⇒ [page 152](#).

1.5 Replacing components

⇒ [“1.5.1 General information on replacing components”, page 78](#)

⇒ [“1.5.2 Replacing leaky or damaged components, empty refrigerant circuit \(except for air conditioner compressor and receiver\)”, page 81](#)

⇒ [“1.5.3 Replacing leaky or damaged components, charged refrigerant circuit \(except for air conditioner compressor and receiver\)”, page 83](#)

⇒ [“1.5.4 Replacing the air conditioner compressor without the necessity of cleaning the refrigerant circuit”, page 84](#).

⇒ [“1.5.5 Replacing the air conditioner compressor due to leaks or internal damage”, page 86](#)

⇒ [“1.5.6 Replacing the desiccant cartridge/receiver after cleaning the refrigerant circuit”, page 87](#)

⇒ [“1.5.7 Replacing the receiver without the necessity of cleaning the refrigerant circuit”, page 89](#).

⇒ [“1.5.8 Replacing the desiccant cartridge/desiccant bag without the necessity of cleaning the refrigerant circuit”, page 90](#)

⇒ [“1.5.9 Removing and installing, replacing the air conditioner compressor regulating valve N280”, page 91](#)

1.5.1 General information on replacing components

- All refrigerant circuit components that are sent in for quality monitoring must be sealed (use genuine spare part caps).
- [Replacing damaged or leaking refrigerant circuit components](#)
⇒ [page 78](#)
- The spare parts air conditioner compressor, receiver, evaporator and condenser were previously filled with nitrogen gas. This charge is being gradually discontinued/the pressure of the nitrogen charge is now so low that the escape of gas is no longer perceptible on initial opening.

- On vehicles fitted with an air conditioner compressor with no magnetic clutch, the engine is only to be started following complete assembly of the refrigerant circuit (constant air conditioner compressor operation).
- When the refrigerant circuit is empty, the air conditioner compressor with air conditioner compressor regulating valve - N280- (without air conditioner magnetic clutch - N25-) is switched to internal lubrication, so that only a small quantity of oil is pumped from the air conditioner compressor into the circuit.



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**Note**

- ◆ *The following spare parts (air conditioner compressor, reservoir, evaporator and condenser) may be filled with nitrogen gas, but this is not always the case. Therefore, no or only very minimal pressure compensation may be noticed when the plugs are unscrewed from the spare part.*
- ◆ *Depending on the fitting location and storage time, no or only very minimal pressure compensation may be apparent when unscrewing the plugs for the first time even in the case of components that were filled with nitrogen by the manufacturer. Consequently, it is impossible to determine whether or not a component is leaking. For example, the filled nitrogen gas may escape via the shaft seal of a spare part air conditioner compressor over time, even though the air conditioner compressor is not leaking.*
- ◆ *As replacement parts are sometimes stored for lengthy periods and at different locations, it is quite possible that gas will escape from some parts and not from others on initial opening (even in the case of identical replacement part numbers). The sealing caps at the replacement part connections are therefore to be detached carefully and the nitrogen gas allowed to escape slowly.*
- ◆ *The refrigerant circuit contains one or two expansion valves and a receiver or dryer vessel ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *Replace the desiccant cartridge or components with desiccant bag (receiver) after cleaning the refrigerant circuit (flush with refrigerant R1234yf
⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#)), taking care to keep it closed as long as possible to keep the absorption of moisture to a minimum.*
- ◆ *Replace the desiccant cartridge or components with desiccant bag (receiver) if required for certain repair jobs or if the refrigerant circuit was open for a longer period and moisture has penetrated (e.g. following an accident)
⇒ ["1.5.2 Replacing leaky or damaged components, empty refrigerant circuit \(except for air conditioner compressor and receiver\)", page 81](#).*
- ◆ *The time that a refrigerant circuit may be open without needing to replace the component with the desiccant bag (receiver) depends to a great extent on environmental factors. Given a high ambient temperature and a high humidity level or if the vehicle has been standing in the open for example or driven (in wet, foggy weather conditions), the period will be considerably shorter than for a vehicle which has been standing in a heated dry area. The size of the opening through which moisture may penetrate the circuit also influences the time that a refrigerant circuit can remain open, before the component with the desiccant bag needs to be replaced
⇒ ["1.5.2 Replacing leaky or damaged components, empty refrigerant circuit \(except for air conditioner compressor and receiver\)", page 81](#).*
- ◆ *Seal open connections and lines (absorption of moisture).*



Note

Contaminated refrigerant oil must be disposed of as used oil of unknown origin (pay attention to local regulations) ⇒ VW/Audi ServiceNet.

1.5.2 Replacing leaky or damaged components, empty refrigerant circuit (except for air conditioner compressor and receiver)

Refrigerant circuit completely empty (e.g. in the event of major leakage or a burst hose)

- ◆ Note the general information on replacing components
⇒ [“1.5.1 General information on replacing components”, page 78](#)



Note

- ◆ *If only a small leak is present and refrigerant has only escaped slowly (e.g. via a point with a small leak), not enough refrigerant escapes or humidity enters to influence the function of the air conditioner after repair.*
- ◆ *The operations marked * are only to be implemented in the case of a major leak (e.g. following an accident).*
- Removing a faulty component * ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Cleaning the refrigerant circuit (flushing with refrigerant R1234yf)* ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#).

Electrically driven air conditioner compressor

- Removing and cleaning the electrically driven air conditioner compressor (flush with refrigerant R1234yf) *
⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).

Mechanically driven air conditioner compressor

- Removing the air conditioner compressor. * ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).

- Remove the oil drain plug -B- / -D- from the air conditioner compressor -A-.*



Note

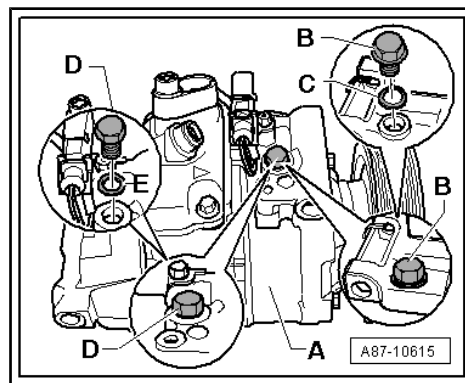
- ◆ The oil drain plug -B- / -D- and seal -C- / -E- version differs depending on the manufacturer of the air conditioner compressor) ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
- ◆ Note the tightening torque when installing the oil drain plug -B- / -D- (dependent upon manufacturer of air conditioner compressor and the oil drain plug version) ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
- ◆ With the Denso air conditioner compressor, the oil drain plug -D- may feature e.g. a sealing ring -E-; replace ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .
- ◆ With the Sanden air conditioner compressor, the oil drain plug -B- may feature e.g. a seal -C-; replace ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue , tightening torque⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ To accelerate the extraction of refrigerant oil, crank the air conditioner compressor e.g. using the pulley or the magnetic clutch plate.
- Tip old refrigerant out of the air conditioner compressor *

⇒ ["1.5.4 Replacing the air conditioner compressor without the necessity of cleaning the refrigerant circuit", page 84](#) (disposal ⇒ VW/Audi-ServiceNet).

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All vehicles

- Pour the intended complete quantity of oil into the air conditioner compressor or circuit
- ⇒ ["1.5.4 Replacing the air conditioner compressor without the necessity of cleaning the refrigerant circuit", page 84](#) and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (approved refrigerant oils and capacities for refrigerant oil in vehicle-specific Workshop Manual).





Note

- ◆ *Next, pour the correct quantity of new refrigerant oil into the air conditioner compressor that corresponds to the quantity of refrigerant oil in the replacement compressor* ⇒ Heating, air conditioner; Rep. gr. 00; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).*
- ◆ *Use different refrigerant oils and quantities for different air conditioner compressors ⇒ Heating, air conditioner; Rep. gr. 00; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).*
- ◆ *To ensure lubrication of the air conditioner compressor on start-up, pour at least 40 cm³ of refrigerant oil into the air conditioner compressor. The rest can be poured e.g. into the new reservoir/receiver or a refrigerant line ⇒ Heating, air conditioner; Rep. gr. 00; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).*
- ◆ *If dirt has entered the air conditioner compressor when the refrigerant circuit was open (e.g. in an accident), replace the air conditioner compressor ⇒ Heating, air conditioner; Rep. gr. 87; Air conditioner compressor (vehicle-specific Workshop Manual).*
- ◆ *Cleaning the refrigerant circuit (flushing with refrigerant R1234yf)* ⇒ "1.6 Cleaning the refrigerant circuit", page 95.*
- Replacing the desiccant cartridge or receiver * ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual).
- Assembling, evacuating and recharging the refrigerant circuit ⇒ [page 138](#).

1.5.3 Replacing leaky or damaged components, charged refrigerant circuit (except for air conditioner compressor and receiver)

Refrigerant circuit still contains refrigerant (e.g. minor leak)

- ◆ Note the general information on replacing components ⇒ ["1.5.1 General information on replacing components", page 78](#)
- Drain the refrigerant circuit ⇒ [page 138](#).
- Remove the defective component, blow out with compressed air and collect the refrigerant oil escaping.
- Pour a fresh refrigerant oil into the new component in the same quantity as the extracted amount (plus 20 cm³ for the evaporator, plus 10 cm³ for the condenser, refrigerant lines and refrigerant hoses).



Note

*Dispose of old refrigerant oil (pay attention to local regulations)
⇒ VW/Audi ServiceNet.*

- Assembling, evacuating and charging the refrigerant circuit ⇒ [page 138](#).

1.5.4 Replacing the air conditioner compressor without the necessity of cleaning the refrigerant circuit



Note

Cleaning the refrigerant circuit means flushing with refrigerant R1234yf ⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#) .

- ◆ Note the general information on replacing components ⇒ ["1.5.1 General information on replacing components", page 78](#)

For example in the case of external damage following an accident

- Drain the refrigerant circuit
⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#) .
- Remove the air conditioner compressor ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).

Electrically driven air conditioner compressor

- Flush the faulty electrically driven air conditioner compressor to remove refrigerant oil (note the quantity of flushed out refrigerant oil)
⇒ ["2.11 Cleaning the electrically driven air conditioner compressor", page 163](#) .



Note

- ◆ *If 75 % more refrigerant oil was flushed out of the faulty air conditioner compressor than in the spare parts air conditioner compressor, do not flush the spare parts air conditioner compressor (a small residual quantity always remains in the air conditioner compressor, so that the quantity of refrigerant oil in the refrigerant circuit can be ignored).*
- ◆ *If less than 75 % of the specified quantity of refrigerant oil is flushed out of the faulty air conditioner compressor, the remaining refrigerant oil is in the components of the refrigerant circuit. To prevent overcharging with refrigerant oil, flush the refrigerant circuit or electrically driven air conditioner compressor.*
- Flush the refrigerant circuit or a new electrical driven air conditioner compressor to remove refrigerant oil
⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#) and
⇒ ["2.11 Cleaning the electrically driven air conditioner compressor", page 163](#) .
- Dispose of refrigerant oil flushed out of the faulty and the new air conditioner compressor/refrigerant circuit ⇒ VW/Audi ServiceNet (pay attention to local regulations).



Note

The electrically driven air conditioner compressor is designed such that it must be flushed to remove refrigerant oil (the refrigerant oil cannot be tipped out as it can in mechanical air conditioner compressors with oil drain plug

⇒ "1.5.2 Replacing leaky or damaged components, empty refrigerant circuit (except for air conditioner compressor and receiver)", page 81 .

- Only pour fresh refrigerant oil into the spare parts air conditioner compressor in the same quantity as the amount of oil flushed out (of the faulty air conditioner compressor).



Note

- ◆ *If e.g. 70 cm³ of refrigerant oil was flushed out of the faulty air conditioner compressor and 140 cm³ out of the spare parts compressor (a small quantity of refrigerant oil remains in the air conditioner compressor and, possibly, in the air conditioner service station). In this case, pour 70 cm³ of refrigerant oil into the air conditioner compressor you are going to install (the refrigerant oil flushed out of the spare parts air conditioner compressor must not be used, it may have become contaminated in the air conditioner service station).*
- ◆ *Use different refrigerant oils and quantities for different air conditioner compressors ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).*
- ◆ *If a larger quantity of refrigerant oil (more than approx. 40 cm³) was flushed out of the faulty air conditioner compressor, the remaining refrigerant oil can also be poured into the evaporator, a refrigerant line or the reservoir/receiver/internal heat exchanger ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).*

Mechanically driven air conditioner compressor

- Remove the oil drain plug from the air conditioner compressor
⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

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Note

Different versions of oil drain plug and associated seal (a seal or a sealing ring may be installed, replace)

⇒ "1.5.2 Replacing leaky or damaged components, empty refrigerant circuit (except for air conditioner compressor and receiver)", page 81 and ⇒ Electronic parts catalogue .

- To accelerate the extraction of refrigerant oil, crank the air conditioner compressor e.g. using the magnetic clutch plate.
- Tip old refrigerant out of the air conditioner compressor and dispose of it ⇒ VW/Audi-ServiceNet (pay attention to local regulations).
- Remove the oil drain plug from the spare parts air conditioner compressor, tip out the refrigerant oil and pour in only the same quantity of refrigerant oil as you have just tipped out (of

the faulty air conditioner compressor)

⇒ [“1.5.2 Replacing leaky or damaged components, empty refrigerant circuit \(except for air conditioner compressor and receiver\)”, page 81](#) .



Note

- ◆ *If e.g. 50 cm³ of refrigerant oil was flushed out of the faulty air conditioner compressor and 100 cm³ out of the spare parts compressor (a small quantity of refrigerant oil remains in the air conditioner compressor). In this case, pour 50 cm³ of refrigerant oil into the air conditioner compressor you are going to install (you may use the refrigerant oil tipped out of the spare parts compressor).*
- ◆ *Use different refrigerant oils and quantities for different air conditioner compressors ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).*
- ◆ *If a larger quantity of refrigerant oil (more than approx. 50 cm³) was tipped out of the faulty air conditioner compressor, the remaining refrigerant oil can also be poured into the evaporator or reservoir/receiver/internal heat exchanger ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).*

All models

- Replace the restrictor (only if installed in this refrigerant circuit).
- Assemble, evacuate and charge the refrigerant circuit
⇒ [page 138](#) .

1.5.5 Replacing the air conditioner compressor due to leaks or internal damage

- ◆ Note the general information on replacing components
⇒ [“1.5.1 General information on replacing components”, page 78](#)

Vehicles with high-voltage system (hybrid vehicles)

- Note the risk classification of the high-voltage system ⇒ Rep. gr. 00 ; Risk classification of high-voltage system .
- Pay attention to the safety precautions when working on the high-voltage system
⇒ [“1.5 Safety precautions when working on vehicles with high-voltage system”, page 3](#) .
- Pay attention to the safety precautions when working in the vicinity of high-voltage components
⇒ [“1.6 Safety precautions when working in the vicinity of high-voltage components”, page 4](#) .

All vehicles

Replace the air conditioner compressor, e.g. due to noises from the compressor or no compressor output.

- Drain the refrigerant circuit ⇒ [page 138](#) .
- Remove the air conditioner compressor ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).

- Clean the refrigerant circuit (flush with refrigerant R1234yf)
⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .



Note

- ◆ *In the case of internal damage (to the air conditioner compressor), check the refrigerant hoses and condenser. If e.g. swarf has entered, clean the refrigerant hoses and condenser (flush with refrigerant R1234yf
⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#)) or replace refrigerant hoses.*
- ◆ *In certain vehicles (e.g. those with two evaporators), there may be a larger quantity of refrigerant oil in the refrigerant circuit than the amount in the spare parts compressor. If necessary, pour the residual quantity of refrigerant oil into the refrigerant circuit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).*
- ◆ *In the event of a fault in the electronics of an electrical driven air conditioner compressor (e.g. air conditioner compressor control unit - J842- faulty), do not flush the refrigerant circuit. In this case, the air conditioner compressor is replaced with no need to clean the refrigerant circuit
⇒ [“1.5.4 Replacing the air conditioner compressor without the necessity of cleaning the refrigerant circuit”, page 84](#)*
- Replace the desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Check the expansion valve for dirt or corrosion, replace if necessary ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Assemble, evacuate and charge the refrigerant circuit
⇒ [page 138](#) .

1.5.6 Replacing the desiccant cartridge/receiver after cleaning the refrigerant circuit



Note

The receiver mostly contains a desiccant cartridge or desiccant bag (depending on the refrigerant circuit design) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

- ◆ Note the general information on replacing components
⇒ [“1.5.1 General information on replacing components”, page 78](#)



Note

Cleaning the refrigerant circuit means flushing with refrigerant R1234yf ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .

For example on account of ingress of moisture (refrigerant circuit open for lengthy period) or contamination

- Drain the refrigerant circuit ⇒ [page 146](#) .
- Remove the air conditioner compressor ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
- Remedy the cause of the fault ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .

Electrically driven air conditioner compressor

- Flush old refrigerant oil out of the air conditioner compressor ⇒ [“2.11 Cleaning the electrically driven air conditioner compressor”, page 163](#) .

Mechanically driven air conditioner compressor

- Remove the oil drain plug from the air conditioner compressor ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).



Note

Different versions of oil drain plug and associated seal, replace ⇒ [“1.5.2 Replacing leaky or damaged components, empty refrigerant circuit \(except for air conditioner compressor and receiver\)”](#), [page 81](#) , ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ [Electronic parts catalogue](#) .

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- To accelerate the extraction of refrigerant oil, crank the air conditioner compressor e.g. using the pulley or the magnetic clutch plate ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
- Tip old refrigerant oil out of the air conditioner compressor ⇒ [“1.5.4 Replacing the air conditioner compressor without the necessity of cleaning the refrigerant circuit”, page 84](#) .



Note

Dispose of old refrigerant oil (pay attention to local regulations) ⇒ VW/Audi ServiceNet .

All air conditioner compressors

- Check the expansion valve for dirt or corrosion, replace if necessary ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Next, pour the correct quantity of new refrigerant oil into the air conditioner compressor that corresponds to the quantity of refrigerant oil in the replacement compressor (or the specified quantity of refrigerant oil for vehicles with two evaporators) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).



Note

- ◆ Use different refrigerant oils and quantities for different air conditioner compressors ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).
- ◆ To ensure lubrication of the air conditioner compressor on start-up, pour at least 40 cm³ of refrigerant oil into the air conditioner compressor. The rest can be poured e.g. into a refrigerant line or the new reservoir/receiver/internal heat exchanger ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).
- ◆ If dirt has entered the air conditioner compressor when the refrigerant circuit was open (e.g. in an accident), clean the refrigerant circuit and replace the air conditioner compressor ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
- ◆ In vehicles with two evaporators, there may be a larger quantity of refrigerant oil in the refrigerant circuit than the amount in the spare parts compressor. If necessary, pour the residual quantity of refrigerant oil into the refrigerant circuit ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).
- Replace the desiccant bag/desiccant cartridge (or receiver) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Assemble, evacuate and charge the refrigerant circuit ⇒ [page 138](#) .

1.5.7 Replacing the receiver without the necessity of cleaning the refrigerant circuit



Note

In most cases a desiccant cartridge or desiccant bag is installed in the receiver (depending on the refrigerant circuit design) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).

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- ◆ Note the general information on replacing components ⇒ [“1.5.1 General information on replacing components”, page 78](#)



Note

Cleaning the refrigerant circuit means flushing with refrigerant R1234yf ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .

- ◆ For example, refrigerant escaped due to a leak, but no dirt entered the circuit
- ◆ If a gas analysis reveals that there was contaminated refrigerant in the circuit, but there are no problems with air conditioner function

⇒ [“2.3 Performing a gas analysis on the refrigerant”, page 143](#)

- Drain the refrigerant circuit ⇒ [page 138](#) .
- Remove the receiver ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Clean dirt from the receiver.
- Weigh the removed receiver.
- Pour refrigerant oil into the new receiver until it has reached the weight of the removed receiver.
- Install the new receiver ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Assemble, evacuate and charge the refrigerant circuit ⇒ [page 138](#) .

1.5.8 Replacing the desiccant cartridge/desiccant bag without the necessity of cleaning the refrigerant circuit



Note

In most cases, the desiccant cartridge/desiccant bag is installed in the receiver, depending on the refrigerant circuit design ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

- ♦ Note the general information on replacing components ⇒ [“1.5.1 General information on replacing components”, page 78](#) .



Note

Cleaning the refrigerant circuit means flushing with refrigerant R1234yf ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .

- ♦ For example, refrigerant escaped due to a leak, but no dirt entered the circuit.
- ♦ If a gas analysis reveals that there was contaminated refrigerant in the circuit, but there are no problems with air conditioner function ⇒ [“2.3 Performing a gas analysis on the refrigerant”, page 143](#)
- Drain the refrigerant circuit ⇒ [page 138](#) .
- Replace the desiccant cartridge/desiccant bag (or reservoir/receiver) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).



Note

If the desiccant cartridge/desiccant bag is permanently installed in a component (e.g. in the condenser receiver) and cannot be replaced individually, replace the receiver or condenser ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

- Assemble, evacuate and charge the refrigerant circuit ⇒ [page 138](#) .

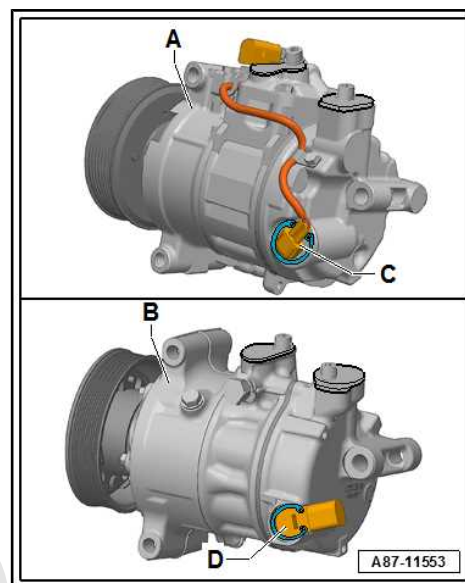


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1.5.9 Removing and installing, replacing the air conditioner compressor regulating valve - N280-

Note

- ◆ *Certain malfunctions in the -N280- (e.g. a sticking valve or an open circuit in the coil) can cause problems with the air conditioner compressor (air conditioner does not cool, iced up evaporator, etc.). If the problem is due to the -N280- (and not the air conditioner compressor itself), the air conditioner compressor can be repaired by replacing the -N280- -C, D-.*
- ◆ *The -N280- -C, D- is not available as a spare part for all air conditioner compressors. If the -N280- is not available as an individual part for an air conditioner compressor, the entire compressor must be replaced ⇒ Electronic parts catalogue .*
- ◆ *The -N280- is available in different versions and adaptations ⇒ Electronic parts catalogue . With air conditioner compressor -A- (here a compressor from manufacturer "Denso"), the plug for the connection to the vehicle wiring harness is affixed to the -N280- -C- by a short wiring harness. With air conditioner compressor -B- (here a compressor from manufacturer "Sanden"), the plug for the connection to the vehicle wiring harness is affixed directly to the -N280- -C-. For other air conditioner compressors (different type, different manufacturer), removal and installation of the -N280- -C, D- is largely identical and differs only minimally from the procedure described below.*
- ◆ *If after the -N280- has been removed the cause of the fault is found to be -N280- dirt, swarf or other abrasion from the air conditioner compressor, clean the refrigerant circuit and replace the air conditioner compressor
⇒ ["1.5.5 Replacing the air conditioner compressor due to leaks or internal damage", page 86](#) and
⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#)*



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Removing

- Drain the refrigerant circuit
⇒ ["2.1 Working with the air conditioner service station", page 138](#) .

NOTICE

Risk of damage to air conditioner compressor when refrigerant circuit is empty.

- **Never start the engine when the refrigerant circuit is empty.**
- Depending on the vehicle and fitting location of the air conditioner compressor, remove components that hamper access to the -N280- ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

In vehicles in which removal of at least one of the two refrigerant lines and the -N280- is impossible, with air conditioner compressor mounted on the engine.

- Remove the air conditioner compressor ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).

In a vehicle in which removal of at least one of the two refrigerant lines and the -N280- is impossible, with air conditioner compressor mounted on the engine (the air conditioner compressor is not removed)

- Extract refrigerant.



CAUTION

Danger of frostbite from refrigerant escaping under pressure.

The skin and other parts of the body can suffer frostbite.

- Wear protective gloves.
 - Wear safety goggles.
 - Extract the refrigerant and immediately open the refrigerant circuit.
 - Extract the refrigerant again if more than 10 min have passed since initial extraction and the refrigerant circuit has not been opened up. Renewed evaporation leads to the build-up of pressure in the refrigerant circuit.
- Check the pressure in the refrigerant circuit again using the pressure gauge of the air conditioner service station .
 - ◆ If the displayed pressure is greater than ambient pressure (greater than approx. 1 bar absolute pressure), switch on the air conditioner service station again and extract the refrigerant that is causing the build-up of pressure.
 - Detach one of the two refrigerant lines from the air conditioner compressor ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).

All vehicles



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 Note

These and subsequent diagrams show the -N280- -B- with an air conditioner compressor from manufacturer "Sanden", type "6 SEU 14". With these air conditioner compressors, the connector for connection to the vehicle wiring harness is affixed directly to the -N280- -B-. Removal and installation of the -N280- -B- may differ with other air conditioner compressors (different type, different manufacturer, e.g. "Denso", -N280- e.g. with a short wiring harness to the connector). However, the procedure is the same as described below for the air conditioner compressor from manufacturer "Sanden", type "6 SEU 14".

- If present, detach the wiring connection of -N280- -B- to the connector to the vehicle wiring harness of the air conditioner compressor.

 Note

For an air conditioning compressor with an air conditioner magnetic clutch - N25- , in which the -N25- is actuated by the same connector as the -N280- -B-, eject the relevant lines from the connector ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).

- Clean air conditioner compressor in vicinity of -N280- -B-.
- Remove circlip -A-.
- Carefully pull the -N280- -B- out of the air conditioner compressor mount -C-.
- Check the removed -N280- -B- and the air conditioner compressor mount -C- for dirt.

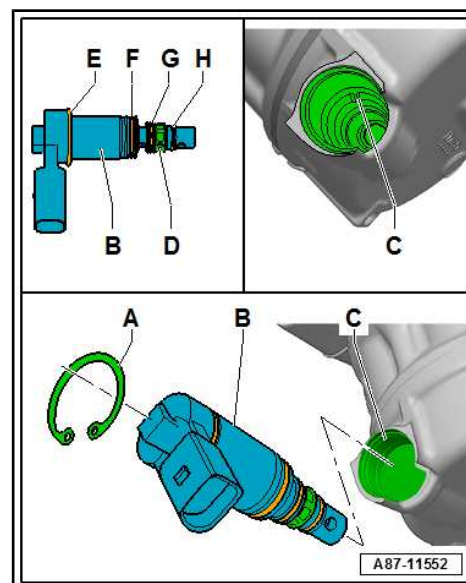
 Note

- ◆ If the screen -D- on the -N280- -B- or the air conditioner compressor mount -C- is very dirty (e.g. with swarf or dark, sticky abrasion), this indicates damage to the air conditioner compressor. In this case, clean the refrigerant circuit and replace the air conditioner compressor
⇒ ["1.5.5 Replacing the air conditioner compressor due to leaks or internal damage", page 86](#) and
⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#)
- ◆ If the screen -D- on the -N280- -B- and the air conditioner compressor mount -C- is only slightly dirty (e.g. with grey deposits from normal air conditioner compressor operation), a fault in the -N280- -B- may be the cause of the malfunctioning air conditioner compressor.

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Installing

- Check the air conditioner compressor mount -C- for dirt and carefully and thoroughly clean with a clean, lint-free cloth if necessary



 NOTICE

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

Risk of repeated failure of the regulating valve or air conditioner compressor

- Only clean the air conditioner compressor 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 beneath the sealing surface for the sealing ring, or the ducts there and that none of the mount sealing surfaces are damaged.
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- Check the air conditioner compressor mount -C- for damage (also look out for small scratches on the surface. Replace the air conditioner compressor if damaged).
 - Check the seals -E-, -F-, -G- and -H- of the -N280- -B- for damage.
 - Coat seals -E-, -F-, -G- and -H- of the -N280- -B- with a little refrigerant oil and check they are correctly seated.
 - Insert the -N280- -B- into the air conditioner compressor mount -C- up to the stop.
 - Install circlip -A-.
 - Re-install all removed parts in reverse order.
 - Assemble, evacuate and recharge the refrigerant circuit
⇒ [page 138](#) .
 - Check function of air conditioner ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

1.6 Cleaning the refrigerant circuit

⇒ [“1.6.1 General information on cleaning the refrigerant circuit”, page 95](#)

⇒ [“1.6.2 Preparatory work for cleaning the refrigerant circuit \(flushing with refrigerant R1234yf\)”, page 97](#)

⇒ [“1.6.3 Procedure for cleaning the refrigerant circuit”, page 99](#)

⇒ [“1.6.4 Block diagrams for cleaning \(flushing circuits\) - Refrigerant circuit with expansion valve and receiver”, page 100](#)

⇒ [“1.6.5 Block diagrams for cleaning \(flushing circuits\) - Refrigerant circuit with restrictor and reservoir \(without high-voltage system\)”, page 105](#)

⇒ [“1.6.6 Block diagrams for cleaning \(flushing circuits\) - Vehicles with high-voltage system \(without air conditioner auxiliary functions\)”, page 108](#)

⇒ [“1.6.7 Block diagrams for cleaning \(flushing circuits\) - Vehicles with high-voltage system \(with air conditioner auxiliary functions, e.g. heat pump mode\)”, page 108](#)

⇒ [“1.6.8 Adapters for connecting up flushing circuits”, page 109](#)

⇒ [“1.6.9 General information on blowing out with compressed air or nitrogen”, page 129](#)

⇒ [“1.6.10 Blow out refrigerant circuit with compressed air or nitrogen”, page 133](#)

1.6.1 General information on cleaning the refrigerant circuit



Note

- ◆ *Most work on the refrigerant circuit using the air conditioner service station can be performed without disconnecting the high-voltage system from mains voltage.*
- ◆ *Since certain components need to be removed in order to clean (flush) the refrigerant circuit, disconnect the high-voltage system from mains voltage before commencing work ⇒ Hybrid electrical system; Rep. gr. 93 ; Disconnecting high-voltage system from mains voltage .*
- ◆ *If you suspect that chemicals (sealing additives) were added to the refrigerant circuit that you wish to flush in order to seal off leaks, do not connect your air conditioner service station to this refrigerant circuit and do not flush it.*
- ◆ *Chemicals (sealing additives) for sealing leaks form deposits in the refrigerant circuit, which adversely affect the function of the air conditioner and lead to failure of the air conditioner (and your air conditioner service station).*
- ◆ *Tell your customers that their air conditioner contains substances that were not approved by Volkswagen/Audi and you are therefore unable to flush or repair this air conditioner.*

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All vehicles



Note

- ◆ Volkswagen/Audi refrains from using chemicals (sealing additives) to seal leaks in the refrigerant circuit.
- ◆ Chemicals (sealing additives) for sealing leaks in the refrigerant circuit mostly react with ambient air or humidity contained within it. Due to deposits in the refrigerant circuit (and in your air conditioner service station), these cause malfunctions in valves and other components with which they come into contact. These deposits cannot be completely removed from the components (even by flushing). The refrigerant circuit can therefore only be repaired by replacing all the components which have come into contact with this substance.
- ◆ Chemical substances (sealing additives) for sealing leaks in the refrigerant circuit are normally not outwardly apparent and the identification stickers which should be affixed for this purpose are usually non-existent. Vehicles with an unknown history should therefore be treated with due caution.
- ◆ If no suitable air conditioner service station for refrigerant R1234yf is available, the refrigerant circuit may also be flushed with the air conditioner service station for refrigerant R134a and with refrigerant R134a. The use of refrigerant R134a for cleaning the refrigerant circuit is currently permitted ⇒ Air conditioner with refrigerant R134a; Rep. gr. 87; Refrigerant circuit (air conditioner with refrigerant R134a, refrigerant circuit, working with the air conditioner service station).
- ◆ If the gas analysis reveals that refrigerant R1234yf is contaminated with another gas, this must be extracted from the refrigerant circuit and disposed of as a gas of unknown composition, in accordance with legal provisions ⇒ VW/Audi ServiceNet and
⇒ ["2.13 Filling contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal", page 170](#).
- ◆ Contaminated refrigerant can lead to the formation of breakdown products that accumulate in the refrigerant oil and cannot be extracted with the refrigerant. In this case, remove the contaminated refrigerant oil by flushing it out of the refrigerant circuit with refrigerant.

- The best way of removing moisture, impurities (e.g. abrasion from a defective air conditioner compressor) and old refrigerant oil without any unnecessary loss of refrigerant and without extensive assembly work, whilst at the same time ensuring environmental compatibility, is to clean the refrigerant circuit with refrigerant R1234yf (flush with refrigerant R1234yf)..

Clean (flush) the refrigerant circuit with refrigerant R1234yf:

- If the event of dirt or other contamination in the circuit.
- If the vacuum reading does not remain during evacuation of a non-leaking refrigerant circuit (moisture is in the refrigerant circuit and is building up pressure).
- The refrigerant circuit was open beyond the normal installation time (e.g. following an accident).
- Moisture is assumed to be in the refrigerant circuit based on pressure and temperature measurements in the circuit.
- There is uncertainty about the quantity of refrigerant oil in the refrigerant circuit.
- In certain circumstances, if contaminated refrigerant R1234yf was poured into the refrigerant circuit

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⇒ ["1.5 Replacing components", page 78](#) and
⇒ ["2.3 Performing a gas analysis on the refrigerant",
page 143](#)



Note

If contaminated refrigerant was detected and refrigerant circuit components manifest internal damage (e.g. corrosion on the inside of refrigerant lines or detached inner layer in refrigerant hoses), flushing the refrigerant circuit may not be sufficient. In this case, all refrigerant circuit components have to be replaced (a gas was added that caused severe damage to components).

- The air conditioner compressor had to be replaced due to internal damage (e.g. noise or no output)
⇒ ["1.5 Replacing components", page 78](#) .
- If stipulated by the vehicle-specific workshop manual following replacement of certain components.

Tools required

- ◆ Flush the air conditioner service station with a flushing device (for this air conditioner service station , the additional function "Flush refrigerant circuit" and the required flushing device, available for refrigerant circuits ⇒ Electronic parts catalogue .
- ◆ Volkswagen/Audi car set adapter case ⇒ [page 109](#) and ⇒ Electronic parts catalogue .



Note

- ◆ *If you do not have an air conditioner service station with flushing device in your business ⇒ Electronic parts catalogue , depending on the version of your air conditioner service station , you can also use the flushing device for refrigerant circuits ⇒ Electronic parts catalogue to flush the refrigerant circuit, but the flushing process must be performed manually.
⇒ [page 168](#)*
- ◆ *In the car set adapter case , you will also find a short charge hose with connections 5/8 -18 UNF and a large inner diameter (commercially available).*

1.6.2 Preparatory work for cleaning the refrigerant circuit (flushing with refrigerant R1234yf)

- Drain the refrigerant circuit
⇒ ["2.4 Draining the refrigerant circuit", page 146](#) .
- Remove the air conditioner compressor ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Vehicle with restrictor and reservoir

- Remove the restrictor (vehicle-specific) and re-connect the lines ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Remove the reservoir (vehicle-specific) and re-connect the lines (to do this, use the adapter and charge hose from the VW/Volkswagen/Audi car set adapter case)
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).



Note

It would be possible to flush the reservoir, however on account of its large internal volume it holds too much liquid refrigerant. On extracting this refrigerant, the reservoir would ice up severely, the refrigerant would only evaporate very slowly and the extraction process would be excessively long.

Vehicle with expansion valve and receiver

- If it is possible and necessary with this refrigerant circuit (see notes), remove the receiver or the desiccant cartridge from the receiver (vehicle-specific) and re-connect the lines (to do so, use the adapter and the charge hose from the Volkswagen/ Audi car set adapter case)
⇒ [“1.6.8 Adapters for connecting up flushing circuits”, page 109](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).



Note

- ◆ *Depending on the version, it may be possible to flush the receiver (remove the desiccant cartridge inside it if necessary)
⇒ [“1.6.8 Adapters for connecting up flushing circuits”, page 109](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *The receiver mounted on the condenser remains in place during the flushing process (due to its design, it can be flushed through and is only replaced after flushing)
⇒ [“1.6.8 Adapters for connecting up flushing circuits”, page 109](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *For condensers with integrated receiver/desiccant cartridge that cannot be individually replaced, or are not available as individual parts, replace the condenser after flushing. With these vehicles, in this case replace the condenser with the receiver ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .*
- ◆ *Depending on the version, an additional filter element may be installed for receivers in which the desiccant cartridge can be individually replaced. This must be replaced with the desiccant cartridge if necessary.*
- In vehicles with a desiccant cartridge in the receiver on the condenser (vehicle-specific), remove the desiccant cartridge and close the opening in the receiver again ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Remove the expansion valve (vehicle-specific) and install an adapter from the Volkswagen/Audi car set adapter case in its place
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⇒ [“1.6.8 Adapters for connecting up flushing circuits”, page 109](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

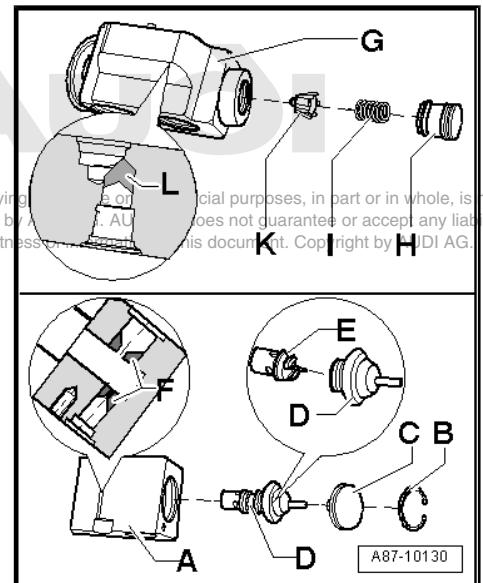
 Note

If there is no suitable adapter for the expansion valve in the Volkswagen/Audi car set adapter case, the removed expansion valve can also be drilled open (the old expansion valve must be replaced in most cases and is therefore no longer needed).

- Take care not to damage the sealing surfaces of the expansion valve. Damaged sealing surfaces can lead to escaping refrigerant.
- Drill out the expansion valve.

 Note

- ◆ *Before drilling out, remove the control element and drill the expansion valve e.g. with a suitable drill bit (drill bit diameter e.g. 6.0 mm).*
- ◆ *Before drilling out, parts may need to be removed from the expansion valve, depending on the version.*
- ◆ *There are different expansion valve versions with differing design. With version -A-, for example, parts -B-, -C- and -D- must be removed. Then separate part -E- (the control element) from component -D-. Next, drill out the expansion valve in the vicinity of -F- using a suitable drill bit.*
- ◆ *With version -G-, for example, remove parts -H-, -I- and -K- and then drill out area -L- using a suitable drill bit.*
- Clean machining residues (chips) from the drilled expansion valve.
- Re-install parts -B-, -C- and -D- in version -A- or part -H- in version -G-.



 Note

In vehicles with two evaporators, separate the circuit to the second evaporator from the circuit for the first evaporator and flush in a separate operation

⇒ "1.6.8 Adapters for connecting up flushing circuits", page 109 and ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual).

- ◆ Clean (flush) the refrigerant circuit
⇒ "2.12 Cleaning the refrigerant circuit", page 166

1.6.3 Procedure for cleaning the refrigerant circuit

 Note

The procedure is automated using the program of the air conditioner service station ⇒ Operating instructions Air conditioner service station.

- ◆ After it is switched on, first evacuate the flushing circuit (refrigerant circuit with connecting hoses and the refrigerant circuit flushing device) and check the refrigerant circuit for leaks

(depending on the version of air conditioner service station ,
you may need to advance the program manually).

- ◆ After you have checked the refrigerant circuit for leaks by evacuating it, now pour in a certain small quantity of refrigerant to check that the flushing/refrigerant circuit is correctly assembled (pressure test).
- ◆ After the pressure test, extract the refrigerant, evacuate the refrigerant circuit again if necessary and commence the cleaning (flushing) process.
- ◆ Pour a set quantity of refrigerant (depending on the interior volume of the flushing circuit, e.g. 3 kg) into the refrigerant circuit via the high-pressure side of the air conditioner service station (against the normal flow of direction during air conditioner operation and therefore on the low-pressure side of the vehicle refrigerant circuit). Alternatively, pour in sufficient refrigerant until the refrigerant circuit and sight glasses of the refrigerant circuit flushing device are completely full of liquid refrigerant (depending on the version of air conditioner service station , the system detects e.g. that no more refrigerant is being supplied over a certain time).
- ◆ Once you have added the specified quantity of refrigerant, depending on the version of air conditioner service station and refrigerant circuit flushing device, switch on e.g. the heater of the refrigerant circuit flushing device (only if gaseous refrigerant is being extracted from the refrigerant circuit flushing device).
- ◆ After the refrigerant has been extracted, switch off the heater of the refrigerant circuit flushing device (if present). Briefly evacuate the refrigerant circuit once more, depending on the version and after evacuation the air conditioner service station separates the refrigerant oil that was extracted from the refrigerant circuit.
- ◆ Repeat the add refrigerant, extract (and evacuate) procedure three times (it is therefore performed four times in total).
- ◆ After the fourth extraction, evacuate the flushing circuit, depending on the version of air conditioner service station .

1.6.4 Block diagrams for cleaning (flushing circuits) - Refrigerant circuit with expansion valve and receiver

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- ◆ With one or two evaporators
- ◆ With and without high-voltage system



Note

- ◆ *The arrows in the diagrams below indicate the direction of flow of refrigerant during flushing (during flushing the refrigerant flows in the reverse direction to during air conditioner operation, which is why the high-pressure side of the air conditioner service station on the low-pressure connection of the refrigerant circuit is connected to the air conditioner compressor).*
- ◆ *This block diagram shows a refrigerant circuit with expansion valve, receiver and a second evaporator (optional extra for certain vehicles).*
- ◆ *On vehicles with expansion valve and receiver, the expansion valve is removed and replaced with an adapter. Depending on the vehicle, the receiver is also removed and the line connections to the receiver are connected using two adapters and a charge hose.*
- ◆ *On vehicles with one evaporator only, the components as of item "16" are not fitted or are not required.*
- ◆ *Depending on the design of the air conditioner service station, non-return valves may be installed between the refrigerant circuit and the air conditioner service station (to ensure the correct direction of flow of refrigerant during flushing).*
- ◆ *The adapters from the VW/Audi car set adapter case feature a 5/8 -18 UNF thread, In order for the charge hoses of the R1234yf- air conditioner service station to be connected, use additional adapters from the case VW/Audi car set adapter case ⇒ Electronic parts catalogue .*
- ◆ *In vehicles with high-voltage system, electrically operated valves are installed in the refrigerant circuit, which must be removed for cleaning (flushing) and replaced with manual shut-off valves or adapters ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

1 - Air conditioner service station

- ❑ With electronics and a flushing program, air conditioner service station with flushing device
 ⇒ Electronic parts catalogue (Tools; Equipment/tools; Air conditioner/heating)
- ❑ If you are using an air conditioner service station without a flushing program, perform the procedure manually (evacuate, flush with at least 3 kg of refrigerant four times, extract refrigerant once more, evacuate).

2 - Refrigerant hose of the air conditioner service station

- ❑ From the high-pressure side of the air conditioner service station (mostly coloured red) to the connection for the low-pressure side of the air conditioner compressor in the refrigerant circuit (larger diameter)

3 - Adapter for the low-pressure side connection on the refrigerant circuit

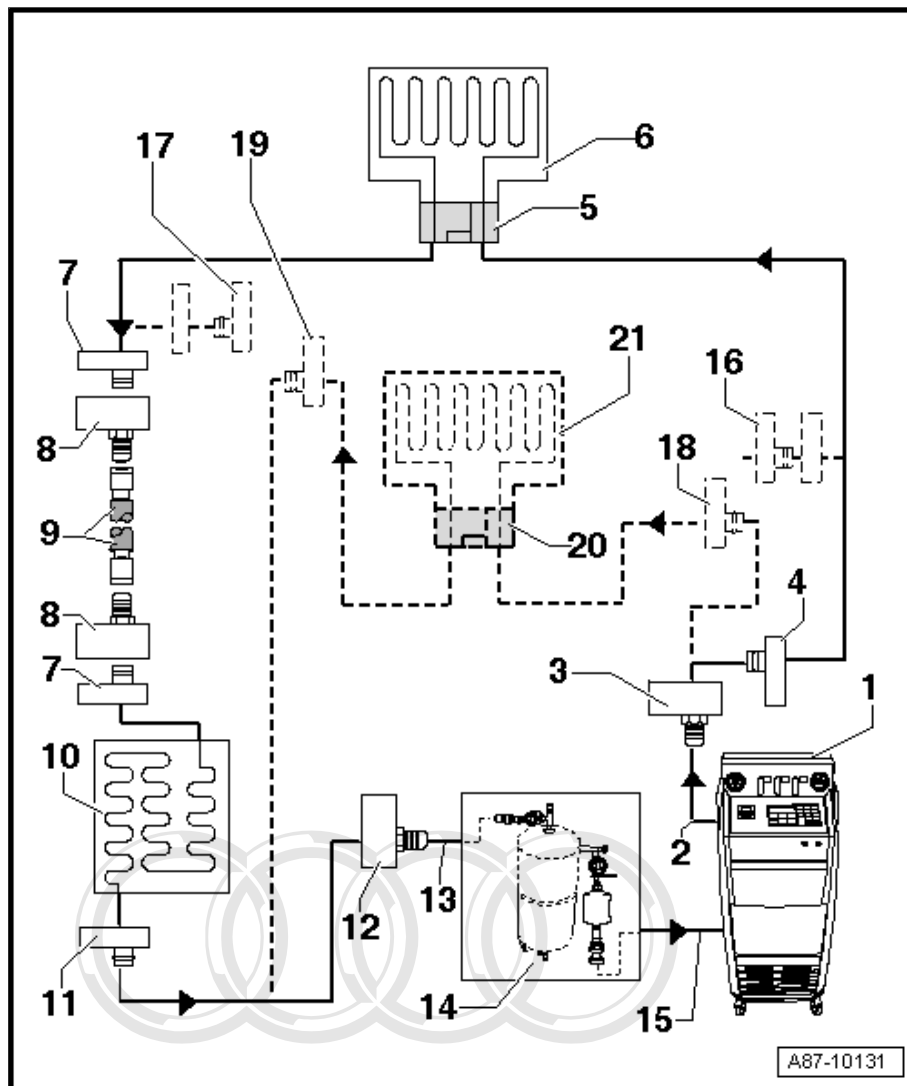
- ❑ Different versions depending on the vehicle
 ⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)

- ❑ Between the refrigerant hose -2- and the adapter -3-, use adapter - VAS 6338/48- .
- ❑ From the VW/Audi car set adapter case
- ❑ Depending on the adapter version, an additional adapter may be required for connecting the charge hose of the air conditioner service station



Note

- ◆ *The charge hose of the air conditioner service station has an outer thread M12 x 1.5-6G to SAE J639. The adapter for the low-pressure side connection has outer thread 5/8 -18 UNF. Therefore, in order to connect the two components an additional adapter is required ⇒ Electronic parts catalogue (Tools; Equipment/tools; Air conditioner/heating).*



- ◆ *In order to achieve the highest possible flow speed, the service coupling of the charge hose is removed for flushing (there are constrictions in the service coupling that would greatly reduce the flow speed).*

4 - Low-pressure side connection in refrigerant circuit

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)

5 - Adapter for expansion valve removed

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)
- ☐ From the VW/Audi car set adapter case ⇒ Electronic parts catalogue (Tools; Equipment/tools; Air conditioner/heating)

6 - Evaporator

7 - Connection to receiver

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)
- ☐ Not installed in vehicles with a desiccant cartridge in the receiver on the condenser, or with a receiver installed in the condenser ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

8 - Adapter for bridging receiver removed

- ☐ Not necessary on all vehicles
- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)
- ☐ From the VW/Audi car set adapter case

9 - charge hose for refrigerant

- ☐ For example, charge hose from the VW/Audi car set adapter case
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)

10 - Condenser

- ☐ If the receiver is mounted directly on the condenser, only remove the receiver after flushing and replace it ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ☐ If a receiver with desiccant cartridge is installed on the condenser, the desiccant cartridge must be removed (close the receiver on or in the condenser again after removal) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).



Note

On certain vehicles, the receiver is integrated into the condenser and the dryer cartridge cannot be replaced separately or is not available separately. With these vehicles, in this case replace the condenser with the receiver/desiccant cartridge after flushing ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .

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11 - High-pressure side connection in refrigerant circuit

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)

12 - Adapter for the high-pressure side connection on the refrigerant circuit

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)
- ☐ From the VW/Audi car set adapter case

13 - charge hose for refrigerant circuit flushing device

- ☐ From the high-pressure side connection of the air conditioner compressor on the refrigerant circuit (smaller diameter) to the inlet of the refrigerant circuit flushing device.

14 - Refrigerant circuit flushing device

- ☐ Different versions and different design of the refrigerant circuit flushing device ⇒ Electronic parts catalogue (Tools; Equipment/tools; Air conditioner/heating)
- ☐ With filter, sight glass, safety valve, heater, refrigerant vessel, etc. (depending on the version).
- ☐ Depending on the design of the air conditioner service station and the refrigerant circuit flushing device, a non-return valve may be installed at the outlet of the refrigerant circuit flushing device (to ensure the correct direction of flow of refrigerant during flushing)
- ☐ Depending on the flushing device, the outlet to the air conditioner service station may have an outer thread 5/8 -18 UNF, a connection for an R134a or R1234yf high-pressure service coupling



Note

- ◆ *To enable the flushing device to be connected to the air conditioner service station, additional adapters are required for flushing devices with outer thread 5/8 -18 UNF or a connection for an R134a low-pressure service coupling, in order to connect the R1234yf low-pressure service coupling or charge hose to the air conditioner service station (with outer thread M12 x 1.5-6G to SAE J639) to the outlet of the flushing device.*
- ◆ *The charge hose of the air conditioner service station has an outer thread M12 x 1.5-6G to SAE J639. Depending on the version, the refrigerant circuit flushing device may have a service connection for a low-pressure service coupling to J639 for refrigerant R1234yf, an internal thread M12 x 1.5-6G to SAE J639, a service connection for an R134a low-pressure service coupling, or an outer thread 5/8 -18 UNF. Therefore, in order for both components to be connected, an additional adapter may be required ⇒ Electronic parts catalogue .*
- ◆ *Since the air conditioner service station only extracts the refrigerant at a low flow speed, the low-pressure service coupling can be used here.*

15 - Refrigerant hose of the air conditioner service station

- ☐ From the low-pressure side of the air conditioner service station (mostly coloured blue) to the outlet of the refrigerant circuit flushing device.

16 - Adapters for closing the outlet to the second evaporator

- ☐ Only required in certain vehicles with the optional extra "second evaporator"

- ☐ From the VW/Audi car set adapter case

17 - Adapters for closing the outlet to the second evaporator

- ☐ Only required in certain vehicles with the optional extra "second evaporator"
- ☐ From the VW/Audi car set adapter case

18 - Low-pressure side connection on refrigerant circuit to second evaporator

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)
- ☐ Only fitted on certain vehicles with "second evaporator" as optional extra

19 - High-pressure side connection on refrigerant circuit to second evaporator

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)
- ☐ Only fitted on certain vehicles with "second evaporator" as optional extra

20 - Adapter for expansion valve removed at second evaporator

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)
- ☐ Only required in certain vehicles with the optional extra "second evaporator"
- ☐ From the VW/Audi car set adapter case

21 - Second evaporator

- ☐ Only fitted on certain vehicles with "second evaporator" as optional extra

1.6.5 Block diagrams for cleaning (flushing circuits) - Refrigerant circuit with restrictor and reservoir (without high-voltage system)



Note

- ◆ *On vehicles with a restrictor and reservoir, the restrictor and reservoir are removed and the lines unfastened to remove the restrictor are connected back together. The line connections to the removed reservoir are connected by two adapters and the charge hose (from the VW/Audi car set adapter case).*
- ◆ *Volkswagen/Audi do not currently plan to use this design with refrigerant circuit restrictor and reservoir.*
- ◆ *The arrows in the diagrams below indicate the direction of flow of refrigerant during flushing (during flushing the refrigerant flows in the reverse direction to during air conditioner operation, which is why the high-pressure side of the air conditioner service station on the low-pressure connection of the refrigerant circuit is connected to the air conditioner compressor).*
- ◆ *Depending on the design of the air conditioner service station, non-return valves may be installed between the refrigerant circuit and the air conditioner service station (to ensure the correct direction of flow of refrigerant during flushing).*
- ◆ *The adapters from the VW/Audi car set adapter case feature a 5/8 -18 UNF thread. In order for the charge hoses of the R1234yf- air conditioner service station to be connected, use additional adapters from the case VW/Audi car set adapter case.*

1 - Air conditioner service station

- ❑ With electronics and a flushing program, e.g. air conditioner service station with flushing device ⇒ Electronic parts catalogue (Tools; Equipment/tools; Air conditioner/heating)
- ❑ If you are using an air conditioner service station without a flushing program, perform the procedure manually (evacuate, flush with at least 3 kg of refrigerant four times, extract refrigerant once more, evacuate).

2 - Refrigerant hose of the air conditioner service station

- ❑ From the high-pressure side of the air conditioner service station (mostly coloured red) to the connection for the low-pressure side of the air conditioner compressor in the refrigerant circuit (larger diameter)

3 - Adapter for the low-pressure side connection on the refrigerant circuit

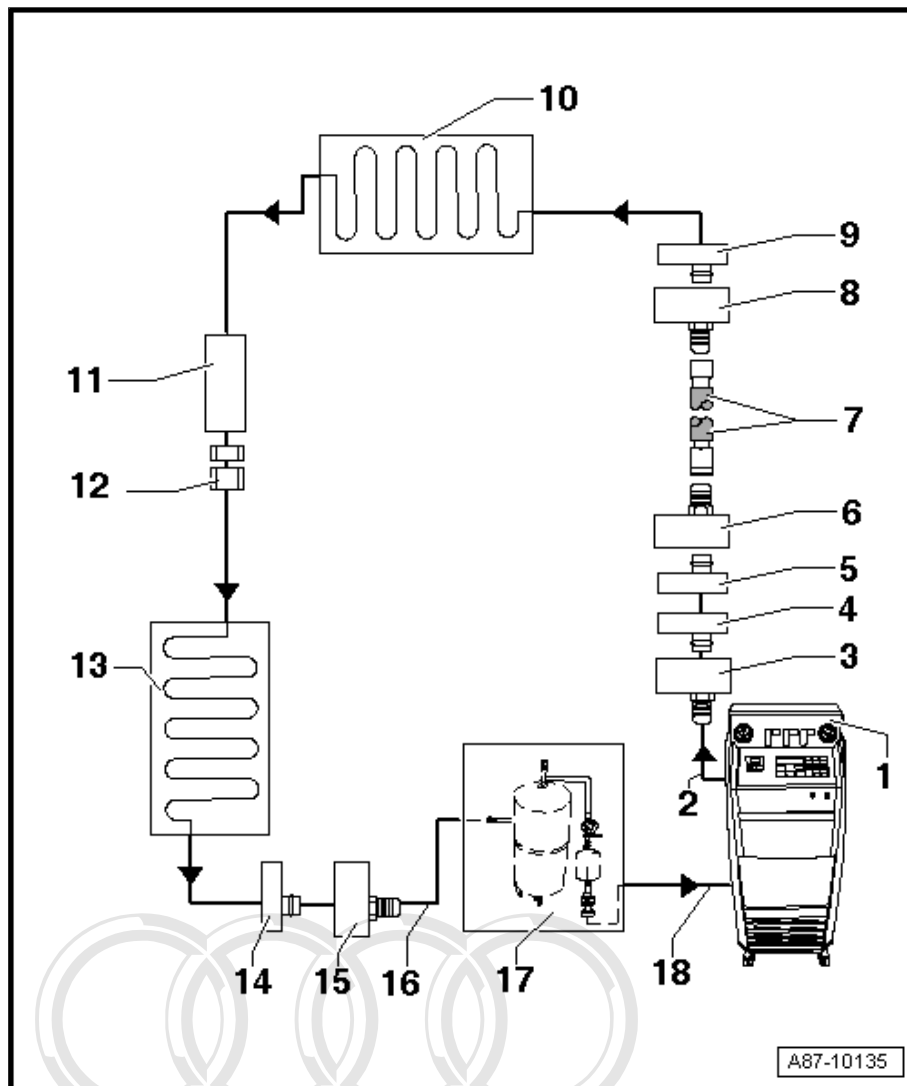
- ❑ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)

- ❑ Between the refrigerant hose -2- and the adapter -3-, use adapter - VAS 6338/48- .
- ❑ From the VW/Audi car set adapter case



Note

- ◆ *The charge hose of the air conditioner service station has an outer thread M12 x 1.5-6G to SAE J639. The adapter for the low-pressure side connection has outer thread 5/8 -18 UNF. Therefore, in order for both components to be connected, an additional adapter is required ⇒ Electronic parts catalogue .*
- ◆ *In order to achieve the highest possible flow speed, the service coupling of the charge hose is removed for flushing (there are constrictions in the service coupling that would greatly reduce the flow speed).*



4 - Low-pressure side connection in refrigerant circuit

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)
- ☐ On the refrigerant line from the air conditioner compressor to the reservoir

5 - Connection to reservoir

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)
- ☐ On the refrigerant line from the air conditioner compressor to the reservoir

6 - Adapter for bypassing the removed reservoir

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)
- ☐ From the VW/Audi car set adapter case

7 - charge hose for refrigerant

- ☐ For example, charge hose (from the VW/Audi car set adapter case)
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#) .

8 - Adapter for bypassing the removed reservoir

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)
- ☐ From the VW/Audi car set adapter case

9 - Connection to reservoir

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)

10 - Evaporator

11 - Restrictor fitting location

- ☐ Restrictor removed
- ☐ Remove the restrictor ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

12 - Union in refrigerant line

- ☐ After removing the restrictor, screw back together ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

13 - Condenser

14 - High-pressure side connection in refrigerant circuit

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)

15 - Adapter for the high-pressure side connection on the refrigerant circuit

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)
- ☐ From the VW/Audi car set adapter case

16 - charge hose for refrigerant circuit flushing device

- ☐ From the high-pressure side connection of the air conditioner compressor on the refrigerant circuit (smaller diameter) to the inlet of the refrigerant circuit flushing device.

17 - Refrigerant circuit flushing device

- ☐ Different versions and different design of the refrigerant circuit flushing device ⇒ Electronic parts catalogue (Tools/Equipment/tools; Air conditioner/heating)
- ☐ With filter, sight glass, safety valve, heater, refrigerant vessel, etc. (depending on the version).
- ☐ Depending on the design of the air conditioner service station and the refrigerant circuit flushing device, a non-return valve may be installed at the outlet of the refrigerant circuit flushing device (to ensure the correct direction of flow of refrigerant during flushing)
- ☐ Depending on the design of the refrigerant circuit flushing device, there may be a connection for a service coupling for refrigerant circuits at the outlet and possibly the inlet of the flushing device (in place of an outer thread 5/8-18 UNF). If a service connection with valve is installed at the outlet of the flushing device, this valve must be fully open when the service coupling is connected (a partially open valve creates a constriction). If there is a connection for a service coupling at the inlet of the flushing device, modify the

inlet so that the refrigerant hose that comes from the vehicle can be directly connected (a service coupling and a valve in the inlet of the flushing device creates a constriction, which hinders the flow of refrigerant out of the vehicle into the flushing device and therefore hampers the flushing process).

18 - Refrigerant hose of the air conditioner service station

- ❑ From the low-pressure side of the air conditioner service station (mostly coloured blue) to the outlet of the refrigerant circuit flushing device.

1.6.6 Block diagrams for cleaning (flushing circuits) - Vehicles with high-voltage system (without air conditioner auxiliary functions)



Note

- ◆ *The refrigerant circuit is cleaned in two flushing cycles (first the section with the evaporator in the front heater and air conditioning unit, then the section with the heat exchanger for high-voltage battery or the evaporator in the battery cooling module) ⇒ [page 109](#)*
- ◆ *In vehicles with two evaporators or one evaporator and a heat exchanger, using manual shut-off valves separate the circuit to the second evaporator or heat exchanger from the circuit for the first evaporator and flush in a separate operation ⇒ [page 109](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *The design of the different flushing circuits for these vehicles is similar to that of a vehicle with two evaporators.*

1.6.7 Block diagrams for cleaning (flushing circuits) - Vehicles with high-voltage system (with air conditioner auxiliary functions, e.g. heat pump mode)

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Note

- ◆ *The refrigerant circuit is cleaned in several flushing cycles ⇒ [page 109](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (Cleaning refrigerant circuit of air conditioner).*
- ◆ *The circuit is divided into several sections for flushing, each of which is flushed in a flushing cycle. It is divided by the actuation of the installed electrically operated valves and the installed manually operated manual shut-off valves ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (Cleaning refrigerant circuit of air conditioner).*
- ◆ *The design of the different flushing circuits for these vehicles is described in the respective vehicle-specific Workshop Manual ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (Cleaning refrigerant circuit of air conditioner ⇒ ["1.6.4 Block diagrams for cleaning \(flushing circuits\) - Refrigerant circuit with expansion valve and receiver", page 100](#)).*

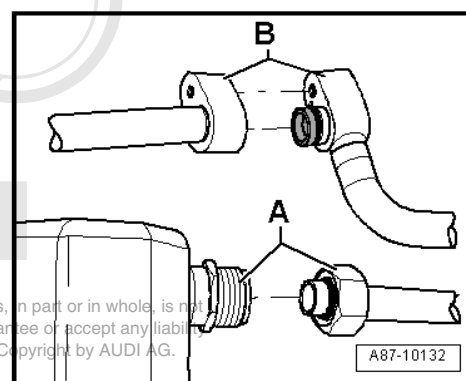
1.6.8 Adapters for connecting up flushing circuits

- ◆ The table below shows the various adapters required for connecting the air conditioner service station to the refrigerant circuit for flushing and for bypassing the removed receiver or reservoir and the expansion valve (vehicle-specific).
- ◆ The adapters from the VW/Audi car set adapter case feature a 5/8 -18 UNF thread. In order for the charge hoses of the R1234yf air conditioner service station to be connected (thread M12 x 1.5-6G to SAE J639), use additional adapters from the case (e.g. adapter - VAS 6338/48-).
- ◆ Using a charge hose with 5/8 -18 UNF connections (short version e.g. charge hose), connect the two adapters that you have installed for the removed reservoir or receiver (contained in VW/Audi car set adapter case).
- ◆ If a flushed refrigerant circuit is not reassembled immediately after flushing, leave adapters on the connections and close the connections on the adapters with the caps - VAS 6338/30- (from the VW/Audi car set adapter case).
- ◆ Depending on the version air conditioner compressor and the production period, you will find different connecting and sealing methods in the refrigerant circuit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Block or screw connections

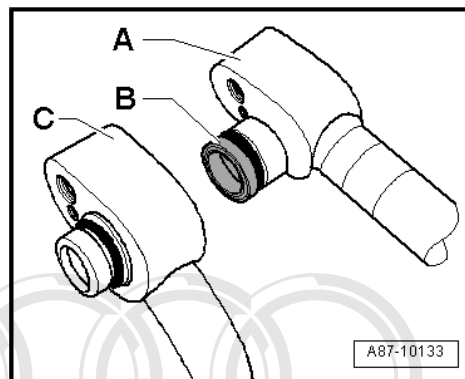
- Screw connection -A-
- Block connection -B-

Block connections with different types of seal



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- Block connection with radial sealing connection -A- (with plastic or metal guide -B-)
- Block connection with axial seal -C-



Assemble the flushing circuit	
Audi A1	⇒ page 110
Audi A3, Audi Q3 and Audi TT	⇒ page 112
Audi A3 e-tron	⇒ page 114
Audi A4	⇒ page 117
Audi A5 Coupé and Sportback, Audi Q5, Audi A5 Cabriolet	⇒ page 118
Audi A6 (4G_ or 4X_ for China), Audi A7 (4G_ or 4X_ for China)	⇒ page 119
Audi A8	⇒ page 121
Audi Q7, Audi Q7 e-tron	⇒ page 123
Audi R8	⇒ page 128

Audi A1

Vehicle	Required adapters for connections to the air conditioner compressor	Required adapters for connections to the receiver or receiver	Miscellaneous
Audi A1 (8X_) 2017 ►	– Compressor manufacturer "Denso", "Sanden" or "Delphi/Mahle" ◆ Low-pressure side adapter - VAS 6338/12- connected to air conditioner service station and adapter - VAS 6338/48- ◆ High-pressure side adapter - VAS 6338/3- or adapter - VAS 6338/2- (depending on the version of air conditioner compressor and associated refrigerant line)	– Different versions – Version 1 (receiver integrated in condenser): No adapter required, the desiccant bag is removed from the receiver on the condenser and the opening is closed again for flushing. – Version 2 (receiver mounted on condenser): No adapter required, the receiver remains installed (it is replaced after flushing)	– Expansion valve removed and adapter - VAS 6338/34- or adapter - VAS 6338/39- (see notes below) installed (or the old removed expansion valve is drilled out for flushing the re-installed

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Note

- ◆ *Depending on the condenser version, the receiver of the Audi A1/S1 may be mounted or integrated. The integrated receiver is fitted with a dryer cartridge which can be replaced separately. If the receiver is mounted (not yet finalised), it must be replaced after flushing ⇒ Electronic parts catalogue and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *Different air conditioning unit versions (different heat exchangers and seals, different expansion valve, etc.), depending on the production period and the vehicle identification number of the Audi A1/S1 ⇒ Electronic parts catalogue . Vehicles with type codes "8X1" and "8XA" in the vehicle identification number feature an expansion valve to which the two refrigerant lines are screwed onto the top. Adapter - VAS 6338/34- fits here. Vehicles with type codes "8XF" and "8XK" in the vehicle identification number feature an expansion valve to which the two refrigerant lines are screwed underneath. Adapter - VAS 6338/39- fits here. ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit; Removing and installing expansion valve (vehicle-specific Workshop Manual).*



Audi A3, Audi Q3 and Audi TT

Vehicle	Required adapters for connections to the air conditioner compressor	Required adapters for connections to the reservoir or receiver	Miscellaneous
Audi Q3 (8U_ / 84_) 2017 ►	- Compressor manufacturer for Audi Q3 "Sanden", "Denso", "Delphi/Mahle" or "Zexel/Valeo" ◆ Low-pressure side adapter - VAS 6338/12- connected to air conditioner service station and adapter - VAS 6338/48- ◆ High-pressure end Adapter - VAS 6338/3-	Receiver (different versions) - Adapter not required, receiver remains in position - Depending on the version of the condenser, it may be necessary to remove the dryer cartridge from the receiver at the condenser before flushing and to seal the opening again (refer to note).	Expansion valve removed and Adapter - VAS 6338/18- (or drilled-open expansion valve e.g. 1K0 820 679) fitted ⇒ page 99
Audi A3 (8V_ / 85_) 2017 ► Audi TT (FV_) 2017 ►	- Compressor manufacturer "Denso", "Delphi/Mahle" or "Sanden", ◆ Low-pressure side adapter - VAS 6338/12- connected to air conditioner service station and adapter - VAS 6338/48- ◆ High-pressure side adapter - VAS 6338/3- ◆	Receiver (different versions) - No adapter required, the receiver remains installed (or is integrated in the condenser) - Depending on the condenser version, remove the desiccant cartridge from the receiver before flushing, if necessary and close the opening again (see note).	Expansion valve removed and adapter - VAS 6338/38- (or a drilled out expansion valve, e.g. 5Q0 820 679 X installed ⇒ page 99)

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Note

- ◆ *Depending on the condenser manufacturer, the receiver version differs in the Audi A3, Audi Q3 and Audi TT. In certain versions, the receiver may be installed in this condenser, for example. A desiccant cartridge is installed in the integrated receiver, which is currently not always available as a spare part. Therefore, in the event of a problem concerning a vehicle with condenser with integrated receiver, the condenser may have to be completely replaced after the problem has been rectified ⇒ Electronic parts catalogue and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *For condensers with integrated receiver/desiccant cartridge, which cannot be individually replaced or is not available as an individual part, the condenser (with installed desiccant cartridge) must be replaced after flushing ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .*

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Audi A3 e-tron

Vehicle	Required adapters for connections to the air conditioner compressor	Required adapters for connections to the reservoir or receiver	Miscellaneous
Audi A3 (8V / 85_) 2017 ►	- Compressor manufacturer "Denso", "Delphi/Mahle" or "Sanden", ◆ Low-pressure side adapter - VAS 6338/12- connected to air conditioner service station and adapter - VAS 6338/48- ◆ High-pressure side adapter - VAS 6338/3-	Receiver (different versions) - No adapter required, the receiver remains installed (or is integrated in the condenser) - Depending on the condenser version, remove the desiccant cartridge from the receiver before flushing, if necessary and close the opening again (see note). ◆ Cut-off valve - VAS 6338/42-	◆ Expansion valve removed and adapter - VAS 6338/38- (or a drilled out expansion valve, e.g. 5Q0 820 679 X installed ⇒ page 99) ◆ Shut-off valves - N541- and - N542- removed and a cut-off valve - VAS 6338/42- installed for each (see notes below) ◆ Restrictor in refrigerant line to heat exchanger for high-voltage battery removed or refrigerant line drilled out (see notes below)

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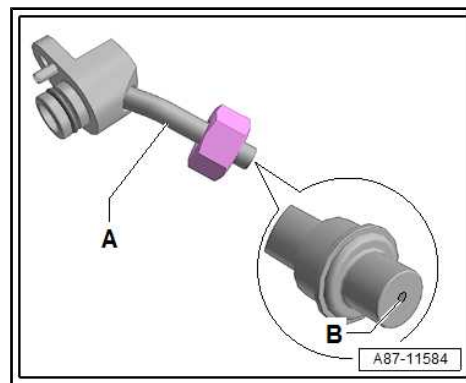
Vehicle	Required adapt- ers for connec- tions to the air conditioner com- pressor	Required adapters for connections to the res- ervoir or receiver	Miscella- neous
	Required adapt- ers/lines for con- nections to the electrically driv- en air condition- er compressor (for flushing the air conditioner compressor). Flush the electric- ally driven air conditioner com- pressor ⇒ page 163		◆ With an electri- cally driven air condition- er compressor, the refrigerant oil must be re- moved by flushing in the direction of flow (flushing against the di- rection of flow is not possi- ble be- cause of the built-in valves) ◆ For flush- ing, position the air condi- tioner com- pressor so that the connec- tion for the high-pres- sure side re- frigerant line is as low as possi- ble

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Note

- ◆ In the Audi A3 e-tron, the refrigerant circuit is flushed in two sections. In the first flushing cycle, the adapter that is installed for shut-off valve -N541- is open and the adapter installed for shut-off valve -N542- is closed. The refrigerant circuit is therefore flushed with the evaporator in the air conditioning unit. In the second flushing cycle, the adapter that is installed for shut-off valve -N541- is closed and the adapter installed for shut-off valve -N542- is open. The refrigerant circuit is therefore flushed with the evaporator in the heat exchanger for high-voltage battery ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ This diagram shows a refrigerant line -A- with a permanently installed restrictor -B- (without screen). This refrigerant line must be drilled out to 5.0 mm with a suitable drill bit for flushing the refrigerant circuit (an inserted restrictor must be removed) and cleaned before installing in the refrigerant circuit. Replace the drilled out refrigerant line after flushing ⇒ Electronic parts catalogue .
- ◆ The restrictor hole -B- has a diameter of approx. 0.7 mm. Depending on the refrigerant line version, this constriction is either permanently installed or just inserted in the refrigerant line. With the inserted version, a screen may be installed to separate suspended bodies that could clog the restrictor hole.
- ◆ Depending on the condenser manufacturer, there are different receiver versions in the Audi A3. This condenser features an integrated receiver for example. The integrated receiver contains a dryer cartridge which is currently not always available as a replacement part. Therefore, in the event of a problem concerning a vehicle with this condenser, it may have to be completely replaced after the problem has been rectified ⇒ Electronic parts catalogue and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ For condensers with integrated receiver/desiccant cartridge, which cannot be individually replaced or is not available as an individual part, the condenser (with installed desiccant cartridge) must be replaced after flushing ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .



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Audi A4

Vehicle	Required adapters for connections to the air conditioner compressor	Required adapters for connections to the reservoir or receiver	Miscellaneous
Audi A4 (8K_) 2017 ►	- Compressor manufacturer "Denso" ◆ Low-pressure side adapter - VAS 6338/12- connected to air conditioner service station and adapter - VAS 6338/48- ◆ High-pressure end Adapter - VAS 6338/3-	Receiver (different versions) - Adapter not required, receiver remains in position - Depending on the version of the condenser, it may be necessary to remove the dryer cartridge from the receiver at the condenser before flushing and to seal the opening again (refer to note).	Expansion valve removed and Adapter - VAS 6338/36- (or drilled-open expansion valve e.g. 8K0 820 679 A) fitted ⇒ page 99 The refrigerant line with internal heat exchanger remains in position or is installed again after fitting the adapter.
Audi A4 (8W_) 2017 ►	- Compressor manufacturer "Denso", "Delphi/Mahle" or "Sanden" ◆ Low-pressure side adapter - VAS 6338/12- connected to air conditioner service station and adapter - VAS 6338/48- ◆ High-pressure side adapter - VAS 6338/3-	No adapter required, the dryer is removed from the receiver on the condenser and the opening is closed again.	Expansion valve removed and adapter - VAS 6338/44- installed (or an old expansion valve drilled out and installed as an adapter ⇒ page 99) ⇒ Electronic parts catalogue .



Note

- ◆ Depending on the condenser manufacturer, there are different receiver versions in the Audi A4 (8K_) 2017 > ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue . Depending on the condenser version, the receiver may be mounted or integrated. A desiccant cartridge is installed in the integrated receiver, which is currently not always available as a spare part. Therefore, in the event of a problem concerning a vehicle with this condenser, it may have to be completely replaced after the problem has been rectified ⇒ Electronic parts catalogue ..
- ◆ For condensers with integrated receiver/desiccant cartridge, which cannot be individually replaced or is not available as an individual part, the condenser (with installed desiccant cartridge) must be replaced after flushing ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .

Audi A5 Coupé and Sportback, Audi Q5, Audi A5 Cabriolet

Vehicle	Required adapters for connections to the air conditioner compressor	Required adapters for connections to the receiver	Miscellaneous
Audi A5 Coupé and Sportback (8T_) 2017 ► Audi Q5 (8R_ / 83_) 2017 ► Audi A5 Cabriolet (8F_) 2017 ►	– Compressor manufacturer "Denso" ◆ Low-pressure side adapter - VAS 6338/12- connected to air conditioner service station and adapter - VAS 6338/48- ◆ High-pressure end Adapter - VAS 6338/3-	Receiver (different versions) – Adapter not required, receiver remains in position – Depending on the version of the condenser, it may be necessary to remove the dryer cartridge from the receiver at the condenser before flushing and to seal the opening again (refer to note).	Expansion valve removed and Adapter - VAS 6338/36- (or drilled-open expansion valve e.g. 8K0 820 679 A) fitted ⇒ page 99 – The refrigerant line with internal heat exchanger remains in position or is installed again after fitting the adapter.

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Note

- ◆ Depending on the condenser manufacturer, there are different receiver versions for these vehicles ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). Depending on the condenser version, the receiver may be mounted or integrated. A desiccant cartridge is installed in the integrated receiver, which is currently not always available as a spare part. Therefore, in the event of a problem concerning a vehicle with this condenser, it may have to be completely replaced after the problem has been rectified ⇒ Electronic parts catalogue ..
- ◆ For condensers with integrated receiver/desiccant cartridge, which cannot be individually replaced or is not available as an individual part, the condenser (with installed desiccant cartridge) must be replaced after flushing ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .

Audi A6 (4G_ or 4X_ for China), Audi A7 (4G_ or 4X_ for China)

Vehicle	Required adapters for connections to the air conditioner compressor	Required adapters for connections to the receiver	Miscellaneous
Audi A6 (4G_ / 4X_) 2017 ► Audi A7 (4G_ / 4X_) 2017 ►	– Compressor manufacturer “Denso” ◆ Low-pressure side adapter - VAS 6338/12- connected to air conditioner service station and adapter - VAS 6338/48- ◆ High-pressure end Adapter - VAS 6338/3-	Receiver (different versions) – Adapter not required, receiver remains in position – Depending on the version of the condenser, it may be necessary to remove the dryer cartridge from the receiver at the condenser before flushing and to seal the opening again (refer to note).	Expansion valve removed and adapter - VAS 6338/18- (or the old removed expansion valve drilled out for flushing and re-installed ⇒ page 99).

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Note

- ◆ *With certain versions for China, type designation 4X_ is used instead of type designation 4X_.*
- ◆ *Depending on the condenser manufacturer, there are different receiver versions for these vehicles ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .*
- ◆ *For condensers with integrated receiver/desiccant cartridge, which cannot be individually replaced or is not available as an individual part, the condenser (with installed desiccant cartridge) must be replaced after flushing ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .*
- ◆ *Until further notice, the Audi A6 e-tron will only be manufactured in China and will not be charged with refrigerant R1234yf there (refrigerant R134a will continue to be used) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual)*



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Audi A8

Vehicle	Required adapters for connections to the air conditioner compressor	Required adapters for connections to the reservoir or receiver	Miscellaneous
Audi A8 (4H_) 2010 ►	– Compressor manufacturer “Denso” (block connections with radial seal) ◆ Low-pressure side adapter - VAS 6338/12- connected to air conditioner service station and adapter - VAS 6338/48- ◆ High-pressure end Adapter - VAS 6338/3-	– No adapter required, the desiccant bag is removed from the receiver at the condenser and the opening sealed off again for flushing.	Expansion valve removed and adapter - VAS 6338/18-fitted (or old expansion valve removed drilled open for flushing and re-installed ⇒ page 99).
		For flushing the circuit with the evaporator in the front air conditioning unit ◆ Adapter - VAS 6338/5- for sealing the “low-pressure end” connection (to the second evaporator) ◆ Adapter - VAS 6338/11- for sealing the “high-pressure end” connection (to the second evaporator) • An additional hole may have to be made in the adapters (see below) to be able to seal the refrigerant lines with the adapters - VAS 6338/5- and - VAS 6338/11-	

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Vehicle	Required adapt-ers for connec-tions to the air conditioner com-pressor	Required adapters for connections to the res-ervoir or receiver	Miscella-neous
		For flushing the sec-ond evaporator and the corresponding lines ♦ Adapter - VAS 6338/3- for con-necting the air con-ditioner service sta-tion to the "low-pressure side" con-nection (to the sec-ond evaporator). ♦ Adapter - VAS 6338/4- for con-necting the air con-ditioner service sta-tion to the "high-pressure side" con-nection (to the sec-ond evaporator). • The adapter may have to be re-worked (see below) to be able to con-nect the refrigerant line to the adapter - VAS 6338/3-	Expansion valve in re-frigerant lines to second evaporator removed and adapt-er - VAS 6338/18-fitted (or old expan-sion valve removed drilled open for flushing and re-in-stalled ⇒ page 99).



Note

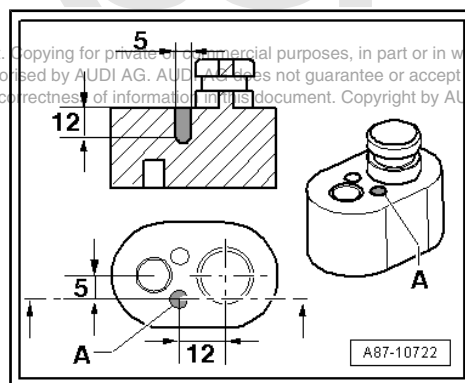
- ♦ *In vehicles with two evaporators, the refrigerant circuit is flush-ed in two work steps.*
- ♦ *At present the front and rear expansion valves have identical connections (only the control characteristic differs).*

Drill an additional hole in adapters - VAS 6338/5- and -VAS 6338/11- .

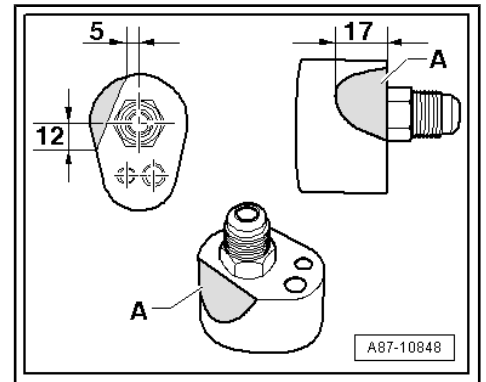
- Make a hole -A- in addition to the hole provided (the dimen-sions in the illustration are given in mm).

Rework adapter - VAS 6338/3- .

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- By grinding or filing off material in area -A-, rework the adapter - VAS 6338/3- such that it can be connected without bending the refrigerant line (the dimensions in the illustration are given in mm).



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Audi Q7, Audi Q7 e-tron

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for connections to receiver / to second evaporator	Miscellaneous
Audi Q7 (4M_) 2016 ▶ ◆ Vehicle with one evaporator	– Compressor manufacturer “Denso” (block connections with radial seal) ◆ Low-pressure side adapter - VAS 6338/12- connected to air conditioner service station and adapter - VAS 6338/48- ◆ High-pressure side adapter - VAS 6338/3-	– No adapter required, the dryer is removed from the receiver on the condenser and the opening is closed again.	Expansion valve removed and adapter - VAS 6338/44- installed (or an old expansion valve drilled out and installed as an adapter ⇒ page 99) ⇒ Electronic parts catalogue .
◆ Additionally for vehicles with 2 evaporators (4-zone air conditioner)		For flushing the circuit with the evaporator in the front air conditioning unit ◆ Adapter - VAS 6338/44- and adapter - VAS 6338/43- (for closing the refrigerant circuit to the second evaporator)	Expansion valve to evaporator in front air conditioning unit removed and adapter - VAS 6338/44- installed. Expansion valve in refrigerant lines to evaporator in rear air conditioning unit removed and adapter - VAS 6338/43- installed.

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for connections to receiver / to second evaporator	Miscellaneous
		For flushing the second evaporator and the corresponding lines ♦ Adapter - VAS 6338/44- and adapter - VAS 6338/43- (for closing the refrigerant circuit to the evaporator in the front air conditioning unit)	Expansion valve to evaporator in front air conditioning unit removed and adapter - VAS 6338/43- installed. Expansion valve in refrigerant lines to evaporator in rear air conditioning unit removed and adapter - VAS 6338/44- installed.



Note

- ♦ In vehicles with two evaporators, the refrigerant circuit is flushed in two work steps.
- ♦ In vehicles with two evaporators, first the refrigerant circuit is flushed with the evaporator in the front air conditioning unit. So that the refrigerant flows in one specified direction during flushing, the refrigerant circuit to the second evaporator (in the rear air conditioning unit) must be shut off. Do this by removing the expansion valve in the refrigerant lines to the second evaporator and installing the adapter - VAS 6338/43- (closed adapter). After the refrigerant circuit has been flushed with the evaporator in the air conditioning unit, replaced the two adapters - VAS 6338/43- und -VAS 6338/44- and flush the refrigerant circuit with the evaporator in the rear air conditioning unit.



Vehicle	Required adapters for connections to the air conditioner compressor	Required adapters for connections to the receiver/for the non-return and shut-off valves	Miscellaneous
Audi Q7 e-tron (4M_) 2017 ► ♦ Vehicle with one evaporator	- Compressor manufacturer "Sanden" (block connections with radial seal) - Low-pressure side adapter - VAS 6338/12- connected to air conditioner service station and adapter - VAS 6338/48- - High-pressure side adapter - VAS 6338/3-	Receiver No adapter required, the dryer is removed from the receiver on the condenser and the opening is closed again.	Expansion valve removed and adapter - VAS 6338/44- installed (or an old expansion valve drilled out and installed as an adapter ⇒ page 99) ⇒ Electronic parts catalogue .
		Non-return valves Four non-return valves removed and shut-off valves (-6338/47-1- and -6338/47-2-) from the shut-off valve set - 6338/47- installed in their place	Open or close the shut-off valves installed for the non-return valves as appropriate for the area to be flushed⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
		Shut-off valve Existing shut-off valve removed and a cut-off valve - VAS 6338/42- installed in its place	Open or close the cut-off valve installed for the shut-off valve as appropriate for the area to be flushed.

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Note

- ◆ *In the Audi Q7 e-tron, the refrigerant circuit is flushed in four work steps (flushing cycles) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (Cleaning refrigerant circuit of air conditioner).*
- ◆ *In order for the entire refrigerant circuit to be flushed in the Audi Q7 e-tron, it is not just the installed shut-off valves that have to be in the correct position (open or closed). In addition, the electrically operated valves (in the valve block) also have to be in the right position. The electric valves are actuated by various routines that are stored in the respective control unit (e.g. in the thermal management control unit - J1024-) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (Cleaning refrigerant circuit of air conditioner).*
- ◆ *In the Audi Q7 e-tron, the circuit is divided into several sections for flushing, each of which is flushed in a flushing cycle. It is divided by the actuation of the installed electrically operated valves and the installed manually operated manual shut-off valves ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (Cleaning refrigerant circuit of air conditioner) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.*
- ◆ *The design of the different flushing circuits for the Audi Q7 e-tron is described in the vehicle-specific Workshop Manual ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (Cleaning refrigerant circuit of air conditioner).*



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Audi R8

Vehicle	Required adapters for connections to the air conditioner compressor	Required adapters for connections to the receiver (with dryer)	Miscellaneous
Audi R8 (4S_) 2017 ►	– Compressor manufacturer "Denso" (block connections with radial seal) ◆ Low-pressure side adapter - VAS 6338/12- connected to air conditioner service station and adapter - VAS 6338/48- ◆ High-pressure side adapter - VAS 6338/3-	Receiver – Block connections with radial seal to inlet and outlet ◆ Adapter - VAS 6338/45- (two required)	Expansion valve removed and adapter - VAS 6338/44- installed (or an old expansion valve drilled out and installed as an adapter ⇒ page 99) ⇒ Electronic parts catalogue Receiver removed and the two connections of the refrigerant lines connected to one another by two adapters adapter - VAS 6338/45- and a commercially available charge hose (short version with 5/8" thread at both ends)

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Note

- ◆ *Depending on the engine, it may only be possible to replace the air conditioner compressor of the Audi R8 when the engine is removed. However, the refrigerant lines of an installed air conditioner compressor can be detached for flushing the refrigerant circuit ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual). However, with an installed air conditioner compressor, it is impossible to determine the quantity of refrigerant oil in the compressor. Therefore, it makes no sense to flush the refrigerant circuit with the air conditioner compressor installed.*
 - ◆ *The two condensers are flushed in situ in the direction opposite to that of the refrigerant flow.*
 - ◆ *A short charge hose is also included in the VW/Audi car set adapter case - VAS 6338/1-.*
 - ◆ *The receiver could possibly be flushed, but due its large internal volume it may take in too much liquid refrigerant. When this is extracted, the receiver then ices up considerably, the refrigerant only evaporates very slowly and the extraction process is therefore excessively long.*
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1.6.9 General information on blowing out with compressed air or nitrogen

The best way of removing moisture, impurities and old refrigerant oil from the refrigerant circuit without any unnecessary loss of refrigerant and without extensive assembly work, whilst at the same time ensuring environmental compatibility, is to clean the refrigerant circuit with refrigerant R1234yf (flush with refrigerant R1234yf) ⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#).

The refrigerant circuit should be blown out with compressed air and nitrogen, e.g. if only individual components need cleaning.



Note

- ◆ *Only blow out the refrigerant circuit with compressed air and then nitrogen if there is no possibility of flushing the refrigerant circuit, or it would take excessively long to flush individual components (e.g. minor impurities and moisture can also be blown out of removed refrigerant lines, for example, in a fairly short time).*
- ◆ *Blowing out the entire refrigerant circuit with compressed air and nitrogen mostly takes considerably longer than cleaning (flushing) with refrigerant R1234yf. When flushing with refrigerant R1234yf, the components are also cleaned far better. Therefore, flushing should always take place in response to a problem (blowing out should be reserved only for particular problems and individual components).*
- ◆ *In certain conditions, it may suffice to blow out certain components (e.g. individual refrigerant lines or hoses) with compressed air (e.g. for forcing old refrigerant oil out of individual, removed components) or with nitrogen (for drying individual components).*
- ◆ *Certain impurities can only be removed from the refrigerant circuit inadequately or not at all using compressed air. These impurities can be removed e.g. by cleaning (flushing) with refrigerant R1234yf
⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#).*
- ◆ *When blowing out (with compressed air or nitrogen), a maximum working pressure of 15 bar must not be exceeded (this corresponds to the pressure that occurs in a charged refrigerant circuit at an ambient temperature of approx. 60 °C, use a pressure reducer for compressed air too, if necessary).*
- ◆ *If the gas analysis reveals that refrigerant R1234yf is contaminated with another gas, this must be extracted from the refrigerant circuit and disposed of as a gas of unknown composition, in accordance with legal provisions ⇒ VW/Audi ServiceNet and ⇒ [page 170](#).*
- ◆ *Contaminated refrigerant can lead to the formation of breakdown products that accumulate in the refrigerant oil and cannot be extracted with the refrigerant. In this case, remove the contaminated refrigerant oil by flushing it out of the refrigerant circuit with refrigerant
⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#).*
- ◆ *If no suitable air conditioner service station for refrigerant R1234yf is available, the refrigerant circuit may also be cleaned (flushed) with the air conditioner service station for refrigerant R134a and with refrigerant R134a. The use of refrigerant R134a for cleaning the refrigerant circuit is currently permitted ⇒ Air conditioner with refrigerant R134a; Rep. gr. 87; Refrigerant circuit (air conditioner with refrigerant R134a, refrigerant circuit, working with the air conditioner service station).*

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CAUTION

Risk of injury from nitrogen flowing out under pressure.

- Use pressure reducers for nitrogen vessels.

- Always clean components against the direction of flow of the refrigerant (flush with refrigerant R1234yf) or blow out.

- Extract the mixture of refrigerant, refrigerant oil, compressed air or nitrogen emerging from the components using an extraction system.



Note

Compressed air and nitrogen cannot be blown through the restrictor, expansion valve, air conditioner compressor, receiver or reservoir.

- For condensers with a desiccant cartridge installed in the integrated receiver, this desiccant cartridge must be removed.



Note

- ◆ *For condensers with integrated receiver/desiccant cartridge that cannot be individually replaced, replace the condenser after cleaning (flushing).*
- ◆ *Depending on the version, an additional filter element may be installed for receivers in which the desiccant cartridge can be individually replaced. This must be replaced with the desiccant cartridge if necessary.*

- First blow out old refrigerant oil and dirt with compressed air, then blow out components with nitrogen (clean, blow out or dehumidify old refrigerant oil).
- Adapter for connecting the pressure hose to the refrigerant circuit VW/Audi car set adapter case ⇒ Electrical parts catalogue .

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Heed the following items to prevent oil and moisture from the compressed-air system ingressing into the refrigerant circuit.

- ◆ The compressed air must be passed through a compressed-air purifier for cleaning and drying. Therefore, use a filter and dryer for the compressed air (supplied as a tool for paint operations) ⇒ Electrical parts catalogue .
- ◆ For refrigerant line connections with thread or union nut, use adapters from the refrigerant circuit adapter set - V.A.G 1785- (adapter - V.A.G 1785/1- to adapter - V.A.G 1785/8-) for connecting the 5/8" -18 UNF charge hoses (some of these adapters are also included in the VW/Audi car set adapter case).
- ◆ For refrigerant line connections without thread or union nut (for connecting adapters), use adapters from the VW/Audi car set adapter case or commercially available blow gun with rubber mouthpiece.



Note

Compressed air/nitrogen emerging from the components is to be drawn off by way of an appropriate system (e.g. workshop extraction system).

Blow out the refrigerant circuit (or individual components) if there is no possibility of flushing, or flushing does not appear feasible

- If dirt or other impurities are in individual components of the circuit.



- If the vacuum reading does not remain during evacuation of a non-leaking refrigerant circuit (moisture is in the refrigerant circuit and is building up pressure).
- The refrigerant circuit was open beyond the normal installation time (e.g. following an accident).
- Moisture is assumed to be in the refrigerant circuit based on pressure and temperature measurements in the circuit.
- It is stipulated by the vehicle-specific Workshop Manual after the replacement of certain components ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit .



Note

Certain impurities and old refrigerant oil can only be removed from the refrigerant circuit inadequately or not at all using compressed air or nitrogen. These impurities can be removed e.g. by cleaning with refrigerant R1234yf

⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#) .

- ◆ Blow out refrigerant circuit with compressed air or nitrogen
⇒ ["1.6.10 Blow out refrigerant circuit with compressed air or nitrogen", page 133](#)



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1.6.10 Blow out refrigerant circuit with compressed air or nitrogen



Note

- ◆ *In the case of vehicles on which the refrigerant lines have no threads for connection of adapters V.A.G - 1785- , For blowing out individual components, use e.g. a blow gun with rubber mouthpiece or an adapter from the VW/Audi car set adapter case . Special care must be taken not to damage the connections (crushing or scratching) when using a blow-out gun with rubber mouthpiece.*
- ◆ *The evaporator is to be blown out by way of the connection for the low-pressure line (large diameter) after detaching the expansion valve or removing the restrictor.*
- ◆ *Always blow out components against the direction of flow of the refrigerant (or flush with refrigerant R1234yf).*
- ◆ *Check the expansion valve, replace if dirty or corroded.*
- ◆ *If components contain dark, sticky deposits that cannot be removed with compressed air, flush these components with refrigerant R1234yf or replace them.*
- ◆ *Thin, light grey deposits on the insides of pipes do not impair the function of the components.*
- ◆ *After blowing out, replace the receiver (desiccant cartridge) or reservoir and the restrictor. For condensers with a desiccant cartridge installed in the integrated receiver, this desiccant cartridge must be replaced.*
- ◆ *For condensers with integrated receiver/desiccant cartridge, which cannot be individually replaced or is not available as an individual part, the condenser must be replaced after flushing the refrigerant circuit ⇒ [Electronic parts catalogue](#) and ⇒ [Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit \(vehicle-specific Workshop Manual\)](#).*
- ◆ *Depending on the version, receivers on which the dryer cartridge can be replaced separately may be provided with an additional filter element which may have to be replaced together with the dryer cartridge.*

After blowing out the refrigerant circuit:

- Replace these components as appropriate for the specific vehicle (restrictor and reservoir, expansion valve and receiver or desiccant cartridge) ⇒ [Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit \(vehicle-specific Workshop Manual\)](#) and ⇒ [Electronic parts catalogue](#)
- Replace the air conditioner compressor depending on the problem ⇒ [Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit \(vehicle-specific Workshop Manual\)](#) and ⇒ [Electronic parts catalogue](#) , or drain the residual refrigerant oil from the removed air conditioner compressor
⇒ ["1.5 Replacing components", page 78](#) and fill with the specified quantity of fresh refrigerant oil ⇒ [Heating, air conditioner; Rep. gr. 00 ; Technical data \(vehicle-specific Workshop Manual\)](#) and ⇒ [Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil \(vehicle-specific Workshop Manual\)](#).



Note

- ◆ *The spare part compressor contains a certain, specified quantity of refrigerant oil. In vehicles with two evaporators, it may be necessary to add a certain additional quantity of refrigerant oil to the circuit ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *If the air conditioner compressor is not replaced, add a quantity of refrigerant oil to the air conditioner compressor as per the specified capacity (tip out refrigerant oil and pour the specified quantity into the air conditioner compressor or refrigerant circuit) ⇒ [page 78](#) , ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- Fully reassemble the refrigerant circuit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Evacuate and charge the refrigerant circuit as per instructions ⇒ [“2.5 Evacuating the refrigerant circuit”, page 148](#) and ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Start up the air conditioner as per instructions ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ [“2.7 Starting up air conditioner after charging”, page 158](#)



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1.7 Check pressure values with a pressure gauge

⇒ [“1.7.1 Display on pressure gauges”, page 135](#)

⇒ [“1.7.2 Pressure gauges permit the following test and measurement operations”, page 135](#)

1.7.1 Display on pressure gauges

- 1 - Temperature scale for refrigerant R1234yf ($\text{CF}_3\text{CF} = \text{CH}_2$) in °C
- 2 - Pressure scale in bar overpressure

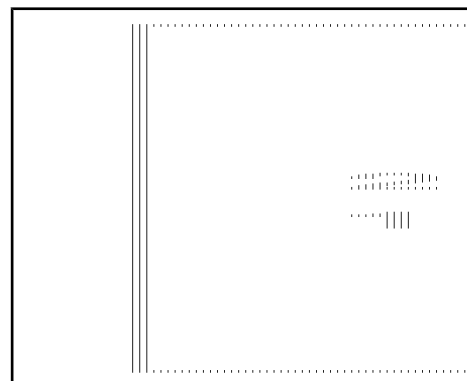


Note

- ◆ *Pressure is stated in different units, 1 MPa (megapascal) equals 10 bar overpressure or 145 psi, 1 bar absolute pressure equals 0 bar overpressure, or roughly ambient pressure (atmospheric pressure).*

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- ◆ *This diagram shows a pressure gauge indicating the pressure on the low-pressure side. Here, the display is in bar overpressure (recognisable by the display “-1”).*



In addition to the pressure scale, pressure gauges may have one or more temperature scales. The scale values for R1234yf are assigned in accordance with the vapour pressure table. Since different refrigerants build up different vapour pressures at the same temperature, each temperature scale is marked for the corresponding refrigerant.

- ◆ Pressure gauges enable the following checking and measurement work
⇒ [“1.7.2 Pressure gauges permit the following test and measurement operations”, page 135](#) .

1.7.2 Pressure gauges permit the following test and measurement operations

Refrigerant circuit pressure and temperature measurements

- ◆ The high-pressure gauge measures the pressure (and temperature) that is uniformly distributed from the outlet of the air conditioner compressor through the condenser to the constriction (restrictor or expansion valve) when the air conditioner is switched on.
- ◆ The low-pressure gauge measures the pressure (and temperature) that is uniformly distributed from the constriction (restrictor or expansion valve) through the evaporator to the inlet of the air conditioner compressor when the air conditioner is switched on.



Note

The relationship between pressure and temperature described by the pressure gauges only exists where the refrigerant circuit contains liquid or vapour, but not gas. In the gas state, the temperature is approx. 10 °C to 30 °C higher than the pressure gauge reading.

Detection of refrigerant in a closed vessel

Refrigerant R1234yf is present in a closed vessel or the refrigerant circuit if the temperature display of the pressure gauge shows

the refrigerant temperature (liquid under pressure assumes ambient temperature).

A closed vessel or a deactivated refrigerant circuit is empty if the temperature indicated on the pressure gauge is below the temperature of the refrigerant.



Note

- ◆ *The relationship between pressure and temperature indicated on the pressure gauges no longer applies if no liquid is present and the pressure is built up solely by gas.*
- ◆ *Since the pressures of refrigerants R1234yf and R134a are very close together over a wide temperature range, they cannot be distinguished using pressure measurement. They can only be distinguished e.g. by means of a gas analysis
⇒ "6.2.16 Analysis of refrigerant R1234yf", page 26 .*



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2 Working with the air conditioner service station

⇒ [“2.1 Working with the air conditioner service station”, page 138](#)

⇒ [“2.2 Connecting the air conditioner service station to the refrigerant circuit”, page 140](#)

⇒ [“2.3 Performing a gas analysis on the refrigerant”, page 143](#)

⇒ [“2.4 Draining the refrigerant circuit”, page 146](#)

⇒ [“2.5 Evacuating the refrigerant circuit”, page 148](#)

⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)

⇒ [“2.7 Starting up air conditioner after charging”, page 158](#)

⇒ [“2.8 Switching off the air conditioner service station and disconnecting from the refrigerant circuit”, page 160](#)

⇒ [“2.9 Charging the reservoirs with refrigerant”, page 162](#)

⇒ [“2.10 Draining the air conditioner service station”, page 163](#)

⇒ [“2.11 Cleaning the electrically driven air conditioner compressor”, page 163](#)

⇒ [“2.12 Cleaning the refrigerant circuit”, page 166](#)

⇒ [“2.13 Filling contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal”, page 170](#)

⇒ [“2.14 Checking pressure values”, page 177](#)

2.1 Working with the air conditioner service station



Note

- ◆ *If you suspect that chemicals (sealing additives) have been added to the refrigerant circuit from which you wish to extract refrigerant, for the purpose of sealing leaks, do not connect the air conditioner service station to this refrigerant circuit and do not extract refrigerant.*
- ◆ *Chemicals (sealing additives) for sealing leaks form deposits in the refrigerant circuit, which adversely affect the function of the air conditioner and lead to failure of the air conditioner (and your air conditioner service station).*
- ◆ *Tell your customers that their air conditioner contains substances that were not approved by Volkswagen/Audi and therefore this air conditioner cannot be drained or repaired.*
- ◆ *Chemicals (sealing additives) freely available on the market for sealing leaks in the refrigerant circuit are not approved by Volkswagen/Audi. No endurance, effectiveness or material compatibility tests have been conducted, so that the possibility of damage to or malfunction of the air conditioner or air conditioner service station cannot be excluded.*
- ◆ *Stop leak additives freely available on the market have different physical and chemical properties. These can permanently impair the function of the air conditioner and the air conditioner service station and even result in complete failure. Volkswagen/Audi refrains from using chemicals (sealing additives) to seal leaks in the refrigerant circuit.*

- ◆ *Chemicals (sealing additives) for sealing leaks in the refrigerant circuit mostly react with ambient air or humidity contained within it. Due to deposits in the refrigerant circuit (and in your air conditioner service station), these cause malfunctions in valves and other components with which they come into contact. These deposits cannot be completely removed from the components (even by flushing).*
- ◆ *Chemical substances (sealing additives) for sealing leaks in the refrigerant circuit are normally not outwardly apparent and the identification stickers which should be affixed are usually non-existent. Vehicles with an unknown history should therefore be treated with due caution.*
- ◆ *Canisters with built-in filters designed to separate these chemical substances (sealing additives for sealing leaks) are available on the accessories market. Since Volkswagen/Audi does not know the composition and therefore the physical and chemical properties of these substances, we are unable to comment here on the effectiveness and deposition rate of these filters.*

If air conditioner refrigerant circuit repair work has to be performed on a vehicle on which chemical substances (sealing additives) have been added to the refrigerant circuit to seal leaking components (or even if this is just strongly suspected), the customer (vehicle owner) is to be made aware of the following:

- ◆ Because of the substances (sealing additives) added to the circuit, which damage your air conditioner service station, the air conditioner refrigerant cannot be extracted. To extract the refrigerant, it can be poured into a recycling cylinder, as in the case of contaminated refrigerant.
⇒ "2.13 Filling contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal", page 170. If this is not possible, a company may need to be contracted, for example, which can extract the contaminated refrigerant using suitable equipment and then extract it from the refrigerant circuit for treatment (or disposal) (e.g. a local waste disposal company that specialises in the disposal of refrigerants).
- ◆ To ensure proper repair of the air conditioner, all refrigerant circuit components that came into contact with the sealing additive must be replaced. Due to the sealing additive, certain refrigerant circuit components (e.g. the air conditioner compressor regulating valve - N280-) may have suffered preliminary damage or be damaged when started up again and fail after a short time. Furthermore, sealing additive deposits may subsequently work loose in the refrigerant circuit components and then lead to renewed failure of the air conditioner (complete cleaning of these components with workshop equipment is not possible at present).
- ◆ Contaminated refrigerant can render all refrigerant in your air conditioner service station unusable.
- ◆ Check the composition of the refrigerant in the refrigerant circuit with a suitable tester before extraction
⇒ "2.3 Performing a gas analysis on the refrigerant", page 143.
- ◆ Extract contaminated refrigerant into a recycling cylinder and return this to your gas supplier for analysis, treatment or disposal
⇒ "6.2.17 Returning contaminated refrigerant R1234yf for analysis, treatment or disposal", page 27.



Note

- ◆ *Contaminated refrigerant can alter the function of the air conditioner and/or irreparably damage refrigerant circuit components.*
- ◆ *Mixtures of different refrigerants (e.g. refrigerant R1234yf with an uncertain proportion of refrigerant R134a) must not be added to a vehicle that was type tested with refrigerant R1234yf.*

Further notes on working with the air conditioner service station

For operating the air conditioner service station (currently available air conditioner service station ⇒ Equipment and special tools catalogue), please note the following:

- ◆ The filters and dryers fitted must be replaced at the latest at the end of the period of use specified in the corresponding operating instructions.
- ◆ If an air conditioner service station is also used to clean (flush) the refrigerant circuit, the installed dryers and filters must be replaced at shorter intervals ⇒ [page 133](#).
- ◆ Only fill reservoirs with refrigerant oils that have also been approved for the vehicle-specific refrigerant circuit (or pour refrigerant oil directly into the refrigerant circuit) ⇒ Electronic parts catalogue .
- ◆ Depending on the version of air conditioner service station and the work to be performed, a certain quantity minimum quantity of refrigerant, refrigerant oil and UV sealing additive must be in the corresponding reservoirs of the air conditioner service station ⇒ Operating instructions for air conditioner service station

Extracted refrigerant must not be reused even after cleaning in the air conditioner service station , if there is any uncertainty concerning the composition of the refrigerant extracted from the circuit

⇒ [“2.3 Performing a gas analysis on the refrigerant”, page 143](#) .

- ◆ If the wrong refrigerant is inadvertently added to the air conditioner service station , drain it
⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) and
⇒ [“2.2 Connecting the air conditioner service station to the refrigerant circuit”, page 140](#) , clean the system if necessary and replace the filters and dryers and the added refrigerant oil.
- ◆ In Germany, for example, contaminated refrigerant can be returned to the refrigerant supplier in so-called recycling cylinders for analysis, treatment or environmentally friendly disposal (different or additional regulations may apply in individual countries)
⇒ [“6.2.17 Returning contaminated refrigerant R1234yf for analysis, treatment or disposal”, page 27](#) .

2.2 Connecting the air conditioner service station to the refrigerant circuit

Connecting

- The work procedure may vary depending on the type of tools selected (the tool-specific operating instructions should therefore be heeded).



Note

Perform this procedure as described in the operating instructions of your air conditioner service station ⇒ Operating instructions for air conditioner service station .

To prevent air or moisture entering the refrigerant circuit through the charging hoses, these are to be connected as follows:

- In vehicles with high-voltage system, switch off (deactivate) the “auxiliary air conditioning” function ⇒ Owner's Manual and ⇒ Infotainment/MMI Operating Manual .
- Switch off ignition.
- Connect the air conditioner service station to the voltage supply.
- Switch on the air conditioner service station and start up in accordance with the relevant operating instructions ⇒ Operating instructions for air conditioner service station .
- Unscrew the caps from the service connections (see vehicle-specific refrigerant circuit) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Evacuate the charging hoses if necessary.
- Check service connections of the refrigerant circuit for dirt or corrosion, clean if necessary.



Note

Dirt or a rough surface on service connections due to corrosion can damage the seals and therefore lead to premature failure of the quick release couplings.

- Connect quick release couplings to the service connections of the refrigerant circuit.



NOTICE

Risk of damage to air conditioner compressor or air conditioner service station.

When the air conditioner is switched on, a short circuit between the high and low-pressure sides is possible when the valves open.

- **Never open valves on the high or low-pressure side when the air conditioner is switched on.**
- Only screw in the adjuster knob of the quick release coupling adapter on the low-pressure side far enough to reliably open the valve in the service connection (pay attention to pressure gauge, do not press valve too far).
- Perform a gas analysis with the air conditioner service station (only necessary if refrigerant is to be extracted, or you wish to check the pressure values in the refrigerant circuit)
⇒ [“2.3 Performing a gas analysis on the refrigerant”](#), page 143 .

**Note**

Connect the gas analyser or air conditioner service station to the refrigerant circuit and start up in accordance with the relevant operating instructions ⇒ Gas analyser operating instructions , ⇒ [page 140](#) and/or ⇒ Operating instructions for air conditioner service station .

If the gas analysis reveals that refrigerant in the circuit does not conform to specifications.

- Only screw in the adjuster knob of the quick release coupling adapter on the high-pressure side far enough to reliably open the valve in the service connection (pay attention to pressure gauge, do not press valve too far).
- Perform the work on the refrigerant circuit with the air conditioner service station .

**Note**

- ♦ *If the gas analysis detects that refrigerant R1234yf is contaminated, extract the refrigerant from the refrigerant circuit and return e.g. to your gas supplier for treatment (or disposal) ⇒ [“2.13 Filling contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal”, page 170](#) , ⇒ [“6.2.17 Returning contaminated refrigerant R1234yf for analysis, treatment or disposal”, page 27](#) and ⇒ [“6.1 Basics of air conditioning technology”, page 18](#) .*

- ♦ *If it is not possible to extract the contaminated refrigerant from the vehicle refrigerant circuit and pour it into a recycling cylinder immediately. Unscrew (close) the adjuster knob of the quick release coupling adapter on the low-pressure side, switch off the air conditioner service station (and disconnect from the power supply if necessary). Next, disconnect the quick release coupling adapter on the low-pressure side from the vehicle. Then disconnect the quick release coupling adapter on the low-pressure side from the charge hose to the air conditioner service station , e.g. upstream of an extraction hose of the workshop extraction system and allow the contaminated refrigerant to flow out of the charge hose into the extraction hose of the workshop extraction system. To get the air conditioner service station ready for operation once more, reconnect the quick release coupling adapter on the low-pressure side to the charge hose to the air conditioner service station and evacuate with the air conditioner service station in accordance with the operating instructions ⇒ Operating instructions for air conditioner service station*

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- Perform the work with the air conditioner service station .
- ♦ ⇒ [“2.3 Performing a gas analysis on the refrigerant”, page 143](#)
- ♦ ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
- ♦ ⇒ [“2.5 Evacuating the refrigerant circuit”, page 148](#) .
- ♦ ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#) .
- ♦ ⇒ [“2.8 Switching off the air conditioner service station and disconnecting from the refrigerant circuit”, page 160](#)
- ♦ ⇒ [“2.9 Charging the reservoirs with refrigerant”, page 162](#) .
- ♦ ⇒ [“2.10 Draining the air conditioner service station”, page 163](#) .

- ◆ ⇒ ["2.14 Checking pressure values", page 177](#)

2.3 Performing a gas analysis on the refrigerant



Note

- ◆ *The refrigerant used must have a certain purity for air conditioner operation.*
- ◆ *Contamination with other refrigerants or gases can cause damage and therefore failure of the air conditioner.*
- ◆ *Contaminated refrigerant must be returned e.g. to your gas supplier for treatment (or disposal) as a gas of unknown composition, in accordance with legal provisions ⇒ VW/Audi ServiceNet .*
- ◆ *To prevent liquid elements (e.g. drops of refrigerant oil) in the extracted refrigerant gas from leading to an incorrect gas analysis result, the gas analyser contains separators (filters) that separate these droplets of liquid. Replace separators in accordance with the operating instructions of the gas analyser or air conditioner service station ⇒ Gas analyser operating instructions or ⇒ Operating instructions for air conditioner service station .*

All vehicles

- Connect the gas analyser or air conditioner service station to the refrigerant circuit and start up in accordance with the relevant operating instructions ⇒ Gas analyser operating instructions ,
⇒ ["2.2 Connecting the air conditioner service station to the refrigerant circuit", page 140](#) and/or ⇒ Operating instructions for air conditioner service station .
- Perform gas analysis in accordance with operating instructions ⇒ Operating instructions for air conditioner service station .



Note

- ◆ *Incorrect gas analysis is possible due to air in refrigerant hoses or non-compliance with the gas analysis procedure stated in the operating instructions.*
- ◆ *Pay close attention to the operating instructions for the gas analyser/ air conditioner service station .*
- ◆ *Evacuate coolant hoses of the air conditioner service station with refrigerant R1234yf before connecting service couplings to the refrigerant circuit/a gas cylinder (see operating instructions for gas analyser/ air conditioner service station*

The gas analysis may indicate the following results:

- ◆ The analysed refrigerant R1234yf conforms to the specifications, the planned work can be performed with the air conditioner service station .
- ◆ A fault occurred during the gas analysis. Locate and remedy the fault, then perform the gas analysis again ⇒ Operating instructions for air conditioner service station .
- ◆ The analysed refrigerant R1234yf does not conform to the specifications. The analysed refrigerant must be extracted as refrigerant of unknown composition and returned e.g. to your gas supplier for analysis, treatment or disposal

⇒ ["6.2.17 Returning contaminated refrigerant R1234yf for analysis, treatment or disposal", page 27](#)



Note

- ◆ *If contamination is detected during the analysis of refrigerant that is to be extracted e.g. from a vehicle refrigerant circuit. If you wish to be sure about the result of analysis, your gas supplier can also perform a gas analysis e.g. with refrigerant from a delivery cylinder.*
- ◆ *Due to the required purity of refrigerant R1234yf, even small residues of ambient air in the charge hoses of the air conditioner service station can lead to an incorrect result. Therefore, a routine is stored in most air conditioner service stations that repeat the gas analysis up to two times, before a not OK result is displayed ⇒ Operating instructions for air conditioner service station .*
- ◆ *You can perform a simple function test of your gas analyser e.g. with ambient air (unscrew the service coupling from the refrigerant hose used to perform the gas analysis and conduct the gas analysis with the refrigerant hose open). This test must then indicate that the analysed gas is not OK.*
- ◆ *The gas analysis procedure employed here was developed for automotive workshops; it does not deliver any information on the exact composition of the refrigerant. This gas analysis can therefore only provide information on the proportion of refrigerant R1234yf in the analysed refrigerant. If the proportion of R1234yf is below 95 %, the refrigerant no longer conforms to specifications and can cause damage to refrigerant circuit components. A gas analysis that provides information on the exact composition of the analysed refrigerant is currently not available for workshops. Gas analyses that can determine the exact composition of gases require sophisticated, expensive equipment and procedures and can mostly only be conducted in test facilities specially designed for this purpose.*

If the gas analysis detects contaminated refrigerant, talk to the customer before continuing with the work and make them aware of the following:

The refrigerant circuit of his vehicle contains contaminated refrigerant or refrigerant of an unknown composition, which does not conform to the specifications of the vehicle manufacturer. This refrigerant:

- ◆ **Must be returned e.g. to your gas supplier for analysis, treatment (or disposal) as a refrigerant of unknown composition**
⇒ ["6.2.17 Returning contaminated refrigerant R1234yf for analysis, treatment or disposal", page 27](#) .
- ◆ **Can be the cause of a malfunction or already have caused preliminary damage to the refrigerant circuit, so that malfunctions may occur in the near future.**
- ◆ **Depending on its composition, the use of contaminated refrigerant may cause the vehicle's type approval to become void.**
- ◆ **If the contaminated refrigerant has caused internal damage to the refrigerant circuit (e.g. if refrigerant circuit components have been attacked by breakdown products of the contaminated refrigerant ⇒ ["1.5 Replacing components", page 78](#)), the refrigerant circuit can only be 100 % repaired if all components that came into contact with the contaminated refrigerant are replaced. You can assess the internal condition of the refrigerant circuit e.g. by visually inspecting certain refrigerant circuit components (e.g. from the condition of the inner surface of removed refrigerant lines and hoses, the inner surface of**

the receiver and the condition of the removed desiccant cartridge).

- ◆ If the contaminated refrigerant has caused internal damage to the refrigerant circuit (e.g. failure of the air conditioner compressor due to damaged control elements or overheating, the refrigerant oil is more coloured than usual, but parts conducting the refrigerant were not damaged
⇒ ["1.5 Replacing components", page 78](#)), the refrigerant circuit can be recharged again after it has been flushed (replace the air conditioner compressor, dryer and expansion valve). However, since it is impossible to know the long-term effect of the contaminated refrigerant on the refrigerant oil and refrigerant circuit components, in this case the future function of the refrigerant circuit components cannot be guaranteed.
- ◆ If the contaminated refrigerant has not caused internal damage to the refrigerant circuit (e.g. the refrigerant oil is not more coloured than usual, the refrigerant circuit components have not been damaged), after replacing the dryer and evacuating the refrigerant circuit for a longer time (at least one hour), the refrigerant circuit can be recharged. However, since it is impossible to know the long-term effect of the contaminated refrigerant on the refrigerant oil and refrigerant circuit components, in this case the future function of the refrigerant circuit components cannot be guaranteed
⇒ ["1.5 Replacing components", page 78](#).

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Note

- ◆ *If a problem is present that was caused by contaminated refrigerant (e.g. leaking seals or hoses, damage to the air conditioner compressor, contaminated refrigerant oil), flush the refrigerant circuit, then replace all components that were damaged by the contaminated refrigerant (seals, hoses, the receiver or desiccant cartridge, the expansion valve and the air conditioner compressor). If it becomes clear that the contaminated refrigerant has also damaged other components (e.g. the inner surfaces of refrigerant pipes and hoses, damaged seals), the complete refrigerant circuit must be replaced. Then recharge the refrigerant circuit with clean refrigerant. Next, check the function of the air conditioner. For customers and to cover yourself, make a note of the fact that the refrigerant circuit was charged with contaminated refrigerant.*
- ◆ *If a problem is present that was caused by contaminated refrigerant (e.g. no or insufficient cooling output) and no other problems with the refrigerant circuit are detected, or the refrigerant has to be extracted due to work in the vicinity of the refrigerant circuit, proceed as follows after extraction. Remove the dryer and check for contamination, as there is also refrigerant oil on or in the dryer; check this as well. If the refrigerant oil is contaminated, dark or viscous, or if there are dirt deposits on the dryer, flush the refrigerant circuit and replace parts as described above (preliminary damage may have already occurred, which could cause the air conditioner to fail in the near future). If the refrigerant oil is OK and the dryer is also not more contaminated than in normal operation, replace the dryer. Evacuate the refrigerant circuit for longer than usual (at least one hour), then recharge with clean refrigerant. Check function of air conditioner. For customers and to cover yourself, make a note of the fact that the refrigerant circuit was charged with contaminated refrigerant.*

2.4 Draining the refrigerant circuit

- Depending on the type of tools selected, the work procedure may vary (note tool-specific operating instructions) ⇒ Operating instructions for air conditioner service station .
- Drain the refrigerant circuit if parts of the circuit need to be removed, if there is uncertainty regarding the quantity of refrigerant in the circuit, if contaminated refrigerant is detected during the gas analysis, or if demanded by safety precautions.
- All important user information for work with the air conditioner service station for refrigerant can be found in the operating instructions for the air conditioner service station ⇒ Operating instructions for air conditioner service station .

Drainage:

- In vehicles with high-voltage system, switch off (deactivate) the “auxiliary air conditioning” function ⇒ Owner's Manual and ⇒ Infotainment/MMI Operating Manual .
- Switch off ignition.
- Connect the air conditioner service station to the voltage supply.

Additionally for vehicles with electrically operated valves in the refrigerant circuit, which are not open without flow:



Note

In vehicles with high-voltage system and air conditioner auxiliary functions (“heat pump mode” or “high-voltage battery cooling”), valves that are not open without flow may be installed in the refrigerant circuit. These valves are opened and closed e.g. by control motors and are no longer actuated after the ignition is switched off. To completely drain, correctly evacuate and charge the refrigerant circuit, however, no areas may be shut off. For this reason, these valves must be opened prior to this work ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.

- Using the vehicle diagnostic tester, open the electrically operated valves that are not open without flow ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.

All vehicles

- Start up the air conditioner service station in accordance with the relevant operating instructions.
- Unscrew the caps from the refrigerant circuit service connections (see vehicle-specific refrigerant circuit) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Connect the air conditioner service station to the refrigerant circuit
⇒ [“2.2 Connecting the air conditioner service station to the refrigerant circuit”, page 140](#) .
- Perform a gas analysis with the air conditioner service station
⇒ [“2.3 Performing a gas analysis on the refrigerant”, page 143](#) .



Note

If the gas analysis detects that refrigerant R1234yf is contaminated, extract the refrigerant from the refrigerant circuit (pour into a recycling cylinder) and return e.g. to your gas supplier for analysis, treatment or disposal

⇒ ["6.2.17 Returning contaminated refrigerant R1234yf for analysis, treatment or disposal", page 27](#) .

- Drain the refrigerant circuit with the air conditioner service station in accordance with the operating instructions.



NOTICE

Risk of damage to air conditioner compressor if there is vacuum in the refrigerant circuit.

- **Never start the engine if there is vacuum in the refrigerant circuit.**



Note

- ◆ *It is not possible to eliminate the possibility of refrigerant oil from being extracted from the refrigerant circuit along with refrigerant. To ensure lubrication of the air conditioner compressor, top up the quantity of refrigerant oil in the circuit with fresh refrigerant oil*
⇒ ["2.6 Charging the refrigerant circuit", page 155](#) .

- ◆ *Depending on the version of air conditioner service station , this may produce a vacuum in the refrigerant circuit during refrigerant extraction (residual pressure less than approx. 300 mbar).*

- ◆ *On vehicles fitted with an air conditioner compressor with no magnetic clutch (with an air conditioner compressor regulating valve - N280-), the engine should not be run for longer than absolutely necessary with the refrigerant circuit empty and high engine speeds are to be avoided (constant air conditioner compressor operation).*

- ◆ *On vehicles with an air conditioner compressor with no magnetic clutch, the engine is only to be started following complete assembly of the refrigerant circuit (avoid high engine speeds).*

- ◆ *Depending on the version of the air conditioner compressor, the high-pressure end of the air conditioner compressor may be fitted with a valve to prevent the backflow of liquid refrigerant into the compressor after switching off the air conditioning system. If an air conditioner compressor with this valve is fitted on a vehicle with a refrigerant circuit with an expansion valve, a relatively long period may elapse before the pressure on the high-pressure end decreases (the expansion valve is cold and the pressure on the low-pressure end increases rapidly after switch-off, the expansion valve closes and the refrigerant can only flow slowly to the low-pressure end). If the air conditioner compressor is switched on (or the refrigerant circuit is discharged via the low-pressure end), the pressure on the low-pressure end decreases, the expansion valve opens and the refrigerant can flow to the low-pressure end.*

If work is to be performed on the vehicle after draining, for which the air conditioner service station is not required.

- Disconnect the air conditioner service station from the refrigerant circuit and switch off

⇒ ["2.8 Switching off the air conditioner service station and disconnecting from the refrigerant circuit", page 160](#) .

- Open the refrigerant circuit at a connection point.

CAUTION

Danger of frostbite from refrigerant escaping under pressure.

The skin and other parts of the body can suffer frostbite.

- Wear protective gloves.
- Wear safety goggles.
- Extract the refrigerant and immediately open the refrigerant circuit.
- Extract the refrigerant again if more than 10 min have passed since initial extraction and the refrigerant circuit has not been opened up. Renewed evaporation leads to the build-up of pressure in the refrigerant circuit.

- Perform the planned work on the refrigerant circuit.

If evacuation and recharging is necessary after draining the refrigerant circuit

⇒ ["2.5 Evacuating the refrigerant circuit", page 148](#) .



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- ◆ *After opening connection points in the refrigerant circuit, close the open lines and component connections (to prevent moisture and dirt from penetrating these components).*
- ◆ *It is not possible to eliminate the possibility of refrigerant oil from being extracted from the refrigerant circuit along with refrigerant. To ensure lubrication of the air conditioner compressor, top up the quantity of refrigerant oil in the circuit with fresh refrigerant oil.*
- ◆ *In vehicles with an air conditioner compressor with air conditioner compressor regulating valve - N280- , only run the engine with an empty refrigerant circuit for as long as absolutely necessary, taking care to avoid higher engine speeds (the air conditioner compressor runs continually as well).*
- ◆ *In vehicles with an air conditioner compressor with air conditioner compressor regulating valve - N280- , only start the engine with a fully assembled refrigerant circuit, taking care to avoid higher engine speeds.*

2.5 Evacuating the refrigerant circuit

- Perform this procedure as described in the operating instructions of your air conditioner service station ⇒ Operating instructions for air conditioner service station .
- The quantity of refrigerant oil in the air conditioner service station has been checked and corrected if necessary ⇒ Operating instructions for air conditioner service station .
- The quantity of refrigerant in the air conditioner service station has been checked and corrected if necessary ⇒ Operating instructions for air conditioner service station .

The refrigerant circuit must be evacuated before it is filled with refrigerant. In addition, this removes moisture from the circuit.

Leaks can be detected during evacuation of the refrigerant circuit

⇒ ["1.4 Locating leaks", page 69](#) .

 NOTICE

Risk of damage to air conditioner compressor if there is vacuum in the refrigerant circuit.

- **Never start the engine if there is vacuum in the refrigerant circuit.**

Evacuation:

- The refrigerant circuit is fully assembled.
- In vehicles with high-voltage system, switch off (deactivate) the "auxiliary air conditioning" function ⇒ Owner's Manual and ⇒ Infotainment/MMI Operating Manual .
- Switch off ignition.
- Connect the air conditioner service station to the voltage supply.

Additionally for vehicles with electrically operated valves in the refrigerant circuit, which are not open without flow:



Note

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- ◆ *In vehicles with high-voltage system and air conditioner auxiliary functions ("heat pump mode" or "high-voltage battery cooling"), valves that are not open without flow may be installed in the refrigerant circuit. These valves are opened and closed e.g. by control motors and are no longer actuated after the ignition is switched off. To completely drain, correctly evacuate and charge the refrigerant circuit, however, no areas may be shut off. For this reason, these valves must be opened prior to this work ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.*
 - ◆ *Non-return valves in the refrigerant circuit have a certain holding pressure in the flow direction (approx. 0.1 bar or 100 mbar). Therefore, all electrically actuated valves must be open in order for the refrigerant circuit to be fully evacuated (residual pressure less than 5 mbar).*
 - Using the vehicle diagnostic tester, open the electrically operated valves that are not open without flow ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.

All vehicles

- Start up the air conditioner service station in accordance with the relevant operating instructions ⇒ Operating instructions for air conditioner service station .
- Unscrew the caps from the refrigerant circuit service connections (see vehicle-specific refrigerant circuit) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Check service connections of the refrigerant circuit for dirt or corrosion, clean if necessary.



Note

Dirt or a rough surface on service connections due to corrosion can damage the seals and therefore lead to premature failure of the quick release couplings.



- Connect the air conditioner service station to the refrigerant circuit
⇒ [“2.2 Connecting the air conditioner service station to the refrigerant circuit”, page 140](#) .
- Switch on the air conditioner service station , evacuate the refrigerant circuit and perform a vacuum test (duration e.g. 10 minutes vacuum pump on, to remove air, refrigerant residues and moisture and 20 minutes vacuum/pressure rise test).

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Note

- ◆ *The vacuum at the end of the evacuation process (vacuum pump of the air conditioner service station running), must be less than 5 mbar absolute. If the pressure in the refrigerant circuit does not fall to less than 5 mbar during evacuation, this can be caused by various factors. Examples are leaks in the refrigerant circuit or in the connection to the air conditioner service station , set time for evacuation too short, the vacuum pump of the air conditioner service station does not generate the required vacuum, or the vacuum sensor of the air conditioner service station is not correctly calibrated ⇒ Operating instructions for air conditioner service station.*
- ◆ *At an ambient pressure of 980 mbar, for example, an absolute pressure of 5 mbar corresponds to a vacuum of 975 mbar.*
- ◆ *The pressure in the refrigerant circuit must not exceed 20 mbar absolute pressure at the end of the vacuum/pressure rise test. If the pressure in the refrigerant circuit exceeds 20 mbar during the vacuum/pressure rise test, switch on the vacuum pump and start the process again from the beginning ⇒ Operating instructions for air conditioner service station . If the pressure in the refrigerant circuit does not stay at less than 20 mbar after repeating the process twice, this can be caused by various factors. Examples are leaks in the refrigerant circuit, leaks in the refrigerant circuit connection to the air conditioner service station or in the air conditioner service station itself, set time for evacuation too short, time for vacuum/pressure rise test too long.*
- ◆ *If you suspect that there is a leak in the refrigerant circuit, switch off the air conditioner service station if applicable and leave at standstill for as long as possible (e.g. at least one hour for checking that the refrigerant circuit is not leaking ⇒ Operating instructions for air conditioner service station .*
- ◆ *Depending on the version of air conditioner service station , the pressure in the refrigerant circuit is displayed directly. However, it may be the case that the current pressure is only displayed when the vacuum pump is running ⇒ Operating instructions for air conditioner service station . If an air conditioner service station only displays ambient pressure, the display of the pressure in the refrigerant circuit is dependent on the ambient pressure on switch-on (if the ambient pressure is 980 mbar, a vacuum of 975 mbar corresponds to a residual pressure of 5 mbar absolute pressure).*
- ◆ *If the refrigerant circuit was open, small quantities of moisture may have penetrated the refrigerant circuit with the ambient air. In this case, evacuate the refrigerant circuit for at least 30 minutes (pressure in refrigerant circuit less than 20 mbar before charging).*
- ◆ *If the refrigerant has been extracted (to check the capacity) and if you are only evacuating the refrigerant in order to then refill it (the refrigerant circuit was not opened and is not leaking), it suffices to evacuate the refrigerant circuit for 5 minutes and to set no or just a short time (e.g. 1 minute) for the vacuum/pressure rise test (no air or moisture has penetrated the refrigerant circuit).*

- ◆ *Depending on the quantity of refrigerant oil in the refrigerant circuit, the vehicle's age and mileage, the design of the refrigerant circuit, etc., the specified absolute pressure in the refrigerant circuit may rise above the stipulated 20 mbar during the vacuum test, even if the refrigerant circuit has no leaks, due to refrigerant (or possibly moisture) evaporating out of the refrigerant oil. If this is the case, it may be necessary to repeat the process and/or adapt the preset times accordingly.*

If the vacuum display does not change (and the pressure remains at less than 20 mbar), the system is tight and can be recharged.



Note

- ◆ *Depending on the version of air conditioner service station, the current pressure in the refrigerant circuit is displayed either continuously or only after each switch-on, e.g. of the "evacuation" function ⇒ Operating instructions for air conditioner service station.*
 - ◆ *Due to the high rate of evacuation, it is possible that refrigerant evaporating out of the refrigerant oil during the vacuum test causes the pressure in the refrigerant circuit to rise to 20 to 40 mbar (absolute pressure). This does not indicate leaks in the refrigerant circuit but, depending on the version of air conditioner service station, can lead to a fault display. If necessary, evacuate the refrigerant circuit again and observe the vacuum display over a longer period. Only charge the system once vacuum remains and you are sure that the refrigerant circuit is tight.*
- Charge refrigerant circuit with the air conditioner service station ⇒ ["2.6 Charging the refrigerant circuit", page 155](#).

Proceed as follows if the vacuum is not maintained or an adequate vacuum cannot be generated:

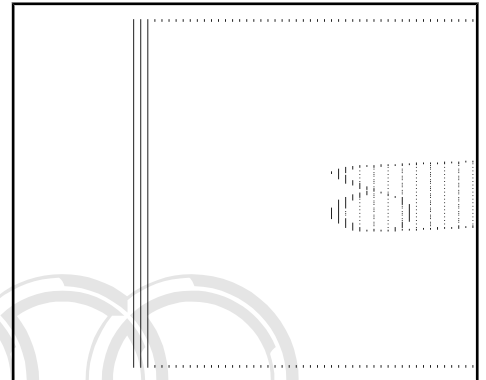
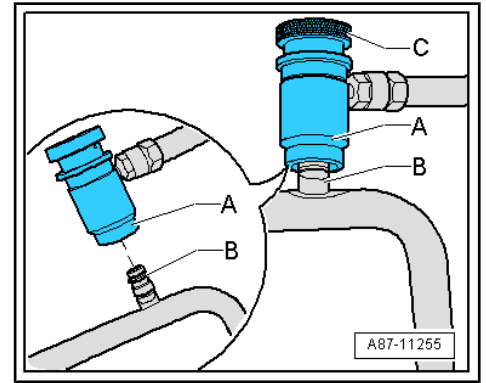
- ◆ If the pressure in the refrigerant circuit only rises slowly after evacuation, e.g. due to refrigerant (or moisture) evaporating out of the refrigerant oil, evacuate the refrigerant circuit again and observe the vacuum display over a longer period.
- If it is not certain whether the refrigerant circuit is really leak-proof, repeat evacuation and observe the vacuum display over a lengthy period. Charging can only be performed once the vacuum is maintained.
- Only charge the refrigerant circuit when you are absolutely sure that it is tight
⇒ ["2.6 Charging the refrigerant circuit", page 155](#).

Further procedure if a leak is discovered during evacuation:

- ◆ If a leak is found of a size that causes so much air to enter, even during evacuation, that the air conditioner service station cannot generate sufficient vacuum, or the vacuum display indicates an ingress of air and a loss of vacuum immediately after the air conditioner service station is switched off.
- Locate leaks in the refrigerant circuit as follows:



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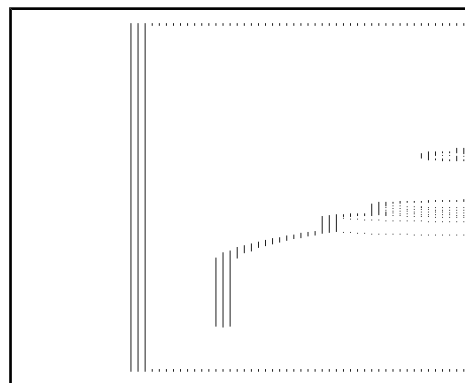


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Note

- ◆ A larger leak can be located e.g. by the fact that in a refrigerant circuit with cleaned and dried compressed air or nitrogen, the maximum pressure build-up is 15 bar ➔ [page 133](#) . If the leak is of sufficient magnitude, the leakage location will be revealed by the noise of the gas escaping.
 - ◆ Introduce compressed air or nitrogen into the closed, empty refrigerant circuit via the service connection -B- to which you connected a quick release coupling adapter -A-.
 - ◆ Screw the adjuster knob -C- into the quick release coupling adapter -A- until the valve in the service connection -B- is reliably open, do not press valve too far.
 - ◆ You can connect the quick release coupling adapter for service connections to the workshop compressed air system e.g. with a modified charge hose -A- (e.g. with thread M12 x 1.5 -6G to SAE J639), depending on the thread of the quick release coupling adapter) and a suitable adapter -B- ➔ [page 265](#) . To prevent moisture, oil and dirt from the workshop compressed air system from entering the air conditioner refrigerant circuit, make additional use of a combination fine filter unit for the compressed air system, with an oil, dirt and water separator, as commonly used for painting systems. Install this between the compressed air system and the charge hose -A- ➔ *Electronic parts catalogue* .
 - ◆ Using a gauge manifold with pressure reducer for nitrogen (maximum reducing pressure: 15 bar) -1-, you can connect a compressed gas cylinder filled with nitrogen -3- to the closed, empty refrigerant circuit via a charge hose -2- (e.g. with thread M12 x 1.5 -6G to SAE J639), to the service connection (to which you connected a quick release coupling adapter for service connections) ➔ [page 265](#) .
- Slowly increase the pressure in the refrigerant circuit to maximum 15 bar.



CAUTION

Risk of injury from nitrogen flowing out under pressure.

- Use pressure reducers for nitrogen vessels.

- Locate the leak by means of the noise produced by gas escaping at this point.
- Eliminate the leak.
- Evacuate the refrigerant circuit and observe the vacuum display again over a period of hours. Charging can only be performed once the vacuum is maintained.
- ◆ If a leak is found of a size that causes no or just very little air to enter when the refrigerant circuit is evacuated and the air conditioner service station is unable to generate sufficient vacuum. The vacuum display increase only very slowly or not at all after the air conditioner service station is switched off, thereby indicating that air is penetrating and vacuum being lost via just a small leak.

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- Add 100 grams of refrigerant to the circuit and locate the possible leak using an electronic leak detector
⇒ [“1.4.2 Finding leaks in the refrigerant circuit using an electronic leak detector”, page 70](#) , or add refrigerant with UV contrasting agent and search for the leak in the refrigerant circuit using the leak detection system
⇒ [“1.4.3 Finding leaks with the UV leak detector system”, page 72](#) .
- Drain the refrigerant circuit if necessary
⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
- Repair the refrigerant circuit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Evacuate the refrigerant circuit and again observe the vacuum display over a longer period. Only charge the circuit if the vacuum is maintained
⇒ [“2.5 Evacuating the refrigerant circuit”, page 148](#) .

If work is to be performed on the vehicle after evacuation, for which the air conditioner service station is not required.

- Disconnect the air conditioner service station from the refrigerant circuit and switch off
⇒ [“2.8 Switching off the air conditioner service station and disconnecting from the refrigerant circuit”, page 160](#) .

 NOTICE

Risk of damage to air conditioner compressor if there is vacuum in the refrigerant circuit.

- **Never start the engine if there is vacuum in the refrigerant circuit.**
- Make sure that the engine cannot be started until the refrigerant circuit has been charged.

If the refrigerant circuit is to be recharged after drainage and evacuation ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#) .

2.6 Charging the refrigerant circuit

 Note

- ◆ *The entire quantity of refrigerant can be poured into either the high or the low-pressure side. Below we describe charging the refrigerant circuit via the high-pressure side.*

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- ◆ *Pay attention to refrigerant and refrigerant oil capacities⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).*
- Perform this procedure as described in the operating instructions of the air conditioner service station ⇒ Operating instructions for air conditioner service station .
- Correct the quantity of refrigerant oil before charging the circuit with refrigerant ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).
- When charging the refrigerant circuit, make sure that the air conditioner service station is at the same level as the vehicle, the refrigerant circuit of which you wish to charge (maximum difference 50 cm). Depending on the version of air conditioner service station , an excessive difference in height can lead to deviations between the displayed and the actual charged

quantity of refrigerant. The charging accuracy of the air conditioner service station can change.

- The refrigerant circuit is fully reassembled ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- In vehicles with high-voltage system, switch off (deactivate) the “auxiliary air conditioning” function ⇒ Owner's Manual and ⇒ Infotainment/MMI Operating Manual .
- Switch off ignition.
- Connect the air conditioner service station to the voltage supply.
- Check the refrigerant quantity, the quantity of refrigerant oil and the quantity of UV additive for leak detection in the air conditioner service station and top up if necessary ⇒ Operating instructions for air conditioner service station .

Additionally for vehicles with electrically operated valves in the refrigerant circuit, which are not open without flow:



Note

In vehicles with high-voltage system and air conditioner auxiliary functions (“heat pump mode” or “high-voltage battery cooling”), valves that are not open without flow may be installed in the refrigerant circuit. These valves are opened and closed e.g. by control motors and are no longer actuated after the ignition is switched off. To completely drain, correctly evacuate and charge the refrigerant circuit, however, no areas may be shut off. For this reason, these valves must be opened prior to this work ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.

- Using the vehicle diagnostic tester, open the electrically operated valves that are not open without flow ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.

All vehicles

- Start up the air conditioner service station in accordance with the relevant operating instructions ⇒ Operating instructions for air conditioner service station .
- Unscrew the caps from the refrigerant circuit service connections (see vehicle-specific refrigerant circuit) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Connect quick release couplings to the service connections of the refrigerant circuit
⇒ [“2.2 Connecting the air conditioner service station to the refrigerant circuit”, page 140](#) .
- Evacuate the refrigerant circuit with the air conditioner service station ⇒ [“2.5 Evacuating the refrigerant circuit”, page 148](#) .
- Set the intended quantity of refrigerant, or the quantity of refrigerant oil to be topped up and the quantity of UV additive for leak detection on the air conditioner service station ⇒ Operating instructions for air conditioner service station , ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).
- Set the air conditioner service station so that refrigerant is added via the high-pressure side ⇒ Operating instructions for air conditioner service station .

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When charging the refrigerant circuit via the low-pressure side, liquid refrigerant can accumulate in the compression chamber of the air conditioner compressor.

- If the refrigerant circuit has to be charged via the low-pressure side, crank the air conditioner compressor manually for 10 revolutions before starting up for the first time after charging (remove the drive belt for this purpose if necessary).



Note

- ◆ *The refrigerant and refrigerant oil are added to the refrigerant circuit via the high-pressure side.*
- ◆ *If a vehicle does not have a service connection on the high-pressure side of the refrigerant circuit, refrigerant may also be introduced via the service connection on the low-pressure side. However, always note the settings and operating instructions for the air conditioner service station .*
- ◆ *If the charging direction cannot be set on an air conditioner service station , unscrew (close) the adjuster knob on the quick release coupling adapter on the low-pressure side, if necessary.*
- Charge the refrigerant circuit with the intended quantity of refrigerant and if necessary, the required top-up quantity of refrigerant oil and the correct quantity of UV additive.
- After charging, start up the air conditioner ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit; Starting up air conditioner after charging the refrigerant circuit (vehicle-specific Workshop Manual) and
⇒ ["2.7 Starting up air conditioner after charging", page 158](#)

Starting up an air conditioner with an electrically driven air conditioner compressor

- Start up the air conditioner compressor via the "Basic setting, Compressor run-in" function of Guided Fault Finding ⇒ Vehicle diagnostic tester.

Additionally for vehicles with electrically operated valves in the refrigerant circuit, which are not open without flow:

- Via the respective control unit, enable actuation of electrically operated valves (for opening or closing) that are not open without flow for air conditioner operation using the vehicle diagnostic tester ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.



Note

In vehicles with high-voltage system and air conditioner auxiliary functions ("heat pump mode" or "high-voltage battery cooling"), valves that are not open without flow may be installed in the refrigerant circuit. These valves are opened and closed e.g. by control motors and are no longer actuated after the ignition is switched off. To completely drain, correctly evacuate and charge the refrigerant circuit, however, no areas may be shut off. For this reason, these valves must be opened prior to this work. On completion of the work, the respective control unit enables actuation of these valves once again ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.

All vehicles

Should a function test be performed after charging the refrigerant circuit?

- Check pressure values in the refrigerant circuit ⇒ [page 177](#) .

Should no function test be performed after charging the refrigerant circuit?

- Disconnect the air conditioner service station from the refrigerant circuit and switch off
⇒ ["2.8 Switching off the air conditioner service station and disconnecting from the refrigerant circuit", page 160](#) .

2.7 Starting up air conditioner after charging



Note

- ◆ *If the mechanically driven air conditioner compressor was removed, it must be cranked manually approx. 10 revolutions before being started up for the first time (during or after installation, e.g. before putting on the belt). This ensures that it does not sustain any damage from fluid hammer when first switched on (if there is refrigerant oil in the cylinder of the air conditioner compressor, this is forced out during cranking) ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor (vehicle-specific Workshop Manual).*
- ◆ *Before starting up the air conditioner for the first time, if the electrically driven air conditioner compressor was removed, start up the air conditioner compressor via the function "Basic setting, Compressor run-in" in Guided Fault Finding ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation. This prevents the air conditioner compressor from sustaining damage e.g. due to fluid hammer when first switched on (if there is refrigerant oil in the compression chamber of the air conditioner compressor, it is forced out).*
- ◆ *The mechanically driven air conditioner compressor is driven by the vehicle engine via a belt or shaft. The electrically driven air conditioner compressor is driven by an electric motor mounted directly on the compressor (e.g. in vehicles with hybrid drive) ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor (vehicle-specific Workshop Manual).*

Start-up of air conditioner with mechanically driven air conditioner compressor

- Switch on ignition.
- Set the air conditioner to the lowest possible output (e.g. select "A/C off" mode).
- Switch off air conditioner compressor actuation (e.g. select "A/C off" mode).
- Start the engine with the air conditioner compressor switched off (e.g. "A/C off" mode selected).
- Wait for the idling speed to stabilize.
- Switch on the air conditioner compressor and operate the system for at least 2 minutes at idling speed.
- If necessary, check the pressure values in the refrigerant circuit with the air conditioner service station ⇒ [page 138](#) .
- Switch off the engine.

- Disconnect the air conditioner service station from the refrigerant circuit and switch off
⇒ [“2.8 Switching off the air conditioner service station and disconnecting from the refrigerant circuit”, page 160](#) .

Starting up an air conditioner with an electrically driven air conditioner compressor

- Switch on ignition.
- Start up the air conditioner compressor via the function “Basic setting, Compressor run-in” of Guided Fault Finding ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation.

Additionally for vehicles with electrically operated valves in the refrigerant circuit, which are not open without flow:

- Via the respective control unit, enable actuation of electrically operated valves (for opening or closing) that are not open without flow for air conditioner operation using the vehicle diagnostic tester ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.



Note

In vehicles with high-voltage system and air conditioner auxiliary functions (“heat pump mode” or “high-voltage battery cooling”), valves that are not open without flow may be installed in the refrigerant circuit. These valves are opened and closed e.g. by control motors and are no longer actuated after the ignition is switched off. To completely drain, correctly evacuate and charge the refrigerant circuit, however, no areas may be shut off. For this reason, these valves must be opened prior to this work. On completion of the work, enable actuation of these valves once again via the respective control unit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.

All the respective control units with an electrically driven the respective control unit compressor

- After performing basic settings, if necessary check the pressure values in the refrigerant circuit with the air conditioner service station .
- In vehicles with high-voltage system, switch off (deactivate) the “auxiliary air conditioning” function ⇒ Owner's Manual and ⇒ Infotainment/MMI Operating Manual .
- Switch off ignition.
- Disconnect the air conditioner service station from the refrigerant circuit and switch off
⇒ [“2.8 Switching off the air conditioner service station and disconnecting from the refrigerant circuit”, page 160](#) .

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Vehicles with an electrically driven air conditioner compressor

- The engine may only be started if the refrigerant circuit is fully assembled.
- In vehicles with battery cooling, hybrid drive is only possible with a charged air conditioner with no stored faults ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode for air conditioner and battery regulation.
- After installing the electrically driven air conditioner compressor and then charging the refrigerant circuit, first start up the compressor by way of the “Compressor run-in” function of the basic setting routine. Otherwise, the air conditioner compressor may be damaged if refrigerant oil has accumulated in the

compression chamber of the air conditioner compressor due to inappropriate storage prior to installation ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode for air conditioner and battery regulation.

- Electrically driven air conditioner compressors may only be activated when the refrigerant circuit is charged. Running the air conditioner compressor with the refrigerant circuit empty could lead to compressor damage ⇒ Vehicle diagnostic tester ("Guided Fault Finding" for air conditioner and battery regulation).
- To minimise the number of automatic engine starts with READY active during checking and measurement work, the vehicle batteries must be charged, e.g. with the battery charger, 60 A - VAS 5904- in battery back-up mode ⇒ Electrical system; General information; Rep. gr. 27 ; Charging battery and ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .
- For test and measurement work that requires the vehicle's drive system to be active (READY) or the ignition to be switched on, move the selector lever to position "P", activate the parking brake and take care to keep well clear of the engine when it is running. Set up any tools needed so that they cannot come into contact with moving parts.

2.8 Switching off the air conditioner service station and disconnecting from the refrigerant circuit

- Complete the planned work with the air conditioner service station .
- Switch off ignition.
- Unscrew (close) adjuster knobs of the two service couplings.

CAUTION

Danger of frostbite from refrigerant escaping under pressure. The skin and other parts of the body can suffer frostbite.

- Wear protective gloves.
- Wear safety goggles.
- If refrigerant escapes from the refrigerant line for more than 1 s when the adjuster knob of the service coupling is unscrewed, screw in the adjuster knob and replace the faulty valve.
- Extract the refrigerant and immediately open the refrigerant circuit.
- Extract the refrigerant again if more than 10 min have passed since initial extraction and the refrigerant circuit has not been opened up. Renewed evaporation leads to the build-up of pressure in the refrigerant circuit.

Different versions of service couplings

- ◆ In one service coupling version, the chamber between the valve in the refrigerant circuit service connection and the valve in the service coupling is vented to the outside when the adjuster knob is unscrewed. For these service couplings, first the valve in the vehicle service connection closes, followed by the valve in the service coupling to the filler hose to the air conditioner service station , when the service coupling adjuster knob is unscrewed. As it is unscrewed further, the pressure in the chamber between the two valves is allowed to escape via a further valve (approx. 2 cm³ of refrigerant). If one of these two valves (the valve on the vehicle service connection or the one

in the service coupling to the filler hose) does not close properly, all refrigerant can escape from the vehicle refrigerant circuit or the filler hose.

- ◆ In the other service coupling version, the chamber between the valve in the refrigerant circuit service connection and the valve in the service coupling is not vented to the outside when the adjuster knob is unscrewed. This version contains a valve that is open when the service coupling is connected, so that pressure can be compensated between the chamber to the valve in the refrigerant circuit service connection and the filler hose connected to the service coupling. In this version, no refrigerant escapes when the service coupling adjuster knob is screwed back in. Therefore, in this case the refrigerant must be sucked back out of the filler hoses into the air conditioner service station before the service couplings are disconnected. If a larger quantity of refrigerant (more than approx. 50 g) is recovered e.g. after a pressure test or while charging the refrigerant circuit, this indicates that a valve in one of the refrigerant circuit service connections may not be tight and refrigerant is escaping from the vehicle refrigerant circuit (extract refrigerant and replace the faulty valve)

Before sucking the refrigerant out of the filler hoses into the air conditioner service station, unscrew the adjuster knobs of both service couplings up to the stop.



Note

- ◆ *The air conditioner service station features a stored function that brings it into a defined operating state when switched off. This function sucks all the refrigerant out of the filler hoses into the air conditioner service station.*
- ◆ *If the adjuster knobs of both service couplings are not unscrewed when this function is activated, refrigerant may be extracted out of the vehicle refrigerant circuit.*
- Extract refrigerant from the two filler hoses with the air conditioner service station in accordance with the relevant operating instructions ⇒ Operating instructions for air conditioner service station.



Note

- ◆ *If this process takes longer than approx. 2 min or a larger quantity of refrigerant is extracted when using an air conditioner service station with a service coupling in which pressure is not vented to the outside, this indicates a fault in one of the valves in a service connection.*
- ◆ *If this process takes longer than approx. 2 min when using an air conditioner service station with a service coupling in which pressure is vented to the outside, this indicates a fault in one of the valves in a service coupling.*



Note

Inadvertent extraction of the vehicle refrigerant circuit.

- First unscrew (close) the adjuster knobs on the quick release coupling adapters.
- Next extract refrigerant out of the two filler hoses with the air conditioner service station.

- Switch off the air conditioner service station (and disconnect from the power supply if necessary) ⇒ Operating instructions for air conditioner service station .
- Disconnect quick release couplings from the service connections of the refrigerant circuit.
- Screw the caps onto the service connections (see vehicle-specific refrigerant circuit) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

2.9 Charging the reservoirs with refrigerant

- Connect a delivery cylinder of fresh refrigerant R1234yf to the low-pressure side service coupling to the air conditioner service station ⇒ Operating instructions for air conditioner service station .
- Perform a gas analysis on the refrigerant to be filled (out of the delivery cylinder) with the air conditioner service station ⇒ [“2.3 Performing a gas analysis on the refrigerant”, page 143](#) .
- Perform this procedure as described in the operating instructions of your air conditioner service station ⇒ Operating instructions for air conditioner service station .

CAUTION

Risk of explosion from overfilled refrigerant vessels.

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

- Use refrigerant vessels with a safety valve.
- Never exceed the permitted capacity of the refrigerant vessel.



Note

Depending on the version of air conditioner service station and the work to be performed, a certain minimum quantity of refrigerant, refrigerant oil and UV sealing additive must be in the corresponding reservoirs of the air conditioner service station ⇒ Operating instructions for air conditioner service station .

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2.10 Draining the air conditioner service station



Note

- ◆ *If the air conditioner service station needs to be drained (e.g. because contaminated refrigerant has been extracted, all filters and dryers must be replaced (only take filters and dryers out of their hermetically sealed transport packaging immediately before installation, to keep the absorption of moisture to a minimum).*
- ◆ *If you need to drain the air conditioner service station (e.g. because certain work needs to be performed on the air conditioner service station and the refrigerant that has been or will be extracted from the air conditioner service station conforms to the specifications (it is not contaminated), it may be filled into a recycling cylinder and then reused ⇒ Operating instructions for air conditioner service station .*
- ◆ *Refrigerant cylinders filled with contaminated or used refrigerant are termed "recycling cylinders " or "R-cylinders".*
- ◆ *Always evacuate recycling containers before first filling with refrigerant (refrigerant containers are not to be filled with refrigerant if they contain any air).*
- ◆ *Different types of refrigerant are not to be mixed (refrigerant mixtures cannot be recycled and are to be disposed of). If there is uncertainty regarding the composition of a cylinder's content, please inform the gas treatment/gas disposal firm
⇒ ["2.13 Filling contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal", page 170](#) and
⇒ ["6.2.17 Returning contaminated refrigerant R1234yf for analysis, treatment or disposal", page 27](#) .*



CAUTION

Risk of explosion from overfilled refrigerant vessels.

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

- Use refrigerant vessels with a safety valve.
- Never exceed the permitted capacity of the refrigerant vessel.

There are various options for draining an air conditioner service station see operating instructions for air conditioner service station ⇒ Operating instructions for air conditioner service station .

- Fill refrigerant from the drained air conditioner service station into another air conditioner service station , note the operating instructions for air conditioner service station ⇒ Operating instructions for air conditioner service station and
⇒ ["2.13 Filling contaminated refrigerant into a recycling cylinder for analysis, treatment or disposal", page 170](#) .

2.11 Cleaning the electrically driven air conditioner compressor

Vehicles with high-voltage system

For all work on vehicles with high-voltage system, note the additional warning instructions for these vehicles ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .

If work is required in proximity to components of the high-voltage system, "visually inspect the high-voltage components and lines for damage" "Note general warning instructions for work on the high-voltage system" ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .

If work is required on components of the high-voltage system, disconnect the high-voltage system from mains voltage ⇒ Electrical system; Rep. gr. 93 ; Disconnecting high-voltage system from mains voltage and "Note general warning instructions for work on the high-voltage system" ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .

Flushing the air conditioner compressor



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- ◆ *With an electrically driven air conditioner compressor, the refrigerant oil cannot be tipped out (there is no oil drain plug). Oil cannot be tipped out due to the design*
- ◆ *With an electrically driven air conditioner compressor, the refrigerant oil must be removed by flushing in the direction of flow (flushing against the direction of flow is not possible because of the built-in valves).*
- ◆ *For flushing, position the air conditioner compressor so that the connection for the high-pressure side refrigerant line is as low as possible.*
- ◆ *With a new air conditioner compressor that is filled with more than 100 cm³, tip out as much refrigerant oil as possible before flushing ⇒ [Item 5 \(page 165\)](#) .*

1 - Air conditioner service station

- ☐ With electronics and a flushing program, air conditioner service station with flushing device
⇒ Electronic parts catalogue
- ☐ If you are using an air conditioner service station without a flushing program, perform the procedure manually (evacuate, flush with at least 2 kg of refrigerant four times, extract refrigerant once more, evacuate).

2 - Refrigerant hose of the air conditioner service station

- ☐ From the high-pressure side of the air conditioner service station (mostly coloured red) to the connection for the low-pressure side of the air conditioner compressor in the refrigerant circuit (larger diameter)

3 - Adapter for the low-pressure side connection on the air conditioner compressor

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits"](#), page 109
- ☐ Between the refrigerant hose -2- and the adapter -3-, use adapter - VAS 6338/48- .
- ☐ From the VW/Audi car set adapter case

4 - Refrigerant line

- ☐ For connecting the air conditioner compressor to the adapter ⇒ [Item 3 \(page 165\)](#)

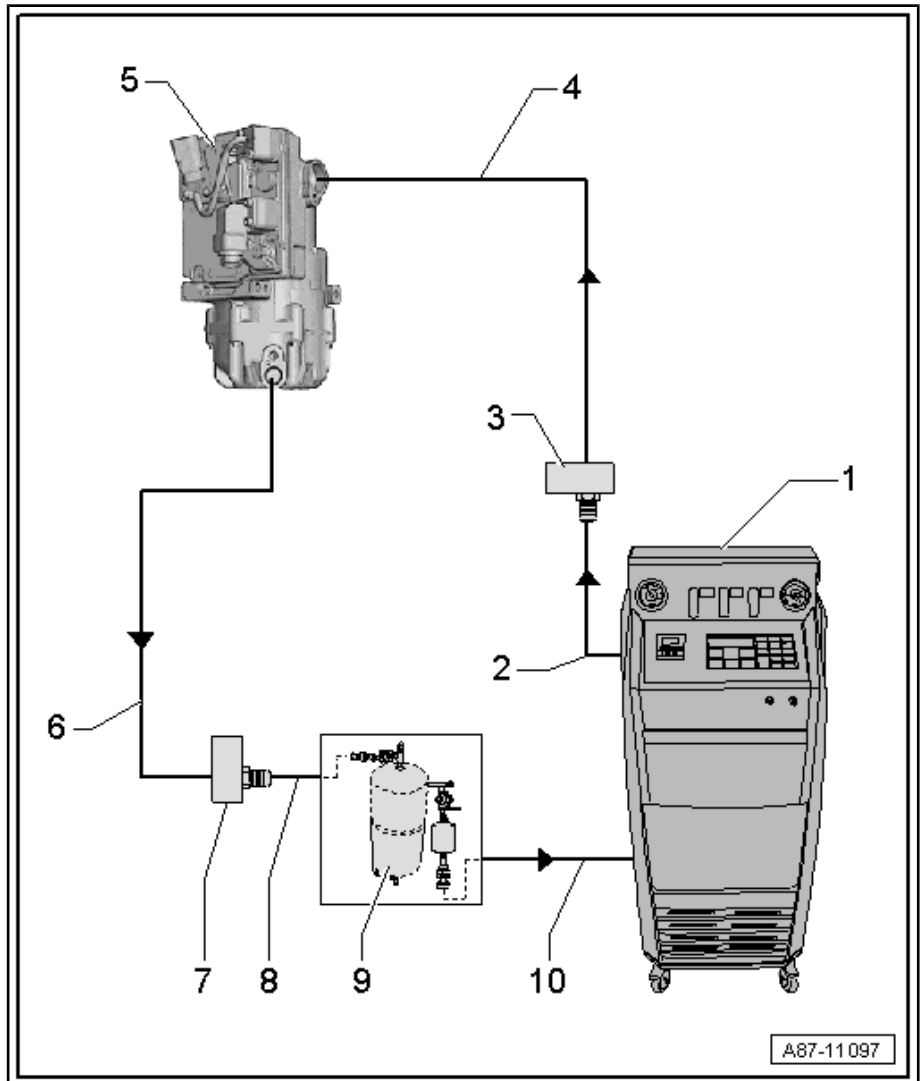
5 - Electrically driven air conditioner compressor

- ☐ Flush the air conditioner compressor in the direction of flow (from the low-pressure side inlet to the high-pressure side outlet)
- ☐ To ensure as much refrigerant oil as possible is flushed out of the air conditioner compressor, for flushing position the compressor so that the high-pressure side outlet is as high as possible



Note

- ◆ *Depending on the air conditioner compressor, a new compressor may be filled with a larger quantity of refrigerant oil (see manufacturer's sign on air conditioner compressor and ⇒ ["5.2 Refrigerant oil capacities"](#), page 16).*



- ◆ *With a new air conditioner compressor that is filled with more than 100 cm³, tip out as much refrigerant oil as possible before flushing.*
- ◆ *Reason: Depending on the version of air conditioner service station, the quantity of oil that can be extracted in one work step may be limited.*



Note

If you are tipping clean refrigerant oil out of a new air conditioner compressor into a clean vessel, which is then hermetically sealed, this can be reused to make up the quantity of refrigerant oil in the circuit.

6 - Refrigerant line

- ☐ For connecting the air conditioner compressor to the adapter ⇒ [Item 7 \(page 166\)](#)
- ☐ To make the flushing circuit, use e.g. a refrigerant line with part number 7L6 820 721 BF ⇒ Electronic parts catalogue

7 - Adapter for the high-pressure side connection on the air conditioner compressor

- ☐ Different versions depending on the vehicle
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)
- ☐ From the VW/Audi car set adapter case

8 - Filler hose for refrigerant circuit flushing device

- ☐ From the high-pressure side connection of the air conditioner compressor on the refrigerant circuit (smaller diameter) to the inlet of the refrigerant circuit flushing device.

9 - Refrigerant circuit flushing device

- ☐ Different versions and different design of the refrigerant circuit flushing device ⇒ Electronic parts catalogue (Tools; Equipment/tools; Air conditioner/heating)
- ☐ With filter, sight glass, safety valve, heater, refrigerant vessel, etc. (depending on the version).
- ☐ Depending on the design of the air conditioner service station and refrigerant circuit flushing device, a connection for a service coupling for refrigerant circuits may be installed at the outlet and possibly the inlet of the flushing device. If a service connection with valve is installed at the outlet of the flushing device, this valve must be fully open when the service coupling is connected. A valve that is only partially open presents a constriction.
- ☐ If a connection for a service coupling is installed at the inlet of the flushing device, modify the inlet so that the refrigerant hose from the vehicle can be connected directly.



Note

A service coupling and a valve in the inlet of the flushing device constitute a constriction, which hampers the flow of refrigerant out of the vehicle into the flushing device.

10 - Refrigerant hose of the air conditioner service station

- ☐ From the low-pressure side of the air conditioner service station (mostly coloured blue) to the outlet of the refrigerant circuit flushing device.

2.12 Cleaning the refrigerant circuit

- Perform preparatory work for cleaning (flushing with refrigerant R1234yf)

⇒ ["1.6.2 Preparatory work for cleaning the refrigerant circuit \(flushing with refrigerant R1234yf\)", page 97](#)

- Check the quantity of refrigerant in the air conditioner service station . There must be at least 6 kg of refrigerant R1234yf ⇒ Operating instructions for air conditioner service station .
 - Drain the old oil vessel of the air conditioner service station ⇒ Operating instructions for air conditioner service station .
 - With the aid of an adapter, connect the feed hose (high-pressure side) of the air conditioner service station to the low-pressure line to the air conditioner compressor (line with the largest diameter)
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#) .
 - Connect the return hose (low-pressure or intake side) of the air conditioner service station to the outlet of the refrigerant circuit flushing device.
 - With the aid of an adapter, connect the inlet of the refrigerant circuit flushing device to the high-pressure line to the air conditioner compressor (line with the smallest diameter)
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#) .
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- ◆ **Block diagrams of various flushing circuits**
⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#)
 - ◆ **Adapters for making the flushing circuits**
⇒ ["1.6.8 Adapters for connecting up flushing circuits", page 109](#)



Note

- ◆ *The components are nearly always flushed against the direction of flow of refrigerant in air conditioner operation. (Exception: the electrically driven air conditioner compressor)
⇒ [page 95](#) .*
- ◆ *During flushing, impurities from the refrigerant circuit get into the refrigerant circuit flushing device and the air conditioner service station and are retained by the filters and dryers installed there. Depending on these impurities, these components may need to be replaced at shorter intervals than stated in the operating instructions of the air conditioner service station or the refrigerant circuit flushing device, but in accordance with these instructions ⇒ Operating instructions for air conditioner service station .*
- ◆ *Depending on the nature and severity of the contamination of the flushed refrigerant circuits, the filter in the refrigerant circuit flushing attachment is to be replaced at the latest after 5 to 10 flushing cycles (flushed vehicles). After flushing a severely contaminated refrigerant circuit (the refrigerant oil from the refrigerant circuit is black and viscous or there is a lot of swarf in the refrigerant circuit), the filter is to be replaced. In the case of such severely contaminated refrigerant circuits it is also appropriate to flush the circuit again after replacing the filter.*
- ◆ *Depending on the nature of the impurities, dirt (used refrigerant oil and abrasion from the air conditioner compressor) accumulates at the inspection port of the refrigerant circuit flushing attachment. Clean sight glass after flushing if necessary and flush the refrigerant circuit with one flushing process once more as a check (one process is sufficient).*
- ◆ *Liquid refrigerant cannot be conveyed into certain receivers via the expansion valve, restrictor and desiccant bag at the necessary speed. Therefore remove these components and replace with adapters if necessary ⇒ [page 95](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *Adapters for connecting the air conditioner service station and for bypassing certain refrigerant circuit components
⇒ ["1.6.8 Adapters for connecting up flushing circuits"](#)
[page 109](#) .*

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Perform the flushing process (the procedure is automated using the program of the air conditioner service station ⇒ Operating instructions for air conditioner service station)

- Switch on the air conditioner service station ⇒ Operating instructions for air conditioner service station .
- Select the flushing program on your air conditioner service station ⇒ Operating instructions for air conditioner service station .
- Flush the refrigerant circuit (duration approx. 1 to 1.5 hours for one flushing cycle with 4 flushes) ⇒ Operating instructions for air conditioner service station .



Note

- ◆ *Flushing process routine*
⇒ *["1.6.3 Procedure for cleaning the refrigerant circuit", page 99](#)*.
- ◆ *Perform the flushing process as described in the operating instructions of the air conditioner service station ⇒ Operating instructions for air conditioner service station .*
- ◆ *Depending on the version of air conditioner service station , the old oil vessel may only hold approx. 125 cm³ of refrigerant oil. If a system with a larger quantity of refrigerant oil needs to be flushed, you may need to drain the old oil vessel after the first flush of a flushing cycle.*
- ◆ *Keep an eye on refrigerant flowing back out of the refrigerant circuit into the air conditioner service station . The refrigerant circuit is only clean once the refrigerant flowing through the sight glass of the refrigerant circuit flushing device into the air conditioner service station is clear and completely colourless.*
- ◆ *During flushing, the entire refrigerant oil is rinsed out of the refrigerant circuit (with the exception of slight residue in the evaporator, for example; this can however be ignored).*
- ◆ *If there is severe contamination, you may need to perform the flush process twice (two flushing cycles each with four flushes).*
- On completion of the flushing process, check the sightglass (es) of the refrigerant circuit flushing device. If it is dirty, clean it in accordance with the operating instructions of the refrigerant circuit flushing device or the air conditioner service station and perform the flushing process again as a check (one process is sufficient, duration approx. 30 min.) ⇒ Operating instructions for air conditioner service station .
- Check pressure in the refrigerant circuit; there must be no overpressure in the refrigerant circuit (briefly evacuate again if necessary).
- Dismantle connections to the air conditioner service station from the vehicle refrigerant circuit (there must be no overpressure in the refrigerant circuit).
- Replace these components as appropriate for the specific vehicle (restrictor and reservoir, expansion valve and receiver or desiccant cartridge in receiver) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .
- Replace the air conditioner compressor depending on the problem ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue , or drain the residual refrigerant oil from the removed air conditioner compressor
⇒ *["1.5 Replacing components", page 78](#)* and refill with the specified quantity of fresh refrigerant oil ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual)

Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue , or drain the residual refrigerant oil from the removed air conditioner compressor
⇒ ["1.5 Replacing components", page 78](#) and refill with the specified quantity of fresh refrigerant oil ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual)

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**Note**

- ◆ *The spare part compressor contains a certain, specified quantity of refrigerant oil. In vehicles with two evaporators, it may be necessary to add a certain additional quantity of refrigerant oil to the circuit ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).*
- ◆ *If the air conditioner compressor is not replaced, add a quantity of refrigerant oil to the air conditioner compressor as per the specified capacity (tip out refrigerant oil and pour the specified quantity into the air conditioner compressor or refrigerant circuit) ⇒ ["1.5 Replacing components", page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).*
- Fully reassemble the refrigerant circuit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Evacuate and charge the refrigerant circuit as per specifications ⇒ ["2.5 Evacuating the refrigerant circuit", page 148](#) , ⇒ ["2.6 Charging the refrigerant circuit", page 155](#) and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual).
- Start up the air conditioner as per instructions ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ ["2.7 Starting up air conditioner after charging", page 158](#)

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

**Note**

- ◆ *The recycling cylinder has to be heavily subcooled in order for the contaminated refrigerant to be refilled into it without the use of appropriate equipment.*
- ◆ *To cool the evacuated recycling cylinder, use an insulated vessel and dry ice ⇒ Electronic parts catalogue .*
- ◆ *Dry ice is solid carbon dioxide (CO₂), which changes straight from a solid to a gaseous state at -78 °C.*
- ◆ *Most gases used as refrigerants only have very low vapour pressure (less than 0.6 bar absolute pressure at -50 °C) at very low temperatures. If a subcooled recycling cylinder is connected to a refrigerant circuit, the refrigerant liquefies in the cold cylinder and the pressure in the refrigerant circuit drops to below ambient pressure
⇒ ["6.1.3 Vapour pressure table for refrigerant", page 19](#) .*
- ◆ *Commercially available recycling cylinders mostly consist of general structural steel. These are not always designed for low temperatures (here down to -78 °C). Therefore, only use recycling cylinders approved specifically for this use and warm them to ambient temperature slowly (e.g. by placing the insulating vessel with the recycling cylinder in a safe, well ventilated place where the dry ice can evaporate safely).*

Special tools and workshop equipment required

- ◆ At least 10 kg of dry ice (as pellets or granulate) - commercially available
- ◆ Evacuated recycling cylinder for contaminated R1234yf, which is suitable for low temperatures (e.g. with a permitted capacity of more than 3.0 kg). Commercially available from gas suppliers
- ◆ Extractor device (for refrigerant R1234yf) - Dry ice box ⇒ Electronic parts catalogue - or commercially available
- ◆ Flange connection piece with seal (for connecting the filler hose to the recycling cylinder, internal thread W 21.8 x 1/14 LH left and M 12 x 1.5-6G to SAE J639) ⇒ Electronic parts catalogue - or commercially available
- ◆ Filler hose for refrigerant R1234yf with seals (filler hose 2 m with outer thread M12 x 1.5-6G to SAE J639) ⇒ Electronic parts catalogue - or commercially available.
- ◆ Service coupling on LP side to SAE J639 ⇒ Electronic parts catalogue - or commercially available



Note

Dry ice also evaporates from the insulating container at ambient temperature (approx. 20 to 30 % a day, depending on ambient conditions). Therefore, only order the dry ice once all other necessary tools are to hand and you can perform the work immediately on receipt of the dry ice (for example, do not order dry ice for a Friday afternoon, unless you are working at the weekend).

CAUTION

Risk of frostbite and asphyxiation from dry ice.

The skin and other parts of the body may suffer frostbite and asphyxiation is possible when in the gaseous state.

- **Wear protective gloves.**
- **Wear safety goggles.**
- **Only work with dry ice in well ventilated rooms.**
- **Never work in proximity to cellar entrances or other underground areas.**

CAUTION

Risk of explosion from incorrectly stored dry ice.

When dry ice evaporates, pressure builds up in the container. Unsuitable containers may burst.

- **Only transport and store dry ice in containers specially intended for this purpose.**

Refilling refrigerant with a subcooled recycling cylinder

- Sufficient quantities of all the necessary tools, equipment and dry ice are available
- Remove the seal of the recycling cylinder and unscrew the cap from the connection.



Note

- ◆ *Recycling cylinders from your gas supplier are mostly evacuated before being sealed.*
- ◆ *If a recycling cylinder is not evacuated, evacuate it if necessary using a vacuum pump or an air conditioner service station .*
- ◆ *Recycling cylinders are clearly marked as such. Unlike refrigerant delivery cylinders, they do not have a non-return valve and can therefore be filled*
- ◆ *Recycling cylinders are intended for international use and the "O" on the adjuster knob means "Open" (open the cylinder valve), not "0" (zero for closed).*
- ◆ *If you measure an absolute pressure of more than 100 mbar but less than 900 mbar in the recycling cylinder, evacuate the recycling cylinder with a vacuum pump) or air conditioner service station) (residual pressure less than 50 mbar)
⇒ "2.5 Evacuating the refrigerant circuit", page 148 .*
- ◆ *If you measure an absolute pressure of more than 900 mbar in the recycling cylinder, this could have various reasons. The manual shut-off valve was opened and not closed again properly, or the recycling cylinder was already used to temporarily store refrigerant and then not properly evacuated
⇒ "2.10 Draining the air conditioner service station", page 163 (evacuate recycling cylinder). The recycling cylinder is leaking (return recycling cylinder to supplier).*
- Connect the vacuum meter (or air conditioner service station to the recycling cylinder.
- Open the manual shut-off valve of the recycling cylinder carefully to check the vacuum in the cylinder.
- If necessary, evacuate the recycling cylinder with the air conditioner service station .



Note

- ◆ *If there is air in the recycling cylinder, it can be evacuated with an R1234yf air conditioner service station . To do so, unscrew the low-pressure service coupling from the filler hose of the air conditioner service station and connect the filler hose directly to the recycling cylinder using the adapter belonging to the extractor device (for refrigerant R1234yf) - dry ice box .*
- ◆ *If the recycling cylinder contains air and the R1234yf air conditioner service station is not available, the cylinder can also be evacuated with an R134a air conditioner service station via the associated flushing tank, by using an adapter -VAS 6338/38- and the filler hose belonging to the extractor device (for refrigerant R1234yf) - Dry ice box .*
- Residual pressure in recycling cylinder less than 10 mbar absolute pressure.



Note

- ◆ *Recycling cylinders are already evacuated by the supplier. However, it is not always possible to guarantee that vacuum is retained during storage.*
- ◆ *During the analysis of the contaminated refrigerant filled into a recycling cylinder, in order to clearly tell the type and extent of contamination, the cylinder must be evacuated to a residual pressure of less than 50 mbar before the refilling process begins.*
- Switch off ignition.
- Make sure the workplace is well ventilated. Switch on additional workshop ventilation systems, if available.
- Connect the filler hose to the evacuated recycling cylinder using a suitable adapter.

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CAUTION

Risk of explosion from overfilled refrigerant vessels.

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

- Use refrigerant vessels with a safety valve.
- Never exceed the permitted capacity of the refrigerant vessel.



Note

- ◆ *Since the operation below only concerns the transfer of contaminated refrigerant from a vehicle into a recycling cylinder, the possibility of overfilling a recycling cylinder with a capacity of over 3.0 kg can be excluded.*
- ◆ *If contaminated refrigerant is transferred e.g. from an air conditioner service station into a recycling cylinder, care must be taken to prevent overfilling of the cylinder, because here the quantity is usually large. Use a recycling cylinder with a sufficiently large permitted capacity and weigh it during the transfer process to ensure that the maximum permitted capacity is not exceeded.*



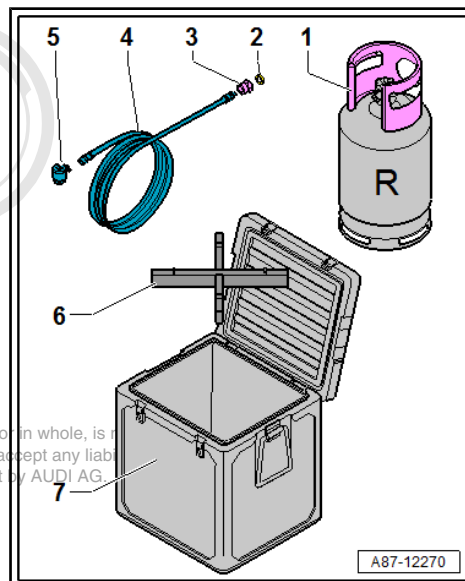
CAUTION

Chemical reactions due to contaminated refrigerant. If mixing gases of unknown composition, different chemical reactions can occur.

Injuries are possible.

- Never mix refrigerants of different origins.

- Connect the service coupling for refrigerant R1234yf -5- to the filler hose -4-.
- Connect the filler hose -4- to the recycling cylinder -1- using the flanged connection piece -3- (and seal -2-).
- Place a spacer -6- in the insulating container -7-.
- Cover the floor of the insulating container -7- with dry ice.
- Place the recycling cylinder -1- in the insulating container -7-.
- Extractor device (for refrigerant R1234yf) - Dry ice box .
- Fill the insulating container -7- with the rest of the dry ice.
- Cool the recycling cylinder -1- with dry ice (approx. 15 min).
- Connect the recycling cylinder -1- to the connection of the air conditioner service station (or the vehicle refrigerant circuit) via the service coupling -5-.
- Open the manual shut-off valve of the recycling cylinder -1-.



Note

Recycling cylinders are intended for international use and the "O" on the adjuster knob means "Open" (open the cylinder valve), not "0" (zero for closed).

- Connect the pressure gauge to the refrigerant circuit (or use the pressure display of the air conditioner service station) and check the pressure in the refrigerant circuit.
- Carefully open the service coupling -5- on the filler hose to the recycling cylinder and allow refrigerant to flow slowly into the recycling cylinder -1-.
- Wait until the refrigerant in the recycling cylinder -1- has liquefied (observe pressure display of connected pressure gauge).



Note

- ◆ *You could use a suitable pressure gauge or the pressure display of your air conditioner service station , for example, when draining a refrigerant circuit.*
- ◆ *If the displayed pressure is less than 0.3 bar absolute pressure after approx. 60 minutes, you can assume that all the refrigerant in the recycling cylinder has liquefied.*
- ◆ *It takes a certain time for the contaminated refrigerant to evaporate completely out of the refrigerant circuit. After 60 min you can assume that this has now taken place.*
- Close the service coupling -5- and manual shut-off valve of the recycling cylinder -1-.
- Detach the filler hose -4- and flanged connection piece -3- from the recycling cylinder -1- and close the recycling cylinder connection with the cap.
- Completely fill out the necessary papers (disposal certificate, acceptance form etc.) for the analysis, treatment (or disposal) of contaminated refrigerant.



Note

- ◆ *You will receive all the necessary information and documents for analysis, treatment (or disposal) from your gas treatment/gas disposal company.*
- ◆ *A form is supplied with the recycling cylinder. Fill this out and attach it to the cylinder.*
- ◆ *If it is not possible to weigh the recycling cylinder before and after filling with contaminated refrigerant, the specified quantity for the vehicle in question can be stated as the amount of refrigerant that was transferred to the recycling cylinder. This is permitted, because a recycling cylinder only ever contains the amount of refrigerant that was in a vehicle.*
- Place the insulating container -7- with recycling cylinder -1- and dry ice in a secure, well ventilated area outside a building.
- Open or remove the lid of the insulating container -7- and allow the dry ice to evaporate.

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Note

Only take the recycling cylinder -1- out of the insulating container -7- when the dry ice has evaporated and the recycling cylinder has risen to ambient temperature.

- Take the recycling cylinder -1- out of the insulating container -7-.
- Bring the recycling cylinder -1- to a suitable place for storage, until it can be fetched by the gas treatment/gas disposal company.
- Evacuate the refrigerant circuit with the air conditioner service station for at least one hour
⇒ [“2.5 Evacuating the refrigerant circuit”, page 148](#) .



Note

- ◆ *Through subsequent evacuation, the last residues of contaminated refrigerant, which could still be bound in the refrigerant oil, is removed at an absolute pressure of less than 10 mbar.*
- ◆ *The work below varies depending on the problem with the refrigerant circuit*
⇒ [“2.3 Performing a gas analysis on the refrigerant”, page 143](#) .
- Fill out the form enclosed with the recycling cylinder (R-cylinder) for contaminated refrigerant and attach securely to the cylinder -1-.



Note

In the “Other remarks” field, you can state who is to receive the result of the analysis, for example and in what form this should take place.

Example of a form supplied with a recycling cylinder (R-cylinder)



Form supplied with an R-cylinder for contaminated refrigerant	
Service contact person	
Dealership contact person:	
e-mail address:	
Customer information:	
Surname, first name:	
Address:	
Town/city:	
Vehicle make and model	
Registration number	
Vehicle identification number:	
Mileage:	
Gas analysis performed on:	
R-cylinder information	
Cylinder number:	
Cylinder weight with contents: (gross weight)	
Capacity (net weight)	
Other remarks	



Note

In the "Other remarks" field, you can state who is to receive the result of the analysis, for example and in what form this should take place.

2.14 Checking pressure values

⇒ [“2.14.1 General information for checking pressure values in the refrigerant circuit”, page 177](#)

⇒ [“2.14.2 Pressures and temperatures in refrigerant circuit”, page 179](#)

⇒ [“2.14.3 Checking pressures in the refrigerant circuit with the ignition switched off”, page 183](#)

⇒ [“2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor”, page 190](#) .

⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#)

2.14.1 General information for checking pressure values in the refrigerant circuit



Note

Most work on the refrigerant circuit using the air conditioner service station can be performed without disconnecting the high-voltage system from mains voltage.

Vehicles with electrically operated valves in the refrigerant circuit, which are not open without flow:



Note

In vehicles with high-voltage system and air conditioner auxiliary functions (“heat pump mode” or “high-voltage battery cooling”), valves that are not open without flow may be installed in the refrigerant circuit. These valves are opened and closed e.g. by control motors and are no longer actuated after the ignition is switched off. To check the pressure in the refrigerant circuit with the air conditioner switched off, however, no areas may be shut off. For this reason, these valves must be opened prior to this work ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.

- Using the vehicle diagnostic tester, open the electrically operated valves that are not open without flow ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.

All vehicles



NOTICE

Risk of damage to air conditioner compressor or air conditioner service station.

When the air conditioner is switched on, a short circuit between the high and low-pressure sides is possible when the valves open.

- **Never open valves on the high or low-pressure side when the air conditioner is switched on.**

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Note

- ◆ *Certain test requirements are vehicle-specific and are described in the Workshop Manual for the vehicle in question ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *Check the cooling output ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *Connections with valve and service connections for measuring and testing ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *Depending on the air conditioner compressor version, a valve may be installed on the high-pressure side of the air conditioner compressor, which prevents liquid refrigerant from flowing back into the compressor after the air conditioner has been switched off. If an air conditioner compressor with this valve is installed in a vehicle with a refrigerant circuit featuring an expansion valve, it can take a relatively long time for the pressure on the high-pressure side to fall (the expansion valve is cold and the pressure on the low-pressure side rises quickly when the air conditioner is switched off; the expansion valve closes and the refrigerant can only flow to the low-pressure side slowly). When the air conditioner 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.*

In certain operating conditions, residues of moisture in the refrigerant circuit can lead to the formation of ice on the air conditioner compressor regulating valve. Such ice formation impedes the control of the air conditioner compressor. The evaporator is cooled down too much and ices up. An iced-up evaporator may cause the following problems:

- ◆ *The air conditioner fails repeatedly or sporadically (no cooling or heating output) after a longer drive. After the vehicle has been stopped, the air conditioner functions properly again after a short wait.*
- ◆ *The insides of the vehicle windows mist up after a longer drive. The windows are not demisted at first even when the De-frost button is pressed. The air conditioner functions properly again after the vehicle is stopped or the air conditioner is switched off, after a short wait.*

Remedy:

- In vehicles with an air conditioner compressor with air conditioner compressor regulating valve - N280- , check the measured value of the evaporator - G263- output temperature sender (in "Read measured values" mode). If the sender measured value is too low at the operating conditions described by the customer (at an ambient temperature above 0 °C, colder than 0 °C for a longer period, even though the -N280- is currently not being actuated) or too high (higher than approx. 10 °C, even though the air conditioner is working perfectly). Can ice up due to incorrect actuation of the -N280- or an incorrect measured value from the -G263- of the evaporator ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).
- In vehicles without evaporator outlet temperature sender - G263- , check the outlet temperature at the setting "Temperature Lo" or "Cold" for the driver and passenger side, e.g.

using the footwell outlet temperature sender - G192- , lowest setting (4 or 5 bars) for the fresh air blower speed, air outlet in the footwell and fresh air mode in the operating conditions described by the customer. If the sender measured value is too low (at an ambient temperature above 0 °C, colder than 0 °C for a longer period), the evaporator may ice up due to the incorrect measured value ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.

- In vehicles with shut-off valves in the refrigerant circuit, check the function and actuation of these valves ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner, ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Check the refrigerant line from the evaporator (or the internal heat exchanger) to the air conditioner compressor (thick pipe, low-pressure side) with the engine running. If this line is severely iced up when the problem occurs (thin layer of ice is permissible), this also indicates that evaporator temperature is too low ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Drain the refrigerant circuit, replace the receiver with dryer, replace the reservoir with dryer or dryer unit, then evacuate the refrigerant circuit for at least three hours evakuieren ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and [⇒ page 138](#) .
- ◆ [⇒ "2.14.3 Checking pressures in the refrigerant circuit with the ignition switched off", page 183](#)
- ◆ [⇒ "2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor", page 190](#) .
- ◆ [⇒ "2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212](#)

2.14.2 Pressures and temperatures in refrigerant circuit

General information on pressures and temperatures in the refrigerant circuit [⇒ page 179](#)

Pressures and temperatures in refrigerant circuits with expansion valve [⇒ page 181](#)

General information on pressures and temperatures in the refrigerant circuit

- ◆ The pressures and temperatures in the refrigerant circuit depend on the current operating states (e.g. engine speed, radiator fan on level 1, 2 or 3, engine temperature, air conditioner compressor actuation on or off) and environmental influences (e.g. ambient temperature, air humidity, required cooling output).
- ◆ On vehicles with air conditioner compressor regulating valve - N280- the pressure on the low pressure end is altered by actuating -N280- .
- ◆ For these reasons, the values given in the following table are only to be taken as a guide. They are attained at an engine speed of 1500 to 2000 rpm and an ambient temperature of 20 °C [after about 20 minutes](#).
- ◆ ~~The connections for the gauge manifold provided for pressure measurement are located in the vehicle-specific refrigerant circuit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).~~



- ◆ At 20 °C with the engine stopped, the pressure in the refrigerant circuit is 4.7 bar overpressure
⇒ ["6.1.3 Vapour pressure table for refrigerant", page 19](#) (vapour pressure table).



Note

- ◆ *Pressure is stated in different units, 1 MPa (megapascal) equals 10 bar overpressure or 145 psi, 1 bar absolute pressure equals 0 bar overpressure, or roughly ambient pressure (atmospheric pressure).*
- ◆ *The pressures and temperatures of refrigerant circuits with restrictor and reservoir are roughly the same as in circuits with an expansion valve. Since Volkswagen/Audi currently only installs refrigerant circuits with an expansion valve, only this type of refrigerant circuit is described here.*

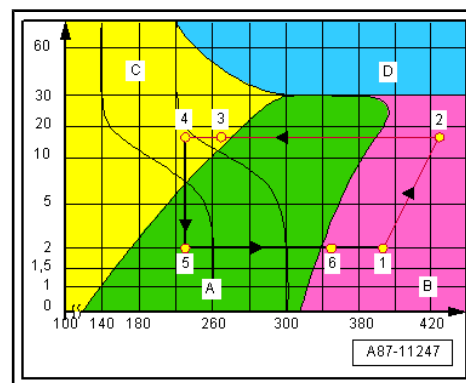
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Pressures and temperatures in refrigerant circuits with expansion valve



Note

- ◆ The log P/h diagram (logarithmic pressure/energy diagram) below illustrates the processes taking place in a refrigerant circuit in a given operating state. These values change depending on the ambient conditions (engine speed, ambient temperature, required cooling output, etc.).
- ◆ The log P/h diagram shows the pressure (0 to 60 in bar absolute pressure and energy content (100 to 420, specific enthalpy in kilojoules per kg of refrigerant R1234yf) in the cycle of a refrigerant circuit.
- ◆ The arrows indicate the direction of refrigerant flow in the refrigerant circuit.



A - Area with vaporous refrigerant

B - Area with gaseous refrigerant

C - Area with liquid refrigerant

D - Supercritical pressure and temperature range, the refrigerant has an indeterminate aggregate state (there is no longer any separation between liquid and gaseous refrigerant)

- 1 - Low-pressure side: Internal heat exchanger outlet, air conditioner compressor outlet, the refrigerant has fully evaporated and is gaseous, the refrigerant temperature is approx. -4°C
- 2 - High-pressure side: Air conditioner outlet, condenser inlet, the refrigerant has compressed and is gaseous, the refrigerant temperature is up to approx. 80°C
- 3 - High-pressure side: Condenser (receiver) outlet, internal heat exchanger inlet, the refrigerant has cooled and is liquid, the refrigerant temperature is approx. 55°C
- 4 - High-pressure side: Internal heat exchanger outlet, expansion valve inlet, the liquid refrigerant cools further, the refrigerant temperature is approx. 50°C
- 5 - Low-pressure side: Expansion valve on evaporator side, evaporator inlet, the liquid refrigerant decompresses and begins to evaporate, the refrigerant temperature is approx. -7°C
- 6 - Low-pressure side: Evaporator outlet, expansions valve, internal heat exchanger inlet, the refrigerant has largely evaporated, but a small proportion is still vaporous, the refrigerant temperature is approx. -6°C

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**Note**

- ◆ *The temperatures stated above refer to the refrigerant in the refrigerant circuit. Due to heat absorption and emission, the temperatures on the surface of the components in contact with refrigerant deviate from these.*
- ◆ *In refrigerant circuits with regulating air conditioner compressor, the pressure (and hence the temperature) is maintained at approx. 3 bar absolute pressure (equivalent to approx. 2 bar overpressure) despite the fluctuating heat transport and different engine speeds. This only applies within the output range of the air conditioner compressor, however. If the output limits of the air conditioner compressor are exceeded, the pressure (and therefore the temperature) rises
⇒ ["2.14 Checking pressure values", page 177](#).*
- ◆ *With air conditioner compressors that do not autonomously regulate their output, the respective control unit regulates the pressure on the low-pressure side and therefore the evaporator temperature, via the air conditioner compressor regulating valve - N280-. Depending on the version and settings, if the air to the evaporator has a measured temperature of less than approx. 2 °C, the output of the air conditioner compressor is reduced and under 0 °C actuation of the -N280- is switched off. This prevents the evaporator from cooling down too much and icing up.*
- ◆ *In vehicles with two evaporators and two expansion valves, the temperature and pressure in the refrigerant circuit are the same for the second evaporator as in vehicles with just one evaporator and one expansion valve (parallel connection).*
- ◆ *Depending on the version of refrigerant circuit, a component with internal heat exchanger may be installed. In the internal heat exchanger, the hot liquid refrigerant flowing on the high-pressure side supplies energy to the cold gaseous or vaporous refrigerant flowing on the low-pressure side, enhancing the efficiency of the air conditioner
⇒ ["1.2.13 Refrigerant line with internal heat exchanger", page 52](#).*
- ◆ *Depending on the version of control unit (e.g. the air conditioner operating and display unit - E87- or the Climatronic control unit - J255-), the measured ambient temperatures (outside temperature, humidity in the passenger compartment, etc.) and on the settings in the control unit (passenger compartment temperature, operating mode, etc.), the pressure and hence the temperature at the evaporator outlet may also be increased to a higher value ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*

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2.14.3 Checking pressures in the refrigerant circuit with the ignition switched off

Test requirements ⇒ [page 183](#)

Checking pressures with the ignition off ⇒ [page 186](#)

Test requirements



Note

- ◆ *Work on the refrigerant circuit (in this case, checking pressures) using the air conditioner service station can be performed without disconnecting the high-voltage system from mains voltage.*
- ◆ *Only disconnect the high-voltage system from mains voltage if you need to work on the high-voltage system ⇒ [page 3](#)*

All vehicles



Note

- ◆ *Certain test requirements are vehicle-specific and are described in the Workshop Manual for the vehicle in question ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *Depending on the air conditioner compressor version, a valve may be installed on the high-pressure side of the air conditioner compressor, which prevents liquid refrigerant from flowing back into the compressor after the air conditioner has been switched off. If an air conditioner compressor with this valve is installed in a vehicle with a refrigerant circuit featuring an expansion valve, it can take a relatively long time for the pressure on the high-pressure side to fall (the expansion valve is cold and the pressure on the low-pressure side rises quickly when the air conditioner is switched off; the expansion valve closes and the refrigerant can only flow to the low-pressure side slowly). When the air conditioner 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.*
- ◆ Check the cooling output ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).
- ◆ Connections with valve and service connections for measuring and testing ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Connect the air conditioner service station
⇒ [“2.2 Connecting the air conditioner service station to the refrigerant circuit”, page 140](#) .

In certain operating conditions, residues of moisture in the refrigerant circuit can lead to the formation of ice on the air conditioner compressor regulating valve. Such ice formation impedes the control of the air conditioner compressor. The evaporator is cooled down too much and ices up. An iced-up evaporator may cause the following problems:

- ◆ The air conditioner fails repeatedly or sporadically (no cooling or heating output) after a longer drive. After the vehicle has been stopped, the air conditioner functions properly again, after a short wait.

- ◆ The insides of the vehicle windows mist up after a longer drive. The windows are not demisted at first even when the De-frost button is pressed. The air conditioner functions properly again after the vehicle is stopped or the air conditioner is switched off, after a short wait.

Remedy:

- In vehicles with an air conditioner compressor with air conditioner compressor regulating valve - N280- , check the measured value of the evaporator - G263- output temperature sender (in "Read measured values" mode). If the sender measured value is too low at the operating conditions described by the customer (at an ambient temperature above 0 °C, colder than 0 °C for a longer period, even though the -N280- is currently not being actuated) or too high (higher than approx. 10 °C, even though the air conditioner is working perfectly). Can ice up due to incorrect actuation of the -N280- or an incorrect measured value from the -G263- of the evaporator
⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).
- In vehicles without evaporator outlet temperature sender - G263- , check the outlet temperature at the setting "Temperature Lo" or "Cold" for the driver and passenger side, e.g. using the footwell outlet temperature sender - G192- , lowest setting (4 or 5 bars) for the fresh air blower speed, air outlet in the footwell and fresh air mode in the operating conditions described by the customer. If the sender measured value is too low (at an ambient temperature above 0 °C, colder than 0 °C for a longer period), the evaporator may ice up due to the incorrect measured value ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.
- In vehicles with shut-off valves in the refrigerant circuit, check the function and actuation of these valves ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner, ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).
- Check the refrigerant line from the evaporator (or the internal heat exchanger) to the air conditioner compressor (thick pipe, low-pressure side) with the engine running. If this line is severely iced up when the problem occurs (thin layer of ice is permissible), this also indicates that evaporator temperature is too low ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Drain the refrigerant circuit, replace each reservoir/receiver with dryer or replace the dryer unit, then evacuate the refrigerant circuit for at least three hours ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and
⇒ ["2 Working with the air conditioner service station", page 138](#) .

Test requirements

- ◆ General information for checking pressures in the refrigerant circuit
⇒ ["2.14.1 General information for checking pressure values in the refrigerant circuit", page 177](#)



Note

*All test requirements marked with * are vehicle-specific and are described in the Workshop Manual for the vehicle in question ⇒ Heating, air conditioner; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*

General test requirements (these only have an influence on the pressure gauge display during this measurement when the air conditioner is switched on)

- The fan and condenser are clean (clean if necessary) *.
- Thermal insulation at expansion valve OK and properly installed.*
- Poly V-belt OK and properly tensioned / belts for air conditioner compressor and alternator OK and properly tensioned.*
- The drive unit for the air conditioner compressor is OK and correctly fitted.*
- All air ducts, covers and seals are OK and correctly fitted*.
- The air conditioner diagnosis does not detect any faults (with the engine running and air conditioner switched on). If no compressor shut-off condition is indicated in the measured values, (only in vehicles with "air conditioner" diagnosis).* ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.
- The air throughput through the dust and pollen filters is not impaired by impurities*.
- All dash panel vents are open*.



Note

- ◆ *The air conditioner compressor is driven by different components (belt or drive shaft), depending on the engine. To protect these components and the engine, the pulley or drive unit of the air conditioner compressor features an overload protection device, which is triggered if the air conditioner compressor cannot rotate freely ⇒ Heating, air conditioner; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87; Air conditioner compressor (vehicle-specific Workshop Manual).*
- ◆ *In certain versions, the fan is only switched on after the pressure in the refrigerant circuit has exceeded a preset value, ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*

Further test requirements (these have an influence on the pressure gauge display during this measurement)

- The vehicle is not exposed to sunlight ⇒ Heating, air conditioner; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).
- The ambient temperature is higher than 15 °C.
- The ignition is switched off.
- Fill the air conditioner service station is connected to the refrigerant circuit
⇒ ["2.2 Connecting the air conditioner service station to the refrigerant circuit", page 140](#) .

- ◆ ⇒ [“2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor”, page 190](#) .
- ◆ ⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#)

Checking pressures with the ignition off



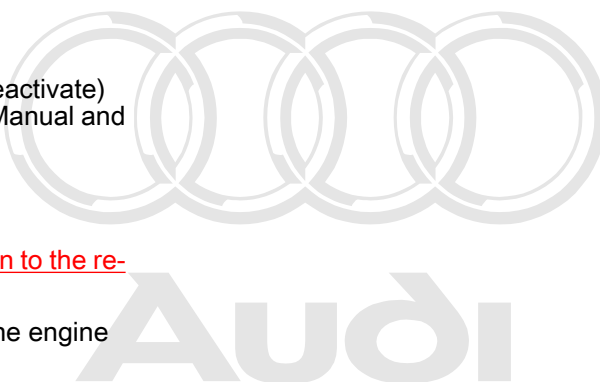
Note

- ◆ *The switching pressures for actuating the air conditioner compressor regulating valve - N280- , the air conditioner magnetic clutch - N25- (if installed) and the radiator fans (e.g. radiator fan - V7- / radiator fan 2 - V177-) are vehicle-specific ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner.*
- ◆ *The pressures are measured at the service connections. The fitting location of these connections is vehicle-specific ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *After finishing the planned work, disconnect the air conditioner service station from the refrigerant circuit and switch off ⇒ [“2.8 Switching off the air conditioner service station and disconnecting from the refrigerant circuit”, page 160](#) .*
- The engine is at operating temperature (at an ambient temperature of less than 25 °C).



Note

- ◆ *If the engine is not at operating temperature, it may be necessary to do a test drive.*
- ◆ *The engine does not have to be at operating temperature to check the cooling output, but in order to demand a certain cooling output from the air conditioner at an ambient temperature under 25 °C, the engine must be at operating temperature at low ambient temperatures.*
- ◆ Note the test requirements ⇒ [page 183](#) .
- In vehicles with high-voltage system, switch off (deactivate) the “auxiliary air conditioning” function⇒ Owner's Manual and ⇒ Infotainment/MMI Operating Manual .
- Switch off ignition.
- Connect the air conditioner service station ⇒ [“2.2 Connecting the air conditioner service station to the refrigerant circuit”, page 140](#) .
- Checking pressures in the refrigerant circuit with the engine running.
- Read the pressure values on the pressure gauges of the air conditioner service station . Two results may be displayed:
- ◆ The pressure in the refrigerant circuit is lower than specified in the following table ⇒ [page 189](#) .
- ◆ The pressure in the refrigerant circuit matches the following table, or is higher ⇒ [page 190](#) .



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Note

- ◆ *Vapour pressure table for refrigerant R1234yf*
⇒ ["6.1.3 Vapour pressure table for refrigerant", page 19](#)
- ◆ *In vehicles with high-voltage system and air conditioner auxiliary functions ("heat pump mode" or "high-voltage battery cooling"), valves that are not open without flow may be installed in the refrigerant circuit. These valves are opened and closed e.g. by control motors and are no longer actuated after the ignition is switched off. Depending on the last operating state of the air conditioner, certain areas of the circuit may be shut off by these valves. Depending on the position of the service connections in the refrigerant circuit, they may be in an area that is shut off (e.g. the area with the high-pressure side service connection in the Audi Q7 e-tron). If necessary, these valves must be opened before the pressure is checked ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.*
- ◆ *The pressures specified in the table below are somewhat lower than in the vapour pressure table for refrigerant R1234yf. The vapour pressure of the refrigerant in the refrigerant circuit is based on the coldest component and can therefore be slightly lower than stated in the vapour pressure table for refrigerant R1234yf, even if the refrigerant circuit is charged correctly.*

Ambient temperature (in degrees Celsius)	Pressure in 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

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**Note**

- ◆ *The temperature of the refrigerant circuit components should be the same as the ambient temperature. If individual refrigerant circuit components are hotter 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 corresponds to 1 bar absolute. On the scales of most pressure gauges, 0 bar equals an absolute pressure of one bar (identifiable by the figure -1 bar below 0).*
- ◆ *In vehicles with pressure senders (high-pressure sender - G65- , refrigerant circuit pressure sender - G805- , refrigerant pressure and refrigerant temperature sender - G395- , etc.), for which the measured pressure is indicated in the measured values of diagnosis, the measured pressure should match the values in the table (or be somewhat higher)⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *The pressure is stated in different units, 1 MPa (megapascal) equals 10 bar overpressure or 145 psi, 1 bar absolute pressure equals 0 bar overpressure, or roughly ambient pressure (atmospheric pressure).*

If the measured values are OK and there are no problems:

- Unscrew (close) the adjuster knobs on the quick release coupling adapter ⇒ Operating instructions for air conditioner service station .
- Extract refrigerant from the two filler hoses with the air conditioner service station in accordance with the relevant operating instructions ⇒ Operating instructions for air conditioner service station .
- Switch off the air conditioner service station (and disconnect from the power supply if necessary)
⇒ ["2.8 Switching off the air conditioner service station and disconnecting from the refrigerant circuit", page 160](#) .

If the measured values are OK but there is a problem:

- Check the cooling output of the air conditioner ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and observe the pressures in the refrigerant circuit.
- ◆ ⇒ ["2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor", page 190](#) .
- ◆ ⇒ ["2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212](#)

If the measured values are not OK:

- Determine and eliminate the cause of the deviation.



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Note

- ◆ *If the pressures are too low, there may be too little refrigerant in the circuit ⇒ Heating, air conditioner; Rep. gr. 00; Technical data (vehicle-specific Workshop Manual) and ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#).*
- ◆ *If the pressures are too high, there may be too much refrigerant or refrigerant oil in the circuit. Drain the refrigerant circuit with the air conditioner service station ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#), if the extracted quantity of refrigerant is larger than the specified capacity for refrigerant R1234yf ⇒ Heating, air conditioner; Rep. gr. 00; Technical data (vehicle-specific Workshop Manual), evacuate the refrigerant circuit and charge with the correct quantity of new refrigerant R1234yf. Then repeat the test. If the extracted quantity of refrigerant roughly corresponds to the specified capacity for refrigerant R1234yf or is less, clean the refrigerant circuit with refrigerant ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#). Next, add the specified quantity of refrigerant oil, evacuate the refrigerant circuit, charge with the correct quantity of new refrigerant R1234yf and repeat the test once more.*
- ◆ *If the pressures are too low or too high and contaminated refrigerant is detected during the gas analysis, this may be the cause of the deviation (different refrigerants have different vapour pressures). Drain the refrigerant circuit and then clean with refrigerant R1234yf ⇒ [“2.3 Performing a gas analysis on the refrigerant”, page 143](#), ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) and ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#)*

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

Too little refrigerant in the circuit.

- Locate leaks in the refrigerant circuit ⇒ [“1.4 Locating leaks”, page 69](#).
- Check the high-pressure safety valve ⇒ [“1.2.17 Pressure relief valve”, page 54](#).

Has the high-pressure safety valve been triggered (check ⇒ [“1.2.17 Pressure relief valve”, page 54](#)):

- Check the actuation of the radiator fan(s) ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner.
- In vehicles with shut-off valves for the refrigerant circuit, check the actuation and function of these shut-off valves ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner (and battery regulation) and ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual).
- Check refrigerant lines and hoses for constrictions, external damage and excessively small bending radii ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87; Coolant circuit (vehicle-specific Workshop Manual).
- If no faults are detected, clean the refrigerant circuit ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#)

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The pressure in the refrigerant circuit matches the table, or is higher

- ◆ ⇒ [“2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor”, page 190](#) .
- ◆ ⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#)

2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor

Checking pressures ⇒ [page 190](#)

Specified values for pressures in the refrigerant circuit
⇒ [page 194](#)

Checking pressures

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



Note

- ◆ *Connect the air conditioner service station
⇒ [“2.2 Connecting the air conditioner service station to the refrigerant circuit”, page 140](#) .*
- ◆ *If only one evaporator has a problem in vehicles with two evaporators, check pressures in the refrigerant circuit. If they are OK, check the line connection between the faulty evaporator and the outlet of the line connection at the distribution point of the refrigerant lines (for constrictions or blockages). If no fault can be identified, drain the refrigerant circuit and charge with the prescribed quantity of new refrigerant. Then check the pressures and cooling output of the air conditioner again. If the problem persists, replace the expansion valve that is upstream of the faulty evaporator ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ ⇒ [“2.14.3 Checking pressures in the refrigerant circuit with the ignition switched off”, page 183](#)

Test requirements

- Fill the air conditioner service station is connected to the refrigerant circuit
⇒ [“2.2 Connecting the air conditioner service station to the refrigerant circuit”, page 140](#) .
- Note the test requirements for checking pressures in the refrigerant circuit with the ignition switched off ⇒ [page 183](#) .
- The pressures in the refrigerant circuit with the ignition switched off conform to the specifications
⇒ [“2.14.3 Checking pressures in the refrigerant circuit with the ignition switched off”, page 183](#) .
- Note the test requirements for checking the cooling output ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).



Note

- ◆ *The switching pressures for actuating the air conditioner compressor regulating valve - N280- , the air conditioner magnetic clutch - N25- (if installed) and the radiator fans - V7- are vehicle-specific ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*
- ◆ *The pressures are measured at the service connections. The fitting location of these connections is vehicle-specific ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- The engine is at operating temperature (at an ambient temperature of less than 25 °C).



Note

- ◆ *If the engine is not at operating temperature, it may be necessary to do a test drive.*
- ◆ *The engine does not have to be at operating temperature to check the cooling output, but in order to demand a certain cooling output from the air conditioner at an ambient temperature under 25 °C, the engine must be at operating temperature at low ambient temperatures.*
- Start the engine.
- Set the air conditioner to maximum cooling output ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).
- The air conditioner compressor is actually being driven with the engine running (visual inspection) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- The air conditioner compressor regulating valve - N280- is actuated ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode for the air conditioner.



Note

- ◆ *The air conditioner compressor is driven by different components (belt or drive shaft), depending on the engine. To protect these components and the engine, the pulley or drive unit of the air conditioner compressor features an overload protection device, which is triggered if the air conditioner compressor cannot rotate freely ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).*
- ◆ *In vehicles with air conditioner compressor regulating valve - N280- , the control current can be read in the measured values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*

If the air conditioner compressor is not driven when the engine is running or the regulating valve is not actuated:

- Determine and eliminate the cause, e.g. by interrogating the event memory of the air conditioner ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.
- If present, check the power supply for the air conditioner magnetic clutch - N25- . If this is OK, repair the magnetic clutch ⇒

Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

- Check the actuation of the air conditioner compressor regulating valve - N280- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.



Note

- ◆ *In air conditioner compressors with an air conditioner magnetic clutch - N25- , the air conditioner compressor only works (supplies refrigerant) if the -N25- is actuated in addition to the air conditioner compressor regulating valve - N280- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*
- ◆ *The -N280- (and the -N25-) are actuated by the air conditioner control unit - J301- , the air conditioner operating and display unit - E87- or the Climatronic control unit - J255- or a downstream control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *All test requirements marked with * are vehicle-specific and are described in the Workshop Manual for the vehicle in question ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

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- Radiator and condenser are clean (clean if necessary) * ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- The thermal insulation on the expansion valve is OK and correctly fitted * ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- The poly V-belt is OK and correctly tensioned. / the belts for the air conditioner compressor and alternator are OK and correctly tensioned.* ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- The drive unit for the air conditioner compressor is OK and correctly fitted * ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
- All air ducts, covers and seals are OK and correctly fitted * ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).
- The air conditioner diagnosis does not detect any faults (with the engine running and air conditioner switched on). If no compressor shut-off condition is indicated in the measured values of the respective control unit (only in vehicles with "air conditioner" diagnosis).* ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.
- The air throughput through the dust and pollen filter is not impaired by impurities.* ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).
- The heater and air conditioning unit does not draw any secondary air at maximum fresh air blower speed. The evaporator and heater do not draw any secondary air at maximum fresh

air blower speed * ⇒ Heating, air conditioner; Rep. gr. 87 ;
Overview of fitting locations - Air conditioner (vehicle-specific
Workshop Manual).

- The air duct flaps in the heater and air conditioning unit, in the heater and evaporator reach their end position * ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).
- The fresh air intake ducts under the bonnet and in the passenger compartment and the associated water drain valves, are OK * ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).
- Engine warm.
- The vehicle is not exposed to sunlight ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).
- The ambient temperature is higher than 15 °C.
- All dash panel vents are open * ⇒ Heating, air conditioner; Rep. gr. 87 ; Air duct (vehicle-specific Workshop Manual).

Setting e.g. on the air conditioner operating and display unit - E87- or the Climatronic control unit - J255- or the air conditioner control unit - J301- (and the rear Climatronic operating and display unit - E265- in vehicles with two heater and air conditioning units) * ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).

Setting on the -E87- / -J255- *: ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).

- Select “Auto” operating mode (air conditioner compressor switched on).
- Preset the temperature to “Cold” or “LO” for the driver and passenger side (and the left and right rear passenger compartment in vehicles with two heater and air conditioning units).

Settings on the -J301- *:

- Press A/C button and "Rec" or air recirculation button.
- Turn the rotary temperature control towards the “cold” stop.
- Set the rotary switch for the fresh air blower to setting “4” (maximum fresh air blower speed).

After this, the following test conditions should be satisfied in the system:

- The radiator fan - V7- is running, or radiator fan - V7- and radiator fan 2 - V177- are running (at least on level 1) * ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).

**Note**

In certain versions, the fan is only switched on after the pressure in the refrigerant circuit has exceeded a preset value, ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.

- The fresh air blower - V2- (and the rear fresh air blower - V80- in vehicles with two heater and air conditioning units) is/are running at maximum speed*.
- The coolant shut-off valve is closed * ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).
- The valves of the pump/valve unit are closed and the coolant circulation pump is not pumping * ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).
- The fresh air blower - V2- (and the rear fresh air blower - V80- in vehicles with two heater and air conditioning units) is/are running at maximum speed*.
- The fresh/recirculated air flap is in "recirculation mode" (the air flow flap closes and the recirculated air flap opens within 1 min of the vehicle being started).*
- The coolant shut-off valve is closed *.
- The valves of the pump/valve unit are closed and the coolant circulation pump is not pumping *.

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Specified values for pressures in the refrigerant circuit

- ♦ Note test requirements and check pressures ⇒ [page 190](#) .

Check:

- Rev engine to 2000 rpm.
- Observe the pressure display (e.g. pressure gauge) of the air conditioner service station ⇒ Operating instructions for air conditioner service station .

**Note**

- ♦ *The switching pressures for actuating the air conditioner compressor regulating valve - N280- and the coolant fan are vehicle-specific ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*
- ♦ *The pressures are measured at the service connections. The fitting location of these connections is vehicle-specific ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

High-pressure side:

From initial pressure (when the pressure gauges are connected) rising to maximum 20 bar overpressure.

Low-pressure side:

From initial pressure (when the pressure gauges are connected)
falling to a value between 1.5 and 2.3 bar absolute pressure (de-
pending on the required cooling output).



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**Note**

- ◆ *If a very high cooling output is required (e.g. at a high outside temperature and a high fresh air blower speed with simultaneously low engine speeds), the air conditioner is initially unable to reduce the pressure on the low-pressure side to the specified value (e.g. for a certain time after the air conditioner is switched on). The air conditioner compressor is actuated with the maximum specified control current, but in these ambient conditions and at this engine speed the delivery rate of the air conditioner compressor is no longer sufficient to lower the pressure on the low-pressure side to the specified value. One way to check the control action of the air conditioner compressor under these conditions is to activate the fresh air blower at only approx. 40 % of the maximum power (voltage) and to check the pressures at reduced fresh air blower speed ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *If low cooling output is required (e.g. at an outside temperature of 20 °C and a low fresh air blower speed), the pressure on the high-pressure side may rise to a value of only 6 to 7 bar (the energy turnover is low, the refrigerant cools down quickly in the condenser). One way to check the control action of the air conditioner compressor and the pressures in the refrigerant circuit under these conditions is to activate the fresh air blower at maximum voltage and to set the air conditioner to maximum heating output and recirculating mode ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *In unfavourable conditions (very high ambient temperatures, high air humidity), the pressure on the high-pressure side may rise to maximum 29 bar.*
- ◆ *The specified working current for the air conditioner compressor regulating valve - N280- is displayed as the measured value by the air conditioner operating and display unit - E87- , the air conditioner control unit - J301- or the Climatronic control unit - J255- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*
- ◆ *The high pressure measured by the high-pressure sender - G65- , the refrigerant circuit pressure sender - G805- or the refrigerant pressure and refrigerant temperature sender - G395- is displayed as a measured value of the -E87- , the - J301- or the -J255- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*
- ◆ *The low pressure is set, based on the control current for the air conditioner compressor regulating valve - N280- and the regulatory curve of the expansion valve within the power output range of the air conditioner compressor in the tolerance range ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*
- ◆ *In unfavourable conditions (very high ambient temperatures, high air humidity), the output of the air conditioner compressor may not always be sufficient to reach the specified pressure value within the specified time (depending on the engine speed, it may take somewhat longer until the specified low pressure is reached).*

- ◆ *If utilisation of the air conditioner compressor capacity exceeds 90 %, the pressure on the low-pressure side may be greater than the stated tolerance range. In the prevailing ambient conditions (ambient temperature, air humidity, air conditioner settings, engine speed, etc.), the air conditioner compressor output is no longer sufficient for reducing the pressure on the low-pressure side to a value of approx. 2 bar.*
- ◆ *The specified working current for the air conditioner compressor regulating valve - N280- must be greater than 0.3 A in order to reliably actuate the -N280- ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*
- ◆ *In the "maximum cooling output" setting, the control current for the air conditioner compressor regulating valve - N280- is regulated 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 "Guided Fault Finding" mode of the air conditioner.*
- ◆ *At absolute pressure, 0 bar is an absolute vacuum. The normal ambient pressure is 1 bar absolute pressure. On the scales of most pressure gauges, 0 bar equals an absolute pressure of 1 bar (identifiable by the figure -1 bar below 0). Depending on the version of the respective control unit, the pressure based on absolute or relative pressure can be displayed as the measured value (difference between the displays 1 bar) ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ➔ Heating, air conditioner; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *The temperature of the air to the evaporator, the current air conditioner compressor speed and the refrigerant pressure on the high-pressure side, as well as the specified working current for the air conditioner compressor regulating valve - N280- are used e.g. as the measured value by the operating and display unit and the Climatronic control unit - J255- ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*

Possible deviations from the specified value, causes and how to rectify them	
◆ The required cooling output is not achieved. ◆ The high pressure remains constant or rises only slightly (above the pressure when the engine is stopped) ◆ The low pressure quickly drops to the specified value or lower.	➔ page 198
◆ The required cooling output is not achieved. ◆ The high pressure is at the specified value ◆ The low pressure is at the specified value or is too low	➔ page 200
◆ The necessary cooling output is not achieved. ◆ The high pressure does not rise or or rises only slightly above the pressure when the engine is stopped ◆ The low pressure does not fall or falls only slightly	➔ page 201

Possible deviations from the specified value, causes and how to rectify them	
◆ The necessary cooling output is not achieved. ◆ The high pressure rises above the specified value ◆ The low pressure quickly drops to the specified value or lower	⇒ page 202
◆ The necessary cooling output is initially achieved, after running for a short or long time, the cooling output is no longer sufficient. ◆ The high pressure and low pressure are initially normal ◆ After some time, the high pressure rises above the specified value, the low pressure continues to conform to the specified value or falls below it.	⇒ page 203
◆ The required cooling output is initially achieved, after a long or short time the required cooling output is no longer achieved. ◆ The high pressure and low pressure are initially normal, after some time the high pressure rises above the specified value and the low pressure drops to the specified value or below ◆ The high pressure and low pressure are initially normal, after some time of driving, the low pressure drops to the specified value or lower, the evaporator ices up.	⇒ page 205
◆ The required cooling output is not achieved. ◆ The high pressure is at the specified value ◆ The low pressure is too low (less than the specified value)	⇒ page 206
◆ The air conditioner compressor makes a noise (especially after switching on) ◆ The required cooling output is not achieved. ◆ High pressure normal or too high, ◆ Low pressure normal or too high (the specified value is not always achieved),	⇒ page 208
◆ The required cooling output is not achieved. ◆ The high pressure and low pressure conform to the specified value	⇒ page 210

Possible deviation from the specified value during the pressure test

- ◆ The required cooling output is not achieved.
- ◆ The high pressure remains constant or rises only slightly (above the pressure when the engine is stopped)
- ◆ The low pressure does not fall or falls only slightly.

Possible causes of deviations from the specified value and how to rectify them

- ◆ The actuation of the air conditioner compressor regulating valve - N280- is faulty.
 - Check the actuation of the air conditioner compressor regulating valve - N280- and repair if necessary
⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner.
- ◆ Air conditioner compressor regulating valve - N280- or air conditioner compressor faulty
 - Check the function of the -N280- , if necessary remove the -N280- and check for contamination ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and ⇒ [page 78](#) .
 - -N280- or replace the air conditioner compressor ⇒ [page 78](#)
 - If there is dirt in the refrigerant circuit, clean the circuit (flush with refrigerant R1234yf) and replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor”, page 190](#)



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Note

- ◆ *Make sure that the air conditioner compressor (the shaft of the compressor) is actually driven by the pulley/drive unit if this problem arises ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *If no errors are detected when this problem arises, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#) .*
- ◆ *Check the measured values of the evaporator output temperature sender - G263- and the actuation of the -N280- . If the measured value of the -G263- is incorrect, the evaporator may ice up or the cooling output is not achieved ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*
- ◆ *If the function of the air conditioner is not OK when the test is repeated after replacing the expansion valve, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#) . Next, replace the air conditioner compressor and dryer unit/desiccant cartridge (or reservoir/receiver) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *In the event of this fault, the evaporator may ice up even through the quantity of refrigerant in the circuit is OK.*
- ◆ *If the expansion valve is faulty (continuously closed or does not open far enough), the -N280- is set to maximum power and the low pressure falls to the diagram value or lower (the air conditioner compressor extracts refrigerant out of the low-pressure side)⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner. However, since no refrigerant can flow through the expansion valve, the cooling output is not achieved, the high pressure may also not rise - or only slightly - as there is no energy turnover.*

Possible deviation from the specified value during the pressure test

- ◆ The required cooling output is not achieved.
- ◆ The high pressure is at the specified value
- ◆ The low pressure is at the specified value or is too low

Possible causes of deviations from the specified value and how to rectify them

- ◆ There is not enough refrigerant in the refrigerant circuit.
- ◆ The expansion valve is faulty.
 - Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Draining the refrigerant circuit", page 146](#) .
 - If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g less) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ ["1.4 Locating leaks", page 69](#)
 - The extracted quantity of refrigerant roughly corresponds to the specified capacity, replace the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual)

Concluding work

Possible deviation from the specified value during the pressure test

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor”, page 190](#)



Note

- ◆ *Check the measured values of the evaporator output temperature sender - G263- and the actuation of the -N280-. If the measured value of the -G263- is incorrect, the evaporator may ice up or the cooling output is not achieved ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner.*
- ◆ *If the function of the air conditioner is not OK when the test is repeated after replacing the expansion valve, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#). Next, replace the air conditioner compressor and reservoir/receiver (or dryer unit) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

Possible deviation from the specified value during the pressure test

- ◆ The necessary cooling output is not achieved.
- ◆ The high pressure does not rise or or rises only slightly above the pressure when the engine is stopped
- ◆ The low pressure does not fall or falls only slightly

Possible causes of deviations from the specified value and how to rectify them

- ◆ The air conditioner compressor is not driven, or not at the specified speed
 - Check the drive of the air conditioner compressor (via belt or drive unit) ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
- ◆ The actuation of the air conditioner compressor regulating valve - N280- (of the air conditioner magnetic clutch - N25-) is faulty.
 - Check the actuation of the air conditioner compressor regulating valve - N280- (and the air conditioner magnetic clutch - N25-) and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner.
- ◆ Air conditioner compressor regulating valve - N280- or air conditioner compressor faulty
 - Check the function of the -N280- , if necessary remove the -N280- and check for contamination ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and ⇒ [page 78](#) .
 - -N280- or replace the air conditioner compressor ⇒ [page 78](#)
 - If there is dirt in the refrigerant circuit, clean the circuit (flush with refrigerant R1234yf) and replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [page 78](#) , ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .
- ◆ Constriction or blockage in the refrigerant circuit (e.g. in the refrigerant line between the service connection on the “low-pressure side” and the air conditioner compressor).
 - Feel the refrigerant circuit for a drop in temperature with your hand ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). If a drop in temperature is detected on a component, with a kinked or constricted hose or pipe, replace this component. In the event of a blockage or if no faults are detected, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#)
- Replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

Possible deviation from the specified value during the pressure test

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor”, page 190](#)



Note

- ◆ *Make sure that the air conditioner compressor (the shaft of the compressor) is actually driven by the pulley/drive unit if this problem arises (pay attention to overload protection) ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).*
- ◆ *With certain engines, air conditioner compressors are used which, as well as the -N280- also feature an air conditioner magnetic clutch - N25- on the pulley. Make sure that the -N25- is actually actuated if this problem arises and the air conditioner compressor (shaft of the compressor) is also driven via the pulley ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .*
- ◆ *If no faults are detected when this problem arises, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .*
- ◆ *Check the measured values of the evaporator output temperature sender - G263- and the actuation of the -N280- . If the measured value of the -G263- is incorrect, the evaporator may ice up or the cooling output is not achieved ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner.*
- ◆ *If the function of the air conditioner is not OK when the test is repeated after replacing the expansion valve, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) . Next, replace the air conditioner compressor and reservoir/receiver (or dryer unit) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *If the expansion valve is faulty (continuously closed or does not open far enough), the -N280- is set to maximum power and the low pressure falls to the diagram value or lower (the air conditioner compressor extracts refrigerant out of the low-pressure side)⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner. However, since no refrigerant can flow through the expansion valve, the cooling output is not achieved, the high pressure may also not rise - or only slightly - as there is no energy turnover.*

Possible deviation from the specified value during the pressure test

- ◆ The necessary cooling output is not achieved.
- ◆ The high pressure rises above the specified value
- ◆ The low pressure quickly drops to the specified value or lower

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ The actuation of the air conditioner compressor regulating valve - N280- is faulty.
 - Check the actuation of the -N280- and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner.
- ◆ Constriction or blockage in the refrigerant circuit.
- ◆ Faulty expansion valve.
- ◆ A shut-off valve possibly installed in the refrigerant circuit does not open, or does not open properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - Check the function of the installed shut-off valve, if present ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - Feel the refrigerant circuit for a drop in temperature with your hand ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). If a drop in temperature is detected on a component, with a kinked or constricted hose or pipe, replace this component. In the event of a blockage or if no faults are detected, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#)
 - Replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor”, page 190](#)



Note

- ◆ *In the event of this fault, the evaporator may ice up even though the quantity of refrigerant in the circuit is OK.*
- ◆ *If the expansion valve is faulty (continuously closed or does not open far enough), the air conditioner compressor regulating valve - N280- is set to maximum power and the low pressure falls to the diagram value or lower (the air conditioner compressor extracts refrigerant out of the low-pressure side). However, since no refrigerant can flow through the expansion valve, the cooling output is not achieved and the high pressure may not rise, or only a little, as no energy turnover is available ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *If there is too much refrigerant oil in the circuit, the air conditioner compressor must be drained and the desiccant bag (the desiccant cartridge) or the reservoir/receiver replaced. After cleaning (flushing with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) the refrigerant circuit, charge the circuit with the correct quantity of refrigerant oil ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *If the specified value is again not reached when the test is repeated, but no faults can be detected in the refrigerant circuit, clean the circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .*



Possible deviation from the specified value during the pressure test

- ◆ The necessary cooling output is initially achieved, after running for a short or long time, the cooling output is no longer sufficient.
- ◆ The high pressure and low pressure are initially normal
- ◆ After some time, the high pressure rises above the specified value, the low pressure continues to conform to the specified value or falls below it.

Possible causes of deviations from the specified value and how to rectify them

- ◆ Coolant radiator, condenser contaminated or coolant fan actuation not OK
 - Check the actuation of the coolant fan and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner
 - Check the condenser and coolant radiator for contamination and clean if necessary ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Engine, mechanics; Rep. gr. 19 ; Radiator/radiator fans .
- ◆ The actuation of the air conditioner compressor regulating valve - N280- is faulty.
 - Check the actuation of the -N280- and measured value of the evaporator output temperature sender - G263- and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner.
- ◆ Too much refrigerant in the refrigerant circuit
 - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
 - If the extracted quantity of refrigerant is considerably greater (more than 100 g) than the specified capacity ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), there was too much refrigerant in the circuit. Charge the refrigerant circuit with the correct quantity of R1234yf and repeat the test.
- ◆ Air conditioner compressor regulating valve - N280- or air conditioner compressor faulty
 - Check the function of the -N280- , if necessary remove the -N280- and check for contamination ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and ⇒ [“1.5 Replacing components”, page 78](#) .
 - -N280- or replace the air conditioner compressor ⇒ [“1.5 Replacing components”, page 78](#)
 - If there is dirt in the refrigerant circuit, clean the circuit (flush with refrigerant R1234yf), replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .
- ◆ Too much refrigerant oil in the refrigerant circuit
- ◆ Moisture in the refrigerant circuit.
 - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
 - If the extracted quantity of refrigerant conforms to the specified capacity or is only slightly less (max. 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), there is too much refrigerant oil in the refrigerant circuit
 - Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .
 - Replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor”, page 190](#)



Note

- ◆ *If there is too much refrigerant oil in the circuit, the air conditioner compressor must be drained and the desiccant bag (the desiccant cartridge) or the reservoir/receiver replaced. After cleaning (flushing with refrigerant R1234yf) ⇒ "1.6 Cleaning the refrigerant circuit", page 95 the refrigerant circuit, charge the circuit with the correct quantity of refrigerant oil ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *In the event of this fault, the evaporator may ice up even through the quantity of refrigerant in the circuit is OK.*
- ◆ *A fault in the evaporator output temperature sender - G263- may also cause icing up of the refrigerant circuit. In the event of this problem, also pay attention to the measured value of the -G263- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).*

Possible deviation from the specified value during the pressure test

- ◆ The required cooling output is initially achieved, after a long or short time the required cooling output is no longer achieved.
- ◆ The high pressure and low pressure are initially normal, after some time the high pressure rises above the specified value and the low pressure drops to the specified value or below
- ◆ The high pressure and low pressure are initially normal, after some time of driving, the low pressure drops to the specified value or lower, the evaporator ices up.

Possible causes of deviations from the specified value and how to rectify them

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Possible deviation from the specified value during the pressure test

- ◆ Coolant radiator, condenser contaminated or coolant fan actuation not OK
 - Check the actuation of the coolant fan and repair if necessary ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.
 - Check the condenser and coolant radiator for contamination and clean if necessary ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Engine, mechanics; Rep. gr. 19 ; Radiator/radiator fans .
- ◆ Measured value of the evaporator output temperature sender - G263- incorrect.
 - Check the measured value and installation of the -G263- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- ◆ The actuation of the air conditioner compressor regulating valve - N280- is faulty.
 - Check the actuation of the air conditioner compressor regulating valve - N280- and repair if necessary ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.
- ◆ Air conditioner compressor regulating valve - N280- or air conditioner compressor faulty
 - Check the function of the -N280- , if necessary remove the -N280- and check for contamination ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ ["1.5 Replacing components", page 78](#) .
 - -N280- or replace the air conditioner compressor ⇒ ["1.5 Replacing components", page 78](#)
 - If there is dirt in the refrigerant circuit, clean the circuit (flush with refrigerant R1234yf) and replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#) , ⇒ ["1.5 Replacing components", page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Moisture in the refrigerant circuit.
 - Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Draining the refrigerant circuit", page 146](#) .
 - Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#) .
 - Replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ ["1.5 Replacing components", page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ ["2.6 Charging the refrigerant circuit", page 155](#)
- Repeat the test ⇒ ["2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor", page 190](#)



Note

- ◆ In the event of this fault, the evaporator may ice up even through the quantity of refrigerant in the circuit is OK.
- ◆ A fault in the evaporator output temperature sender - G263- may cause icing up of the refrigerant circuit. If this problem arises, also pay attention to the measured value of the -G263-.
- ◆ If there is moisture in the circuit, you must drain the air conditioner compressor and replace the desiccant bag/desiccant cartridge (or reservoir/receiver). After cleaning (flushing with refrigerant R1234yf) ⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#) the refrigerant circuit, charge the circuit with the correct quantity of refrigerant oil ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Possible deviation from the specified value during the pressure test

- ◆ The required cooling output is not achieved.
- ◆ The high pressure is at the specified value
- ◆ The low pressure is too low (less than the specified value)

Possible causes of deviations from the specified value and how to rectify them

- ◆ Measured value of the evaporator output temperature sender - G263- incorrect.
 - Check the measured value and installation of the -G263- ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).
- ◆ The actuation of the air conditioner compressor regulating valve - N280- is faulty.
- ◆ A shut-off valve possibly installed in the refrigerant circuit does not open, or does not open properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - Check the actuation of the air conditioner compressor regulating valve - N280- and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner.
 - Check the function of an installed shut-off valve, if present ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit .
- ◆ Air conditioner compressor regulating valve - N280- or air conditioner compressor faulty
 - Check the function of the -N280- , if necessary remove the -N280- and check for contamination ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and ⇒ [“1.5 Replacing components”, page 78](#) .
 - -N280- or replace the air conditioner compressor ⇒ [“1.5 Replacing components”, page 78](#)
 - If there is dirt in the refrigerant circuit, clean the circuit (flush with refrigerant R1234yf) and replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) , ⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor”, page 190](#)



Note

- ◆ If the error "High pressure normal, low pressure too low" appears, please note the following: When this error occurs, the evaporator may ice up even if the quantity of refrigerant in the circuit is OK.
- ◆ If the fault is due to a shut-off valve (shut-off valve does not open), it is not necessary to clean the refrigerant circuit (flush with refrigerant R1234yf
⇒ "1.6 Cleaning the refrigerant circuit", page 95). In the event of this fault, it is sufficient to check the actuation of the shut-off valve. If this is OK, replace the shut-off valve.
- ◆ If the error is due to the air conditioner compressor regulating valve - N280- (the regulating valve is not actuated and the air conditioner compressor works nevertheless), you must clean the refrigerant circuit (flush with refrigerant R1234yf
⇒ "1.6 Cleaning the refrigerant circuit", page 95). It is sufficient in this case to replace the air conditioner compressor (heed quantity of refrigerant oil in air conditioner compressor).
- ◆ If the expansion valve is faulty (continuously closed or does not open far enough), the air conditioner compressor regulating valve - N280- is set to maximum power and the low pressure falls to the diagram value or lower (the air conditioner compressor extracts refrigerant out of the low-pressure side). However, since no refrigerant can flow through the expansion valve, the cooling output is not achieved, the high pressure may also not rise - or only slightly - as there is no energy turnover. In the event of this error, it is not necessary to clean the refrigerant circuit (flush with refrigerant R1234yf
⇒ "1.6 Cleaning the refrigerant circuit", page 95), it suffices to replace the expansion valve
- ◆ Check the measured values of the evaporator output temperature sender - G263- and the actuation of the air conditioner compressor regulating valve - N280- . If the measured value of the -G263- is incorrect, the evaporator may ice up or the cooling output is not achieved ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.

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Possible deviation from the specified value during the pressure test

- ◆ The air conditioner compressor makes a noise (especially after switching on)
- ◆ The required cooling output is not achieved.
- ◆ High pressure normal or too high,
- ◆ Low pressure normal or too high (the specified value is not always achieved),

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ The actuation of the air conditioner compressor regulating valve - N280- is faulty.
 - Check the actuation of the air conditioner compressor regulating valve - N280- and repair if necessary
⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner.
- ◆ Check the function of the -N280- , if necessary remove the -N280- and check for contamination ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner,
⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ -N280- or replace the air conditioner compressor ⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
- ◆ If there is dirt in the refrigerant circuit, clean the circuit (flush with refrigerant R1234yf) and replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver)
⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) , ⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Too much refrigerant or refrigerant oil in the refrigerant circuit
 - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
 - If the extracted quantity of refrigerant is considerably greater (more than 100 g) than the specified capacity
⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), there was too much refrigerant in the circuit. Charge the refrigerant circuit and repeat the test.
 - If the extracted quantity of refrigerant conforms to the specified capacity or is only slightly less than this (max. 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), there is too much refrigerant oil in the refrigerant circuit. Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) , charge with the correct quantity of new refrigerant and refrigerant oil and repeat the test.
- ◆ Faulty expansion valve.
 - A shut-off valve possibly installed in the refrigerant circuit does not open, or does not open properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - Check the function of the installed shut-off valve, if present ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - Replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver)
⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Faulty air conditioner compressor.
 - If a fault cannot be detected in any component and the extracted quantity of refrigerant conforms to the specifications, clean the refrigerant circuit (flush with refrigerant R1234yf)
⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) . If no excessive quantity of refrigerant is found while cleaning the refrigerant circuit, replace the air conditioner compressor
⇒ [“1.5 Replacing components”, page 78](#) , ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor”, page 190](#)



Note

- ◆ *This fault can also be caused by too much refrigerant oil in the refrigerant circuit. Overfilling with refrigerant oil may occur, for example, if the air conditioner compressor was replaced without adjusting the quantity of refrigerant oil accordingly. If there is too much refrigerant oil in the refrigerant circuit, clean the circuit (flush with refrigerant R1234yf).
⇒ "1.6 Cleaning the refrigerant circuit", page 95*
- ◆ *If the expansion valve (or a shut-off valve, if installed) is faulty (continuously closed or does not open far enough), the air conditioner compressor regulating valve - N280- is set to maximum power and the low pressure falls to the diagram value or lower (the air conditioner compressor extracts refrigerant out of the low-pressure side). However, since no refrigerant can flow through the expansion valve, the cooling output is not achieved and the high pressure may not rise, or only a little, as no energy turnover is available ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

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Possible deviation from the specified value during the pressure test

- ◆ The required cooling output is not achieved.
- ◆ The high pressure and low pressure conform to the specified value

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ There is not enough refrigerant in the refrigerant circuit.
 - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
 - If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g less) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ [“1.4 Locating leaks”, page 69](#)
 - The extracted quantity of refrigerant roughly conforms to the specified capacity, measured value from the evaporator output temperature sender - G263- , actuation of the air conditioner compressor regulating valve - N280- , incorrect expansion valve function, or fault in another component (see below).
- ◆ Measured value of the evaporator output temperature sender - G263- incorrect.
 - Check the measured value and installation of the -G263- ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
- ◆ The actuation of the air conditioner compressor regulating valve - N280- is faulty.
 - Check the actuation of the -N280- and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner.
- ◆ Faulty expansion valve.
- ◆ A shut-off valve possibly installed in the refrigerant circuit does not open, or does not open properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Feel the refrigerant circuit for a drop in temperature with your hand ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). If a drop in temperature is detected on a component, with a kinked or constricted hose or pipe, replace this component. In the event of a blockage or if no faults are detected, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#)
- Check the function of the installed shut-off valve, if present ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Too much refrigerant oil in the refrigerant circuit
 - If the extracted quantity of refrigerant conforms to the specified capacity or is only slightly less than this (less than 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), there is too much refrigerant oil in the refrigerant circuit. Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) , charge with the correct quantity of new refrigerant and refrigerant oil and repeat the test.
- ◆ Faulty expansion valve.
- ◆ A shut-off valve possibly installed in the refrigerant circuit does not open, or does not open properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Check the function of the installed shut-off valve, if present ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.4 Checking pressures with the air conditioner switched on in vehicles with mechanically driven air conditioner compressor”, page 190](#)

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**Note**

- ◆ *Check the measured values of the evaporator output temperature sender - G263- and the actuation of the -N280-. If the measured value of the -G263- is incorrect, the evaporator may ice up or the cooling output is not achieved ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).*
- ◆ *Overfilling with refrigerant oil may occur, for example, if the air conditioner compressor was replaced without adjusting the quantity of refrigerant oil accordingly.*
- ◆ *If the expansion valve is faulty (continuously open), the evaporator temperature is no longer regulated so as to ensure that only gaseous refrigerant exits the evaporator. Then, in certain operating conditions drops of liquid can be drawn from the air conditioner compressor, which then lead to noise (liquid cannot be compressed).*
- ◆ *If there is too much refrigerant oil in the circuit, you must drain the air conditioner compressor and, if installed, the reservoir/receiver (or dryer unit) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). After cleaning (flushing with refrigerant R1234yf) ⇒ **"1.6 Cleaning the refrigerant circuit", page 95** the refrigerant circuit, charge the circuit with the correct quantity of refrigerant oil ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).*

2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor

Checking pressures ⇒ **page 212**

Specified values for refrigerant circuit pressures in vehicles with out heat pump ⇒ **page 217**

Specified values for refrigerant circuit pressures in vehicles with heat pump ⇒ **page 240**

Checking pressures

**Note**

Work on the refrigerant circuit (in this case, checking pressures) using the air conditioner service station can be performed without disconnecting the high-voltage system from mains voltage.

- To minimise the number of automatic engine starts with READY active during checking and measurement work, the vehicle batteries must be charged, e.g. with the battery charger, 60 A - VAS 5904- in battery back-up mode ⇒ Electrical system; General information; Rep. gr. 27 ; Charging battery and ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .
- For test and measurement work that requires the vehicle's drive system to be active (READY) or the ignition to be switched on, move the selector lever to position "P", activate the parking brake and take care to keep well clear of the engine

when it is running. Set up any tools needed so that they cannot come into contact with moving parts.

 Note

- ◆ *Move the selector lever to position "P" and activate the parking brake before performing test and measurement work for which the ignition must be switched on but where the vehicle's drive system does not need to be active (READY).*
- ◆ *The status of the drive system (READY) is shown by the control unit in dash panel insert - J285- via the "power meter" → Owner's Manual .*
- ◆ *Activating and deactivating drive system → Owner's Manual (note display of control unit in dash panel insert - J285-).*
- In vehicles with high-voltage system, switch off (deactivate) the "auxiliary air conditioning" function⇒ Owner's Manual and ⇒ Infotainment/MMI Operating Manual .
- Switch off ignition.
- Connect the air conditioner service station
⇒ ["2.2 Connecting the air conditioner service station to the refrigerant circuit", page 140](#) .

 Note

If only one evaporator has a problem in vehicles with two evaporators (one evaporator in the heater and air conditioning unit, one on the heat exchanger for high-voltage battery); check refrigerant circuit pressures, are they OK? Check for cross-sectional restriction or blockage of the line connection between the problematic evaporator and the outgoing line connection at the refrigerant line distribution point. If no fault is found, drain the refrigerant circuit and re-fill it with the specified quantity of refrigerant. Then check the pressures and cooling output of the air conditioner again. If the problem persists, check/replace the following components: If the problem only occurs with the evaporator in the heater and air conditioning unit, check the shut-off valve upstream of the evaporator in the heater and air conditioning unit (it is open when not actuated and allows refrigerant through). If no faults are detected on the shut-off valve, replace the expansion valve on the evaporator in the heater and air conditioning unit. If the problem only occurs with the evaporator on the heat exchanger for high-voltage battery, check the actuation of the shut-off valve on the evaporator expansion valve on the heat exchanger for high-voltage battery (it is closed when not actuated and does not allow refrigerant through) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Test requirements

- Fill the air conditioner service station is connected to the refrigerant circuit
⇒ ["2.2 Connecting the air conditioner service station to the refrigerant circuit", page 140](#) .
- Note the test requirements for checking pressures in the refrigerant circuit with the ignition switched off ⇒ [page 183](#) .
- The pressures in the refrigerant circuit with the ignition switched off conform to the specifications
⇒ ["2.14.3 Checking pressures in the refrigerant circuit with the ignition switched off", page 183](#) .

- Note the test requirements for checking the cooling output ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).

**Note**

- ♦ *The switching pressures for actuating the electric air conditioner compressor - V470- and the radiator fan - V7- are vehicle-specific ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation.*
- ♦ *The pressures are measured at the service connections. The fitting location of these connections is vehicle-specific ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

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- The engine is at operating temperature (at an ambient temperature of less than 25 °C).

**Note**

- ♦ *If the engine is not at operating temperature, it may be necessary to do a test drive.*
- ♦ *The engine does not have to be at operating temperature to check the cooling output, but in order to demand a certain cooling output from the air conditioner at an ambient temperature under 25 °C, the engine must be at operating temperature at low ambient temperatures.*
- To minimise the number of automatic engine starts with READY active during checking and measurement work, the vehicle batteries must be charged, e.g. with the battery charger, 60 A - VAS 5904- in battery back-up mode ⇒ Electrical system; General information; Rep. gr. 27 ; Charging battery and ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .
- Activate drive system (READY) (the engine must not be running) ⇒ Owner's Manual .
- Set the air conditioner to maximum cooling output ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).
- The electric air conditioner compressor - V470- is actuated and running ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).



Note

- ◆ *The electrically driven air conditioner compressor is driven by the vehicle electronics, the engine speed has no influence on the air conditioner's cooling output.*
- ◆ *When the vehicle is stationary or only moving slowly (up to a speed of approx. 45 km/h), the air conditioner compressor is currently not activated at the maximum specified speed (of approx. 8500 rpm); the air conditioner compressor speed is limited to approx. 5000 rpm.*
- ◆ *Actuation of the electrically driven air conditioner compressor can be monitored in Guided Fault Finding ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulations.*
- ◆ *All test requirements marked with * are vehicle-specific and are described in the Workshop Manual for the vehicle in question ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*

If the air conditioner compressor is not actuated with READY active:

- Determine and eliminate the cause, e.g. by interrogating the event memory of the air conditioner ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation.
- Radiator and condenser are clean (clean if necessary) * ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Engine, mechanics; Rep. gr. 19 ; Radiator/radiator fan .
- The thermal insulation on the expansion valve is OK and correctly fitted * ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- All air ducts, covers and seals are OK and correctly fitted * ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).
- The air conditioner diagnosis does not detect any faults (with READY active and air conditioner switched on). No air conditioner compressor shut-off condition is displayed in the measured value block ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation.
- The various pressure/temperature senders and temperature sensors mounted on or in the refrigerant circuit deliver plausible measured values when the air conditioner is in operation, check⇒ Vehicle diagnostic tester in "Guided Fault Finding" and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner . If no faults can be detected, extract refrigerant.
- The air throughput through the dust and pollen filter is not impaired by impurities * ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).
- The heater and air conditioning unit does not draw any secondary air at maximum fresh air blower speed. The evaporator and heater do not draw any secondary air at maximum fresh air blower speed. * ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).
- The air duct flaps in the heater and air conditioning unit, in the heater and evaporator reach their end position * ⇒ Heating,

air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).

- The fresh air intake ducts under the bonnet and in the passenger compartment and the associated water drain valves are OK * ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).
- The vehicle is not exposed to sunlight ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).
- The ambient temperature is higher than 15 °C.
- All dash panel vents are open*.

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Setting, e.g. on the air conditioner operating and display unit - E87- (and the rear Climatronic operating and display unit - E265- in vehicles with two heater and air conditioning units) * ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .

Setting, e.g. on the -E87- *:

- Select "Auto" operating mode (air conditioner compressor switched on).
- Preset the temperature to "Cold" or "LO" for the driver and passenger side (and the left and right rear passenger compartment in vehicles with two heater and air conditioning units) *.

Settings on the -J301- *:

- Press A/C button and Rec (Recirculated) button *.
- Turn the temperature rotary knob towards the "Cold" stop *.
- Set the rotary switch for the fresh air blower to setting "4" (maximum fresh air blower speed) *.

After this, the following test conditions should be satisfied in the system:

- The radiator fan - V7- is running, or radiator fan - V7- and radiator fan 2 - V177- are running (at least on level 1) * ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Engine, mechanics; Rep. gr. 19 ; Radiator/radiator fan .



Note

In certain versions, the fan is only switched on after the pressure in the refrigerant circuit has exceeded a preset value, ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulations.

- The fresh air blower - V2- (and the rear fresh air blower - V80- in vehicles with two heater and air conditioning units) is/are running at maximum speed*.
- The fresh/recirculated air flap is in "recirculation mode" (the air flow flap closes and the recirculated air flap opens within 1 min of the vehicle being started)*.
- The coolant shut-off valve is closed * ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air

conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).

- The valves of the pump/valve unit are closed and the coolant circulation pump is not pumping * ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).



Note

- ◆ *The electrically driven air conditioner compressor is actuated by the vehicle electronics, the engine speed has no influence on the air conditioner's cooling output ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulations.*
- ◆ *When the vehicle is stationary or only moving slowly (up to a speed of approx. 45 km/h), the air conditioner compressor is currently not activated at the maximum specified speed (of approx. 8500 rpm); the air conditioner compressor speed is limited to approx. 5000 rpm.*
- ◆ *Actuation of the electrically driven air conditioner compressor can be monitored in Guided Fault Finding ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulations.*
- ◆ *The pressures are measured at the service connections. The fitting location of these connections is vehicle-specific ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

Specified values for pressures in the refrigerant circuit

- ◆ Specified values for refrigerant circuit pressures in vehicles without heat pump ⇒ [page 217](#)
- ◆ Specified values for refrigerant circuit pressures in vehicles with heat pump ⇒ [page 240](#)



Note

- ◆ *The specified and actual speeds for actuating the electric air conditioner compressor - V470- and the radiator fan - V7- are vehicle-specific ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation.*
- ◆ *The pressures are measured at the service connections. The fitting location of these connections is vehicle-specific ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

Specified values for refrigerant circuit pressures in vehicles without heat pump

- ◆ Note the test requirements ⇒ [page 212](#) .
- Observe the pressure display (e.g. pressure gauge) of the air conditioner service station .



Note

- ◆ *The switching pressures for actuating the electric air conditioner compressor - V470- and the coolant fan -V7- / -V177- are vehicle-specific ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation.*
- ◆ *The pressures are measured at the service connections. The fitting location of these connections is vehicle-specific ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

High-pressure side:

From initial pressure (when the pressure gauges are connected) rising to maximum 20 bar overpressure (depending on the ambient temperature and the operating conditions of the air conditioner).

Low-pressure side:

From initial pressure (when the pressure gauges are connected) falling to a value between 1.5 and 2.3 bar absolute pressure (depending on the required cooling output).

Air conditioner compressor speed:

Between 800 and 8500 rpm, depending on the required cooling capacity (currently 5000 rpm when the vehicle is stationary)

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Note

- ◆ *The temperature of the air after the evaporator, the current air conditioner compressor speed and the refrigerant pressure on the high-pressure side are displayed as a measured value by different controls depending on the vehicle (e.g. by the operating and display unit, the -E87-, the -J255-, the thermal management control unit - J1024- or the air conditioner control unit - J301-) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation.*
- ◆ *If a very high cooling output is required (e.g. at a high outside temperature and a high fresh air blower speed), the air conditioner is initially unable to reduce the pressure on the low-pressure side to the necessary value (e.g. for a certain time after the air conditioner is switched on). When the vehicle is stationary or only moving slowly (up to a speed of approx. 45 km/h), the air conditioner compressor is not activated at the maximum specified speed (of approx. 8500 rpm); the air conditioner compressor speed is limited to approx. 5000 rpm. Limitation of the maximum permitted air conditioner compressor speed is only cancelled at a vehicle speed of over approx. 45 km/h. At an air conditioner compressor speed of 5000 rpm, a high ambient temperature and a high fresh air blower speed (unfavourable ambient conditions), the output (delivery volume) of the air conditioner compressor is at first not always sufficient to reduce the pressure on the low-pressure side to the specified value. One way to check the control action of the air conditioner compressor under these conditions is to activate the fresh air blower at only approx. 40 % of the maximum voltage and to check the pressures at reduced fresh air blower speed ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *If low cooling output is required (e.g. at an outside temperature of 20 °C and a low fresh air blower speed), the pressure on the high-pressure side may rise to a value of only 6 to 7 bar (the energy turnover is low, the refrigerant cools down quickly in the condenser). One way to check the control action of the air conditioner compressor and the pressures in the refrigerant circuit under these conditions is to activate the fresh air blower at maximum voltage and to set the air conditioner to maximum heating output and recirculating mode ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and ⇒ Heating, air conditioner; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *In unfavourable conditions (very high ambient temperatures, high air humidity), the pressure on the high-pressure side may rise to maximum 29 bar.*
- ◆ *The specified speed of the air conditioner compressor is displayed by different control units depending on the vehicle (e.g. by the operating and display unit, the -E87-, -J255- or the air conditioner control unit - J301-) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*
- ◆ *Depending on the vehicle, the high pressure measured by various senders (e.g. by the high-pressure sender - G65-, the refrigerant circuit pressure sender - G805- or the refrigerant pressure and refrigerant temperature sender - G395- is displayed as a measured value (e.g. of the -E87-, -J301-, the thermal management control unit - J1024- or the -J255- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" of the air conditioner.*

- ◆ *The low pressure is set within the power output range of the air conditioner compressor, based on the speed of the air conditioner compressor and the regulatory curve of the expansion valve, in the tolerance range (1.5 to 2.3 bar overpressure).*
- ◆ *For this test, the specified speed of the air conditioner compressor must be higher than 1500 rpm ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*
- ◆ *In the "maximum cooling output" setting, the specified speed of the air conditioner compressor is set to approx. 4000 to 5000 rpm. This value is vehicle-specific and is displayed as a measured value by the control unit (e.g. by the operating and display unit, the -E87-, -J255- or the thermal management control unit -J1024-) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation.*
- ◆ *At absolute pressure, 0 bar is an absolute vacuum. The normal ambient pressure is 1 bar absolute pressure. On the scales of most pressure gauges, 0 bar equals an absolute pressure of 1 bar (identifiable by the figure -1 bar below 0) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner.*
- ◆ *In a vehicle with two evaporators (one in the heater and air conditioning unit and one for battery cooling), the measured temperature matches or is below the specified value on one evaporator, while on the other the required value is not reached, the control system behaves as follows: The control unit in question (e.g. the battery regulation control unit or the thermal management control unit) actuates the electric air conditioner compressor via other control units (e.g. the power and control electronics for electrical system and the air conditioner compressor control unit) at a higher speed (this increases the cooling output of the air conditioner and the pressure on the low-pressure side and the evaporator temperature fall). If an evaporator drops below the specified temperature, the relevant control unit (e.g. the battery regulation control unit) actuates the shut-off valves (e.g. refrigerant shut-off valve 1 or refrigerant shut-off valve 2) in such a way that refrigerant no longer flows through the evaporator that is running too cold ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).*
- ◆ *Since the output of the evaporator in the battery cooling module is considerably lower than that of the evaporator in the heater and air conditioning unit, when there is too little refrigerant in the circuit the required specified temperature may be reached in the battery cooling module, but not that of the evaporator in the heater and air conditioning unit (even though the air conditioner compressor is actuated at a higher speed) ⇒ Heating, air conditioner; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual) and .*

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Possible deviations from the specified value, causes and how to rectify them	
◆ The evaporator in the heater and air conditioning unit (and in the evaporator for the battery cooling module) do not achieve the required cooling output. ◆ High pressure remains constant or rises only slightly (above the pressure when the engine is stationary). ◆ Low pressure quickly drops to the specified value or lower.	⇒ page 222
◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) initially do not reach the required cooling capacity. After some time or a longer period of operation, the cooling output is no longer adequate. ◆ The high pressure and low pressure are initially normal ◆ After some time, the high pressure rises above the specified value, the low pressure continues to conform to the specified value or falls below it.	⇒ page 225
◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) do not achieve the required cooling output. ◆ The high pressure is at the specified value ◆ The low pressure is too low (less than the specified value)	⇒ page 226
◆ The air conditioner compressor makes a noise (especially after switching on) ◆ The evaporator in the heater and air conditioning unit and/or in the battery cooling evaporator do not achieve the required cooling output. ◆ High pressure normal or too high, ◆ Low pressure too high (the specified value is not achieved),	⇒ page 228
◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) do not achieve the required cooling output. ◆ High pressure and low pressure normal (conforms to the specified value)	⇒ page 230
◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) do not achieve the required cooling output. ◆ The high pressure is at the specified value ◆ The low pressure is at the specified value or is too low	⇒ page 232

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Possible deviations from the specified value, causes and how to rectify them	
◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) do not achieve the required cooling output. ◆ The high pressure is at the specified value ◆ Low pressure quickly drops to the specified value or lower,	⇒ page 233
◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) do not achieve the required cooling output. ◆ Only the evaporator in the heater and air conditioning unit does not achieve the required cooling output (the cooling output of the evaporator in the battery cooling module is OK). ◆ High pressure rises only slightly (above the pressure with the engine stationary), or is at the specified value. ◆ Low pressure falls (possibly rapidly) to the specified value or lower.	⇒ page 234
◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) do not achieve the required cooling output. ◆ The high pressure rises above the specified value ◆ Low pressure quickly drops to the specified value or lower,	⇒ page 235
◆ Only the battery cooling evaporator does not achieve the required cooling output (the cooling output of the evaporator in the heater and air conditioning unit is OK). ◆ The high pressure is at the specified value or rises only slightly (above the pressure when the engine is stopped). ◆ Low pressure falls to the specified value or lower.	⇒ page 238
◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) do not achieve the required cooling output. ◆ The high pressure does not rise or rises only slightly above the pressure when the engine is stationary. ◆ The low pressure does not fall or falls only slightly.	⇒ page 239

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Possible deviation from the specified value during the pressure test

- ◆ The evaporator in the heater and air conditioning unit (and in the evaporator for the battery cooling module) do not achieve the required cooling output.
- ◆ High pressure remains constant or rises only slightly (above the pressure when the air conditioner compressor is not running).
- ◆ Low pressure quickly drops to the specified value or lower.

Possible causes of deviations from the specified value and how to rectify them

- ◆ There is not enough refrigerant in the refrigerant circuit.
 - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
 - If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g less) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ [“1.4 Locating leaks”, page 69](#)
 - The extracted quantity of refrigerant roughly corresponds to the specified capacity, check the actuation of the air conditioner compressor and installed shut-off valves, if no faults are detected, replace the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Actuation of the air conditioner compressor (and, if installed, refrigerant shut-off valve 1 and refrigerant shut-off valve 2) faulty ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation, ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual), ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
- Check actuation and function of air conditioner compressor (and, if installed the shut-off valves, e.g. refrigerant shut-off valve 1 , refrigerant shut-off valve 2) and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation. If they are OK, extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
- ◆ The expansion valve for the evaporator in the heater and air conditioning unit is faulty, replace ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ One of the refrigerant shut-off valves (if installed) is faulty (closed), check function and replace if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Constriction or blockage in the refrigerant circuit (e.g. in the refrigerant line between the service connection on the “low-pressure side” and the air conditioner compressor) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - If there is a blockage, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .
 - If a hose or pipe is kinked or constricted, replace this component ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ The expansion valve for the evaporator in the heater and air conditioning unit is faulty, replace ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ A refrigerant shut-off valves is faulty (closed), replace ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#) .

**Note**

- ◆ *If no fault is detected by diagnosis on the occurrence of this problem, inspect the refrigerant circuit for a constriction or blockage (a constriction or blockage in the refrigerant circuit may also lead to one of these problems). If no faults are detected here either, clean the refrigerant circuit (flush with refrigerant R1234yf)
⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#).*
- ◆ *Using the relevant control unit, check the measured values of the evaporator output temperature sender - G263- and, if installed, the temperature sensor upstream of the hybrid battery evaporator and the temperature sensor downstream of the hybrid battery evaporator and the actuation of the air conditioner compressor ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and the battery regulation.*
- ◆ *If there is a fault in the measured value of the -G263-, the temperature sensor upstream of the hybrid battery evaporator or the temperature sensor downstream of the hybrid battery evaporator (depending on the vehicle ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation), this can also lead to problems with cooling output or the evaporator may ice up.*
- ◆ *In the event of a temperature sensor fault, the evaporator may ice up even through the quantity of refrigerant in the circuit is OK.*
- ◆ *If the function of the air conditioner is not OK when the test is repeated, e.g. after replacing the expansion valve, clean the refrigerant circuit (flush with refrigerant R1234yf)
⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#). Next, replace the air conditioner compressor and desiccant cartridge (or reservoir/receiver) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *If the expansion valve on the evaporator in the heater and air conditioning unit or the shut-off valve is faulty (continuously closed or does not open far enough), the air conditioner compressor is actuated at maximum output and the low pressure falls to the specified value or lower (the air conditioner compressor extracts refrigerant out of the low-pressure side). However, since no refrigerant can flow through the expansion valve, the cooling output is not achieved and the high pressure may not rise, or only a little, as no energy turnover is available ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *The evaporator in the heater and air conditioning unit has a much higher output than the battery cooling evaporator. Depending on the type of cooling of the vehicle battery - A2- (depending on the vehicle ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation), refrigerant shut-off valve 2 on the expansion valve in the battery cooling module is only actuated by the respective control unit (e.g. by the battery regulation control unit) above a certain battery temperature, so that the energy turnover via the battery cooling evaporator increases only slightly or not at all, ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

Possible deviation from the specified value during the pressure test

- ◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) initially do not reach the required cooling capacity. After some time or a longer period of operation, the cooling output is no longer adequate.
- ◆ The high pressure and low pressure are initially normal
- ◆ After some time, the high pressure rises above the specified value, the low pressure continues to conform to the specified value or falls below it.

Possible causes of deviations from the specified value and how to rectify them

- ◆ Coolant radiator, condenser contaminated or coolant fan actuation not OK
 - Check the actuation of the coolant fan and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner.
 - Check the condenser and coolant radiator for contamination and clean if necessary ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Engine, mechanics; Rep. gr. 19 ; Radiator/radiator fans .
- ◆ Faulty actuation or function of air conditioner compressor (or refrigerant shut-off valve 1 or refrigerant shut-off valve 2 , if installed).
- ◆ Moisture in the refrigerant circuit.
 - Check actuation of air conditioner compressor (and refrigerant shut-off valve 1 and refrigerant shut-off valve 2 , if installed) and measured value of the evaporator output temperature sender - G263- ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.
 - If actuation of the air conditioner compressor (and of refrigerant shut-off valve 1 and refrigerant shut-off valve 2 , if installed) and the measured value of the -G263- are OK, extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
- ◆ Too much refrigerant in the refrigerant circuit
- ◆ Faulty expansion valve.
- ◆ A shut-off valve possibly installed in the refrigerant circuit does not open, or does not open properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Moisture in the refrigerant circuit.
 - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
 - If the extracted quantity of refrigerant is considerably greater (more than 100 g) than the specified capacity ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), there was too much refrigerant in the circuit. Charge the refrigerant circuit and repeat the test.
 - If the extracted quantity of refrigerant conforms to the specified capacity or is only slightly less than this (max. 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), there is too much refrigerant oil in the refrigerant circuit. Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) , charge with the correct quantity of new refrigerant and refrigerant oil and repeat the test.
 - Check the function of the installed shut-off valve, if present ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - Replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#) .



Note

- ◆ If there is too much refrigerant oil in the circuit, you must drain the air conditioner compressor and replace the reservoir/receiver (or dryer unit) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). After cleaning the refrigerant circuit (flushing with refrigerant R1234yf) ⇒ **"1.6 Cleaning the refrigerant circuit", page 95**, charge the circuit with the correct quantity of refrigerant oil ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).
- ◆ Check the measured values of the evaporator output temperature sender - G263- and the actuation of the air conditioner compressor. If the measured value of the -G263- or actuation of the air conditioner compressor is incorrect, the evaporator may ice up or the cooling output is not achieved ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
- ◆ In the event of this fault, the evaporator may ice up even through the quantity of refrigerant in the circuit is OK.
- ◆ The refrigerant circuit may also ice up due to a fault in the -G263- and/or the temperature sensor downstream of the hybrid battery evaporator. In the event of this problem, also pay attention to the measured value of the -G263- and the temperature sensor downstream of the hybrid battery evaporator (in vehicles with a battery cooling module) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).

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Possible deviation from the specified value during the pressure test

- ◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) do not achieve the required cooling output.
- ◆ The high pressure is at the specified value
- ◆ The low pressure is too low (less than the specified value)

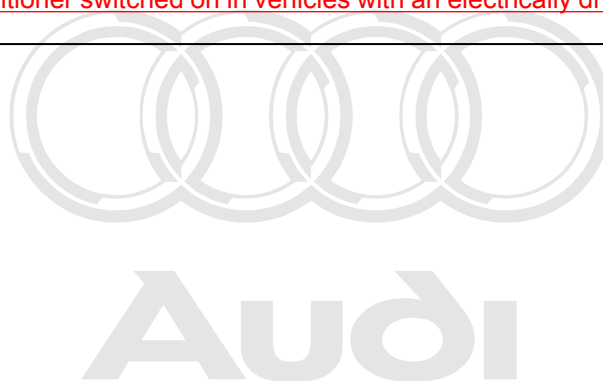
Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ There is not enough refrigerant in the refrigerant circuit.
 - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
 - If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g less) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ [“1.4 Locating leaks”, page 69](#)
 - The extracted quantity of refrigerant roughly corresponds to the specified capacity, check the actuation of the air conditioner compressor and installed shut-off valves, if no faults are detected, replace the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual)
- ◆ Faulty actuation or function of air conditioner compressor or refrigerant shut-off valve 1 / refrigerant shut-off valve 2 , if installed).
 - Check actuation and function of the air conditioner compressor and refrigerant shut-off valve 1 / refrigerant shut-off valve 2 , if installed ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation, no fault can be detected.
 - Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .
- ◆ Faulty expansion valve in heater and air conditioning unit or battery cooling evaporator, if installed.
 - Replace expansion valve for the evaporator in the heater and air conditioning unit (and for the battery cooling evaporator) and the desiccant bag/desiccant cartridge (or reservoir/receiver).
- ◆ Faulty air conditioner compressor
 - Replace the air conditioner compressor ⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
 - If there is dirt in the refrigerant circuit, clean the circuit (flush with refrigerant R1234yf) and replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Replacing components”, page 78](#) and ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test ⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#) .



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**Note**

- ◆ If the error "High pressure normal, low pressure too low" appears, please note the following: When this error occurs, the evaporator may ice up even if the quantity of refrigerant in the circuit is OK.
- ◆ If the error is due to the air conditioner compressor, it is not actuated but works nevertheless, it is not necessary to clean the refrigerant circuit (flush with refrigerant R1234yf)
⇒ "1.6 Cleaning the refrigerant circuit", page 95 . For this error it suffices to replace the air conditioner compressor (note quantity of refrigerant oil in the air conditioner compressor)
⇒ "1.5 Replacing components", page 78 and ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
- ◆ If there is a fault in the air conditioner compressor (the air conditioner compressor is actuated at excessive speed by the air conditioner compressor control unit), it is not necessary to clean the refrigerant circuit (flush with refrigerant R1234yf
⇒ "1.6 Cleaning the refrigerant circuit", page 95). For this error it suffices to replace the air conditioner compressor (note quantity of refrigerant oil in the air conditioner compressor) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
- ◆ If the expansion valve (or one of the two expansion valves) is faulty (continuously closed or does not open far enough), the air conditioner compressor is also actuated at maximum output and the pressure on the low-pressure side falls to the specified value or lower (the air conditioner compressor extracts refrigerant out of the low-pressure side). However, since no refrigerant can flow through the faulty expansion valve, the cooling output is not achieved, the high pressure may also not rise - or only slightly - as there is no energy turnover. In this case, however, the air conditioner can be actuated at a higher speed, as one evaporator is not achieving the required cooling output. The same also applies if the function of actuation of refrigerant shut-off valve 1 or refrigerant shut-off valve 2 is faulty ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Check the measured values of the evaporator output temperature sender - G263- (and the measured values of the Temperature sensor upstream of the hybrid battery evaporator and the Temperature sensor downstream of the hybrid battery evaporator) and the actuation of the air conditioner compressor by the air conditioner compressor control unit . If the measured value of the -G263- the temperature sensor upstream of the hybrid battery evaporator , the temperature sensor downstream of the hybrid battery evaporator - G757-) or the actuation of the air conditioner compressor is faulty, the evaporator may ice up or not achieve the required cooling output ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual).

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Possible deviation from the specified value during the pressure test

- ◆ The air conditioner compressor makes a noise (especially after switching on)
- ◆ The evaporator in the heater and air conditioning unit and/or in the battery cooling evaporator do not achieve the required cooling output.
- ◆ High pressure normal or too high,
- ◆ Low pressure too high (the specified value is not achieved),

Possible causes of deviations from the specified value and how to rectify them

- ◆ Faulty actuation or function of air conditioner compressor or refrigerant shut-off valve 1 / refrigerant shut-off valve 2 , if installed).
- ◆ Too much refrigerant or refrigerant oil in the refrigerant circuit
 - Check actuation and function of the air conditioner compressor and refrigerant shut-off valve 1 / refrigerant shut-off valve 2 , if installed ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and replace if necessary. If no faults can be detected, extract refrigerant from the refrigerant circuit ➔ ["2.4 Draining the refrigerant circuit", page 146](#) .
 - Extract refrigerant from the refrigerant circuit ➔ ["2.4 Draining the refrigerant circuit", page 146](#) .
 - If the extracted quantity of refrigerant is considerably greater (more than 100 g) than the specified capacity ➔ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), there was too much refrigerant in the circuit. Charge the refrigerant circuit and repeat the test.
 - If the extracted quantity of refrigerant conforms to the specified capacity or is only slightly less than this (max. 100 g) ➔ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), there is too much refrigerant oil in the refrigerant circuit. Clean the refrigerant circuit (flush with refrigerant R1234yf) ➔ ["1.6 Cleaning the refrigerant circuit", page 95](#) , charge with the correct quantity of new refrigerant and refrigerant oil and repeat the test.
- ◆ Faulty expansion valve.
 - Replace expansion valve for the evaporator in the air conditioning unit (and for the battery cooling evaporator) and the desiccant bag/desiccant cartridge (or reservoir/receiver) ➔ ["1.5 Replacing components", page 78](#) and ➔ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Faulty air conditioner compressor
 - Replace the air conditioner compressor ➔ ["1.5 Replacing components", page 78](#) and ➔ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
 - If there is dirt in the refrigerant circuit, clean the circuit (flush with refrigerant R1234yf) and replace the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ➔ ["1.5 Replacing components", page 78](#) and ➔ ["1.6 Cleaning the refrigerant circuit", page 95](#) .

Concluding work

- Charge the refrigerant circuit ➔ ["2.6 Charging the refrigerant circuit", page 155](#)
- Repeat the test
➔ ["2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212](#) .



Note

- ◆ *This fault can also be caused by too much refrigerant oil in the refrigerant circuit. Overfilling with refrigerant oil may occur, for example, if the air conditioner compressor was replaced without adjusting the quantity of refrigerant oil accordingly ⇒ "1.5 Replacing components", page 78 and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual). If there is too much refrigerant oil in the refrigerant circuit, clean the circuit (flush with refrigerant R1234yf) ⇒ "1.6 Cleaning the refrigerant circuit", page 95 .*
- ◆ *If the expansion valve on the evaporator in the heater and air conditioning unit (or for the battery cooling shut-off valve) is faulty (continuously closed or does not open far enough), the air conditioner compressor is actuated at maximum output and the low pressure falls to the specified value or lower (the air conditioner compressor extracts refrigerant out of the low-pressure side). However, since no refrigerant can flow through the expansion valve, the cooling output is not achieved, the high pressure may also not rise or only slightly as there is no energy turnover. The same also applies if the function of actuation of refrigerant shut-off valve 1 or refrigerant shut-off valve 2 is faulty ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

Possible deviation from the specified value during the pressure test

- ◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) do not achieve the required cooling output.
- ◆ High pressure and low pressure normal (conforms to the specified value)

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ Faulty actuation or function of air conditioner compressor and refrigerant shut-off valve 1 or refrigerant shut-off valve 2 , if installed).
- ◆ Too little refrigerant in refrigerant circuit.
 - Check actuation and function of the air conditioner compressor and/or refrigerant shut-off valve 1 / refrigerant shut-off valve 2 , if installed ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation and replace if necessary ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). If no faults can be detected, extract refrigerant from the refrigerant circuit.
 - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
 - If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g less) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ [“1.4 Locating leaks”, page 69](#)
 - If the extracted quantity of refrigerant conforms to the specified capacity or is only slightly less (max. 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), the expansion valve for the evaporator or a shut-off valve installed in the heater or air conditioning unit is faulty.
- ◆ The expansion valve for the evaporator in the heater and air conditioning unit is faulty⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ A refrigerant shut-off valve (if installed) is faulty (closed), check function and replace if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - Check the function of the installed shut-off valve, if present ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - Replace the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Too much refrigerant oil in the refrigerant circuit.
 - Clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .
 - Replace expansion valve for the evaporator in the air conditioning unit (and for the battery cooling evaporator) and the desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#) .



Note

- ◆ *This fault can also be caused by too much refrigerant oil in the refrigerant circuit. Overfilling with refrigerant oil may occur, for example, if the air conditioner compressor was replaced without adjusting the quantity of refrigerant oil accordingly ⇒ "1.5 Replacing components", page 78 and ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual). If there is too much refrigerant oil in the refrigerant circuit, clean the circuit (flush with refrigerant R1234yf) ⇒ "1.6 Cleaning the refrigerant circuit", page 95 .*
- ◆ *If the expansion valve on the evaporator in the heater and air conditioning unit (or for the battery cooling shut-off valve) is faulty (continuously closed or does not open far enough), the air conditioner compressor is actuated at maximum output and the low pressure falls to the specified value or lower (the air conditioner compressor extracts refrigerant out of the low-pressure side). However, since no refrigerant can flow through the expansion valve, the cooling output is not achieved, the high pressure may also not rise - or only slightly, as there is no energy turnover. The same also applies if the function of actuation of refrigerant shut-off valve 1 or refrigerant shut-off valve 2 is faulty ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

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Possible deviation from the specified value during the pressure test

- ◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) do not achieve the required cooling output.
- ◆ The high pressure is at the specified value
- ◆ The low pressure is at the specified value or is too low

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ Check actuation and function of the air conditioner compressor (and/or refrigerant shut-off valve 1 , refrigerant shut-off valve 2 , if installed) ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation.
- Check actuation and function of air conditioner compressor (and refrigerant shut-off valve 1 and refrigerant shut-off valve 2 , if installed) and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation. If they are OK, extract refrigerant from the refrigerant circuit.
- ◆ There is not enough refrigerant in the refrigerant circuit.
- Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
- If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ [“1.4 Locating leaks”, page 69](#)
- If the extracted quantity of refrigerant conforms to the specified capacity or is only slightly less (less than 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data . Check function of refrigerant shut-off valves ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ The expansion valve for the evaporator in the heater and air conditioning unit is faulty⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ A refrigerant shut-off valve is faulty (closed) ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Check the function of the installed shut-off valve, if present ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Replace the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Too much refrigerant oil in the refrigerant circuit.
- Clean the refrigerant circuit (flush with refrigerant R1234yf)
⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .
- Replace expansion valve for the evaporator in the air conditioning unit (and for the battery cooling evaporator) and the desiccant bag/desiccant cartridge (or reservoir/receiver)
⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#) .



Note

Observe the notes ⇒ [page 224](#) and ⇒ [page 232](#) .

Possible deviation from the specified value during the pressure test

- ◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) do not achieve the required cooling output.
- ◆ The high pressure is at the specified value
- ◆ Low pressure quickly drops to the specified value or lower,

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ Faulty actuation or function of air conditioner compressor.
- ◆ Constriction or blockage in the refrigerant circuit.
 - Check actuation and function of air conditioner compressor and repair ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation. If no faults can be detected, feel the refrigerant circuit for a drop in temperature with your hand ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - If a drop in temperature is detected on a component. If a hose or pipe is kinked or constricted, replace this component ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). If there is a blockage, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .
- ◆ There is not enough refrigerant in the refrigerant circuit.
 - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
 - If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ [“1.4 Locating leaks”, page 69](#)
 - If the extracted quantity of refrigerant conforms to the specified capacity or is only slightly less (max. 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), check the function of the expansion valve and shut-off valves ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ The expansion valve for the evaporator in the heater and air conditioning unit is faulty ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ A refrigerant shut-off valve is faulty (closed) ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - Check the function of the installed shut-off valve, if present ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - Replace the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

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Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#) .



Note

Observe the notes ⇒ [page 224](#) and ⇒ [page 232](#) .

Possible deviation from the specified value during the pressure test

- ◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) do not achieve the required cooling output.
- ◆ Only the evaporator in the heater and air conditioning unit does not achieve the required cooling output (the cooling output of the evaporator in the battery cooling module is OK).
- ◆ High pressure rises only slightly (above the pressure when the air conditioner is not running), or is at the specified value.
- ◆ Low pressure falls (possibly rapidly) to the specified value or lower.

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ There is not enough refrigerant in the refrigerant circuit.
 - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
 - If the quantity of extracted refrigerant is considerably less (more than 100 g) than the defined capacity ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ [“1.4 Locating leaks”, page 69](#)
 - If the extracted quantity of refrigerant conforms to the specified capacity or is only slightly less (max. 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), check the function of the expansion valve and shut-off valves ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Expansion valve for the evaporator in the heater and air conditioning unit faulty ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ A refrigerant shut-off valve is faulty (closed), check function and replace if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - Check the function of the installed shut-off valve, if present ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - Replace the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Constriction or blockage in the refrigerant circuit (e.g. in the refrigerant line between the service connection on the “low-pressure side” and the air conditioner compressor) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Actuation of than the defined capacity compressor faulty ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the than the defined capacity and battery regulation.
 - Check actuation and function of air conditioner compressor and repair ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation. If no faults can be detected, feel the refrigerant circuit for a drop in temperature with your hand ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - If a drop in temperature is detected on a component. If a hose or pipe is kinked or constricted, replace this component, replace a faulty expansion valve ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). If there is a blockage, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) .
 - If there is a blockage, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) . Replace expansion valve for the evaporator in the air conditioning unit (and for the battery cooling evaporator) and the desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#) .



Note

Observe the notes ⇒ [page 224](#) .

Possible deviation from the specified value during the pressure test

- ◆ The evaporator in the heater and air conditioning unit (and in the battery cooling evaporator) do not achieve the required cooling output.
- ◆ The high pressure rises above the specified value
- ◆ Low pressure quickly drops to the specified value or lower,

Possible deviation from the specified value during the pressure test

Possible causes of deviations from the specified value and how to rectify them

- ◆ Faulty actuation or function of air conditioner compressor.
- ◆ Constriction or blockage in the refrigerant circuit.
- ◆ Faulty expansion valve.
- Check actuation and function of air conditioner compressor and repair ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode of the air conditioner and battery regulation. If no faults can be detected, feel the refrigerant circuit for a drop in temperature with your hand ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- If a drop in temperature is detected on a component. If a hose or pipe is kinked or constricted, replace this component, replace a faulty expansion valve ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- If there is a blockage, clean the refrigerant circuit (flush with refrigerant R1234yf)
⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#) . Replace expansion valve for the evaporator in the air conditioning unit (and for the battery cooling evaporator) and the desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Replacing components”, page 78](#) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ There is not enough refrigerant in the refrigerant circuit.
- Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Draining the refrigerant circuit”, page 146](#) .
- If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ [“1.4 Locating leaks”, page 69](#)
- If the extracted quantity of refrigerant conforms to the specified capacity or is only slightly less (max. 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), check the function of the refrigerant shut-off valve ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#) .



Note

- ◆ *If the function of the air conditioner is not OK when the test is repeated, replace the expansion valve and desiccant bag/ desiccant cartridge (or reservoir/receiver) and, if installed, the refrigerant shut-off valve ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *In the event of this fault, the evaporator may ice up even through the quantity of refrigerant in the circuit is OK.*
- ◆ *If the expansion valve on the evaporator in the heater and air conditioning unit or refrigerant shut-off valve 1 is faulty (continuously closed or does not open far enough), the air conditioner compressor is actuated at maximum output and the low pressure falls to the specified value or lower (the air conditioner compressor extracts refrigerant out of the low-pressure side). However, since no refrigerant can flow through the expansion valve (the refrigerant shut-off valve), the cooling output is not achieved and in addition the high pressure may not rise, or only a little, as no energy turnover is available ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *If the expansion valve on the battery cooling evaporator is faulty (or the function of actuation of refrigerant shut-off valve 2 is faulty), continuously closed or does not open far enough, here too the than the defined capacity compressor is actuated at maximum output (the required temperatures in the battery cooling module are not achieved). If, at the same time, no cooling output is required in the heater and air conditioning unit (refrigerant shut-off valve 1 is actuated and is closed), the pressure on the low-pressure side then drops to the specified value or lower. The air conditioner compressor extracts refrigerant out of the low-pressure side of both evaporators). However, since no refrigerant can flow through the expansion valve in the heater and air conditioning unit (refrigerant shut-off valve 1) and the cooling output for battery cooling is no longer achieved (there is a fault in the area of the battery cooling), the electric air conditioner compressor is actuated at a higher speed. However, since no refrigerant can be supplied, the pressure on the low-pressure side falls below the specified value. In addition, the high pressure may not rise, or only a little, as no energy turnover is available ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *Since the output of the battery cooling evaporator is considerably lower than that of the evaporator in the heater and air conditioning unit, when there is too little refrigerant in the circuit the required specified temperature may be reached in the battery cooling module, but not that of the evaporator in the heater and air conditioning unit (even though the air conditioner compressor is actuated at a higher speed).*
- ◆ *If there is too much refrigerant oil in the circuit, the air conditioner compressor must be drained and the desiccant bag (the desiccant cartridge) or the reservoir/receiver replaced. After cleaning (flushing with refrigerant R1234yf) ⇒ "1.6 Cleaning the refrigerant circuit", page 95 the refrigerant circuit, charge the circuit with the correct quantity of refrigerant oil ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data; Approved refrigerant oils and capacities for refrigerant oil (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).*

- ◆ Observe the further notes ⇒ [page 224](#) .

Possible deviation from the specified value during the pressure test
◆ Only the battery cooling evaporator does not achieve the required cooling output (the cooling output of the evaporator in the heater and air conditioning unit is OK). ◆ The high pressure is at the specified value or rises only slightly (above the pressure when the engine is stopped). ◆ Low pressure falls to the specified value or lower.
Possible causes of deviations from the specified value and how to rectify them
◆ Actuation or function of refrigerant shut-off valve 2 , a control motor, the fan or a temperature sensor in or on the battery cooling module faulty, check and repair if necessary⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). ◆ The expansion valve for the evaporator in the battery cooling module is faulty. – Replace the expansion valve for the battery cooling evaporator ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). – Check the function and actuation of the battery cooling components⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and check the refrigerant lines if no further faults can be found. ◆ Constriction or blockage in the refrigerant line to or from the expansion valve on the battery cooling evaporator. – If there is a blockage, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ "1.6 Cleaning the refrigerant circuit", page 95 . Replace expansion valve for the evaporator in the air conditioning unit (and for the battery cooling evaporator) and the desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ "1.5 Replacing components", page 78 and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). – If a hose or pipe is kinked or constricted, replace this component ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). ◆ Too little refrigerant in the circuit. ◆ Extract refrigerant from the refrigerant circuit ⇒ "2.4 Draining the refrigerant circuit", page 146 . ◆ If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ "1.4 Locating leaks", page 69 ◆ If the extracted quantity of refrigerant conforms to the specified capacity or is only slightly less (max. 100 g) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), check the function of refrigerant shut-off valve 1 ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
Concluding work
– Charge the refrigerant circuit ⇒ "2.6 Charging the refrigerant circuit", page 155 – Repeat the test ⇒ "2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212 .



Note

- ◆ *To cool the vehicle battery - A2- (hybrid battery), refrigerant shut-off valve 1 is currently only actuated above a certain battery temperature, e.g. by the battery regulation control unit. If air conditioner operation is not yet activated at this time, the electric air conditioner compressor - V470- is actuated via the air conditioner compressor control unit - J842- e.g. by the battery regulation control unit. The temperature of the air (or coolant) upstream and downstream of the battery cooling evaporator is determined by the relevant control unit (e.g. the battery regulation control unit). If it becomes clear that cooling is inadequate, this is stored e.g. in the battery regulation control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and the battery regulation.*
- ◆ *The temperature of the air (or coolant) and therefore the cooling output of the battery cooling evaporator is determined by the built-in temperature sensors (currently it cannot be measured with a thermometer during operation). Therefore, it can only be checked using Guided Fault Finding ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation.*
- ◆ *Observe the further notes ⇒ [page 224](#).*

Possible deviation from the specified value during the pressure test
◆ The evaporator in the heater and air conditioning unit (and the battery cooling evaporator) do not achieve the required cooling output. ◆ The high pressure does not rise or or rises only slightly above the pressure when the engine is stationary. ◆ The low pressure does not fall or falls only slightly.
Possible causes of deviations from the specified value and how to rectify them
◆ No air conditioner compressor actuation⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode. ◆ Refrigerant shut-off valve 1 faulty (closed), if installed – Check actuation and function of the air conditioner compressor (and refrigerant shut-off valve 1, refrigerant shut-off valve 2), if installed ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner and battery regulation. If no faults can be detected, replace the expansion valve on the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). ◆ Constriction or blockage in the refrigerant circuit (e.g. in the refrigerant line between the service connection on the "low-pressure side" and the air conditioner compressor). – If there is a blockage, clean the refrigerant circuit (flush with refrigerant R1234yf) ⇒ "1.6 Cleaning the refrigerant circuit", page 95 . Replace expansion valve for the evaporator in the air conditioning unit (and for the battery cooling evaporator) and the desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ "1.5 Replacing components", page 78 and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). – If a hose or pipe is kinked or constricted, replace this component ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). ◆ Faulty air conditioner compressor. – Replace the air conditioner compressor ⇒ "1.5 Replacing components", page 78 and ⇒ Heating, air conditioner; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific Workshop Manual).
Concluding work

Possible deviation from the specified value during the pressure test

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#) .

Specified values for refrigerant circuit pressures in vehicles with heat pump



Note

- ◆ *In vehicles with high-voltage system and heat pump, non-return valves and electrically actuated valves are installed in the refrigerant circuit, which regulate the flow of refrigerant in the circuit based on the current operating state. These valves are available in different versions ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in “Guided Fault Finding”.*
- ◆ *In vehicles with “heat pump” and/or “high-voltage battery cooling” function, high pressure is not available at the service connection on the high-pressure side in all air conditioner operating states. In these vehicles, the pressure on the high-pressure side of the refrigerant circuit can only be measured by the pressure/temperature senders installed in the refrigerant circuit, based on the operating state of the air conditioner ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in “Guided Fault Finding”.*
- ◆ *In these vehicles, the refrigerant circuit of the air conditioner is used not only 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) using the heat pump function. In order to operate these functions, various valves, pressure and temperature senders and pumps must be correctly installed in the refrigerant circuit and coolant circuit of the high-voltage system and work without problem ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual), ⇒ Vehicle diagnostic tester in “Guided Fault Finding” and ⇒ Engine, mechanics; Rep. gr. 19 ; Cooling system/coolant .*
- ◆ *To narrow down the cause of a malfunction, various routines were stored in the basic settings of the thermal management control unit , which activate these functions “Cooling air conditioner”, “Heat pump” and “Cooling high-voltage system components” ⇒ Vehicle diagnostic tester in “Guided Fault Finding”.*

High-pressure side:

From initial pressure (when the pressure gauges are connected) rising to maximum 20 bar overpressure.



Note

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Depending on the position of the high-pressure side service connection and the operating state, it may only be possible to measure the high pressure via pressure/temperature senders installed in the refrigerant circuit ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Low-pressure side:

From initial pressure (when the pressure gauges are connected) falling to a value between 1.5 and 2.3 bar absolute pressure (depending on the required cooling output).

Air conditioner compressor speed:

Between 800 and 8500 rpm, depending on the required cooling capacity (currently 5000 rpm when the vehicle is stationary)



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**Note**

- ◆ *The temperature of the air downstream of the evaporator, the current air conditioner compressor speed and the refrigerant pressure on the high-pressure side are displayed as a measured value by different control units depending on the vehicle (e.g. by the thermal management control unit, the front air conditioner operating and display unit or the Climatronic control unit) ⇒ Heating, air conditioner; Rep. gr. 87; Overview of fitting locations - Air conditioner (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.*
- ◆ *If a very high cooling output is required (e.g. at a high outside temperature and a high fresh air blower speed), the air conditioner is initially unable to reduce the pressure on the low-pressure side to the necessary value (e.g. for a certain time after the air conditioner is switched on). When the vehicle is stationary or only moving slowly (up to a speed of approx. 45 km/h), the air conditioner compressor is not activated at the maximum specified speed (of approx. 8500 rpm); the air conditioner compressor speed is limited to approx. 5000 rpm. Limitation of the maximum permitted air conditioner compressor speed is only cancelled at a vehicle speed of over approx. 45 km/h. At an air conditioner compressor speed of 5000 rpm, a high ambient temperature and a high fresh air blower speed (unfavourable ambient conditions), the output (delivery volume) of the air conditioner compressor is at first not always sufficient to reduce the pressure on the low-pressure side to the specified value. One way to check the control action of the air conditioner compressor under these conditions is to activate the fresh air blower at only approx. 40 % of the maximum voltage and to check the pressures at reduced fresh air blower speed ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode (of the air conditioner and battery regulation) and ⇒ Heating, air conditioner; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *In unfavourable conditions (very high ambient temperatures, high air humidity), the pressure on the high-pressure side may rise to maximum 29 bar.*
- ◆ *The specified speed of the air conditioner compressor is displayed as a measured value, e.g. by the thermal management control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.*
- ◆ *The refrigerant pressure (low or high pressure) measured in the refrigerant circuit by various pressure/temperature sensors based on the current operating state is displayed as a measured value by the relevant control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual).*
- ◆ *The low pressure is set within the power output range of the air conditioner compressor, based on the speed of the air conditioner compressor and the regulatory curve of the expansion valve (on the evaporator of the front heater and air conditioning unit) in the tolerance range (1.5 to 2.3 bar overpressure).*
- ◆ *For this test, the air conditioner compressor must have a specified speed above 1500 rpm.*
- ◆ *In the "maximum cooling output" setting, the specified speed is set to approx. 4000 to 5000 rpm. This value is vehicle-specific and is displayed as a measured value by the relevant control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding".*



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- ◆ *At absolute pressure, 0 bar is an absolute vacuum. The normal ambient pressure is 1 bar absolute pressure. On the scales of most pressure gauges, 0 bar equals an absolute pressure of 1 bar (identifiable by the figure -1 bar below 0).*
- ◆ *In a vehicle with two evaporators (one in the heater and air conditioning unit and one for the high-voltage battery cooling, e.g. the high-voltage battery heat exchanger) and two condensers (one at the front end for the air conditioner and one as a heat exchanger for the heat pump function), if the temperatures or pressures measured on a component conform to the specified value but this is not the case for the other component, depending on the selected function, check the actuation of the electrically actuated valves installed in the refrigerant circuit. At the same time, note the pressure distribution in the refrigerant circuit, depending on the installed non-return valves ⇒ *Vehicle diagnostic tester in "Guided Fault Finding" and ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual).**
- ◆ *In addition, to ensure correct air conditioner function, sufficient heat must be fed to or drawn from the respective heat exchangers, depending on the selected function. Therefore, also pay attention to the integration of the heat exchangers in the engine coolant circuit and high-voltage system and the function of the pumps and valves installed in them⇒ *Vehicle diagnostic tester in "Guided Fault Finding" and ⇒ Heating, air conditioner; Rep. gr. 87; Coolant circuit (vehicle-specific Workshop Manual).**
- ◆ *Since the output of the battery cooling evaporator for high-voltage components (in the battery cooling module and the high-voltage battery heat exchanger) is considerably lower than that of the evaporator in the heater and air conditioning unit, when there is too little refrigerant in the circuit the required specified temperature may be reached in the evaporator for cooling the high-voltage components, but not that of the evaporator in the heater and air conditioning unit (even though the air conditioner compressor is actuated at a higher speed).*

Possible deviations from the specified value, causes and how to rectify them	
• High pressure remains constant or rises only slightly (above the pressure when the engine is stationary), • Low pressure quickly drops to the specified value or lower. • The evaporator in the heater and air conditioning unit and the evaporator for cooling the high-voltage components do not achieve the required cooling output.	⇒ page 245
• High pressure normal, • Low pressure conforms to the specified value, • The required cooling output is not achieved.	⇒ page 248

Possible deviations from the specified value, causes and how to rectify them	
• High pressure normal, • Low pressure normal or too low (less than the specified value) • Only the evaporator in the heater and air conditioning unit does not achieve the required cooling output (the cooling output of the evaporator for cooling the high-voltage components is OK).	⇒ page 249
• High pressure normal, • Low pressure normal or too low (less than the specified value) • Only the evaporator for cooling the high-voltage components does not achieve the required cooling output (the cooling output of the evaporator in the front heater and air conditioning unit is OK).	⇒ page 250
• High pressure does not rise or or rises only slightly above the pressure when the engine is stationary. • Low pressure does not fall or falls only slightly. • The evaporator in the heater and air conditioning unit (and the evaporator for cooling the high-voltage components) do not achieve the required cooling output.	⇒ page 251
• High pressure rises above the specified value, • Low pressure quickly drops to the specified value, • The evaporator in the front heater and air conditioning unit (and/or the evaporator for cooling the high-voltage components) do not achieve the required cooling output.	⇒ page 252
• High pressure and low pressure initially normal. After some time the high pressure rises above the specified value and the low pressure drops to the specified value or lower • The evaporator in the heater and air conditioning unit (and/or the evaporator for cooling the high-voltage components) do not or no longer achieve the required cooling output.	⇒ page 254
• High pressure and low pressure initially normal. After a longer driving time, the low pressure drops below the specified value (the evaporator in the heater and air conditioning unit ices up).	⇒ page 255

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Possible deviations from the specified value, causes and how to rectify them	
• High pressure normal, • Low pressure too low, • The evaporator in the heater and air conditioning unit (and/or the evaporator for cooling the high-voltage components) do not achieve the required cooling output.	⇒ page 257
• High pressure normal or too high, • Low pressure too high, • The air conditioner compressor makes a noise (especially after switching on), • The evaporator in the front heater and air conditioning unit and/or the evaporator for cooling the high-voltage components do not achieve the required cooling output.	⇒ page 258
• High pressure and low pressure normal, • The evaporator in the heater and air conditioning unit (and the evaporator for cooling the high-voltage components) do not achieve the required cooling output. or • High pressure and low pressure normal, • The air conditioner compressor makes a noise (especially after switching on), • The evaporator in the heater and air conditioning unit (and/or the evaporator for cooling the high-voltage components) do not achieve the required cooling output.	⇒ page 260
• High pressure and low pressure normal, • The evaporator in the front heater and air conditioning unit (and the evaporator for cooling the high-voltage components) achieve the required cooling output. • The heat exchanger for heat pump operation does not achieve the required cooling output.	⇒ page 261

Possible deviation from the specified value during the pressure test
• High pressure remains constant or rises only slightly (above the pressure when the engine is stationary), • Low pressure quickly drops to the specified value or lower. • The evaporator in the heater and air conditioning unit and the evaporator for cooling the high-voltage components do not achieve the required cooling output.
Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ A pressure/temperature sender or temperature sensors mounted on or in the refrigerant circuit delivers incorrect values⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- ◆ Too little refrigerant in the circuit.
- ◆ Faulty actuation of air conditioner compressor or one of the valves in the refrigerant circuit.
- Check the measured values of the various pressure/temperature senders and temperature sensors when the air conditioner is in operation, replace components with incorrect measured values⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner . If no faults can be detected, extract refrigerant.
- Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Draining the refrigerant circuit", page 146](#) .
- If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g less) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ ["1.4 Locating leaks", page 69](#)
- The extracted quantity of refrigerant roughly corresponds to the specified capacity, check the actuation of the air conditioner compressor and installed shut-off valves, if no faults are detected, replace the expansion valve for the evaporator in the heater and air conditioning unit⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual)
- Depending on the result, repair actuation or replace the faulty component (air conditioner compressor, shut-off valve, expansion valve)⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ ["2.6 Charging the refrigerant circuit", page 155](#)
- Repeat the test
⇒ ["2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212](#) .



Note

- ◆ To narrow down the cause of a malfunction, various routines were stored in the basic settings of the respective control unit (e.g. in the thermal management control unit), which activate the functions "Cool air conditioner", "Heat pump" and "Cooling high-voltage system components" ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ If no faults are found for this problem, first check the actuation of the electrically actuated values installed in the refrigerant circuit. If you do not detect any faults here, remove and check the non-return valves installed in the refrigerant circuit. If no faults are found here either, clean the refrigerant circuit (flush with refrigerant R1234yf). A constriction or blockage in the refrigerant circuit can also lead to one of these problems ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#)
- ◆ In vehicles with "heat pump" and/or "high-voltage battery cooling" function, high pressure is not available at the service connection on the high-pressure side in all air conditioner operating states. In these vehicles, the pressure on the high-pressure side of the refrigerant circuit can only be measured by the pressure/temperature senders installed in the refrigerant circuit, based on the operating state of the air conditioner ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Vehicle diagnostic tester in "Guided Fault Finding".
- ◆ Before commencing repair work, also check the measured values of the various pressure/temperature senders installed in the refrigerant circuit. An incorrect measured value from a pressure/temperature sender can also cause problems with cooling output or the evaporator in the front heater and air conditioning unit can ice up ⇒ Heating, air conditioner; Rep. gr. 87; Refrigerant circuit (vehicle-specific Workshop Manual), ⇒ Vehicle diagnostic tester in "Guided Fault Finding" and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ When checking the various functions (heat pump or high-voltage battery cooling), also pay attention to the actuation and function of refrigerant circuit components that are connected to these functions ⇒ Heating, air conditioner; Rep. gr. 87; Coolant circuit (vehicle-specific Workshop Manual).
- ◆ If the function of the air conditioner is not OK when the test is repeated, e.g. after replacing the expansion valve, clean the refrigerant circuit (flush with refrigerant R134a) ⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#). Then replace the air conditioner compressor and receiver/desiccant cartridge.
- ◆ In the event of a temperature sensor fault, the evaporator may ice up even though the quantity of refrigerant in the circuit is OK.

- ◆ *If the expansion valve on the evaporator in the heater and air conditioning unit is faulty (continuously closed or does not open far enough), the air conditioner compressor is actuated at maximum output and the low pressure falls to the diagram value or lower (the air conditioner compressor extracts refrigerant out of the low-pressure side). However, since no refrigerant can flow through the expansion valve, the cooling output is not achieved and the high pressure may not rise, or only a little, as no energy turnover is available ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *The evaporator in the heater and air conditioning unit has a higher output than the evaporator for cooling the high-voltage components. Depending on the type of cooling for the vehicle battery / hybrid battery unit (hybrid battery), the expansion valve upstream of this evaporator (the heat exchanger for cooling components of the high-voltage system) is currently only actuated by the relevant control unit above or at a certain battery temperature, with the result that these evaporators increase the energy turnover either not at all or only to a minor extent, ⇒ Vehicle diagnostic tester in "Guided Fault Finding" und ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *If there is too much refrigerant oil in the circuit, you must also drain (flush) the air conditioner compressor and replace the receiver/desiccant cartridge. After cleaning (flushing with refrigerant R134a)
⇒ "1.6 Cleaning the refrigerant circuit", page 95 the refrigerant circuit, charge the circuit (the air conditioner compressor) with the correct quantity of refrigerant oil ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).*

Possible deviation from the specified value during the pressure test

- High pressure normal,
- Low pressure conforms to the specified value,
- The required cooling output is not achieved.

Possible causes of deviations from the specified value and how to rectify them

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Possible deviation from the specified value during the pressure test

- ◆ A pressure/temperature sender or temperature sensors mounted on or in the refrigerant circuit delivers incorrect values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- ◆ Too little refrigerant in the circuit.
- ◆ Faulty shut-off valve upstream of expansion valve for evaporator in front heater and air conditioning unit.
- ◆ One of the other valves installed in the refrigerant circuit is faulty or does not work properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Faulty expansion valve for evaporator in heater and air conditioning unit.
- Check the measured values of the various pressure/temperature senders and temperature sensors when the air conditioner is in operation, replace components with incorrect measured values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner . If no faults can be detected, extract refrigerant.
- Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Draining the refrigerant circuit", page 146](#) .
- If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g less) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ ["1.4 Locating leaks", page 69](#)
- The extracted quantity of refrigerant roughly corresponds to the specified capacity. Check the actuation of the air conditioner compressor and installed shut-off valves, if no faults are detected ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual)
- Charge the refrigerant circuit ⇒ ["2.6 Charging the refrigerant circuit", page 155](#)
- Repeat the test
⇒ ["2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212](#) .
- Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the circuit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Depending on the result, repair actuation or replace the faulty component (shut-off valve/expansion valve) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ ["2.6 Charging the refrigerant circuit", page 155](#)
- Repeat the test
⇒ ["2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212](#) .



Note

Observe the notes ⇒ [page 247](#) .

Possible deviation from the specified value during the pressure test

- High pressure normal,
- Low pressure normal or too low (less than the specified value)
- Only the evaporator in the heater and air conditioning unit does not achieve the required cooling output (the cooling output of the evaporator for cooling the high-voltage components is OK).

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ A pressure/temperature sender or temperature sensors mounted on or in the refrigerant circuit delivers incorrect values⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- ◆ Too little refrigerant in the circuit.
- ◆ Faulty actuation of air conditioner compressor.
- ◆ Faulty expansion valve for evaporator in front heater and air conditioning unit.
- ◆ Faulty shut-off valve upstream of expansion valve for evaporator in front heater and air conditioning unit.
- ◆ One of the other valves installed in the refrigerant circuit is faulty or not working properly.
- Check the measured values of the various pressure/temperature senders and temperature sensors when the air conditioner is in operation, replace components with incorrect measured values⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner . If no faults can be detected, extract refrigerant.
- Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Draining the refrigerant circuit", page 146](#) .
- If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g less) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ ["1.4 Locating leaks", page 69](#)
- The extracted quantity of refrigerant roughly corresponds to the specified capacity. Check the actuation of the air conditioner compressor and installed shut-off valves, if no faults are detected ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual)
- Charge the refrigerant circuit ⇒ ["2.6 Charging the refrigerant circuit", page 155](#)
- Repeat the test
⇒ ["2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212](#) .
- Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the circuit⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Depending on the result, repair actuation or replace the faulty component (shut-off valve/expansion valve) ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).

Concluding work

- Charge the refrigerant circuit ⇒ ["2.6 Charging the refrigerant circuit", page 155](#)
- Repeat the test
⇒ ["2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212](#) .



Note

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Possible deviation from the specified value during the pressure test

- High pressure normal,
- Low pressure normal or too low (less than the specified value)
- Only the evaporator for cooling the high-voltage components does not achieve the required cooling output (the cooling output of the evaporator in the front heater and air conditioning unit is OK).

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ One of the valves installed in the refrigerant circuit is faulty or not working properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ One of the pumps or valves in the coolant circuit of the high-voltage system is faulty or not working properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Coolant circuit (vehicle-specific Workshop Manual).
- ◆ A pressure/temperature sender or temperature sensors mounted on or in the refrigerant circuit delivers incorrect values⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- ◆ Constriction or blockage in the refrigerant line to or from the expansion valve on the evaporator for cooling the high-voltage components
 - Check the measured values of the various pressure/temperature senders and temperature sensors when the air conditioner is in operation, replace components with incorrect measured values⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
 - Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the circuit⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - Check function and actuation of components for cooling the high-voltage components⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner, the air conditioner compressor and battery regulation
 - Depending on the result, repair actuation or replace the faulty component (shut-off valve, expansion valve, coolant pump, coolant shut-off valve)⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) and ⇒ Heating, air conditioner; Rep. gr. 87 ; Coolant circuit (vehicle-specific Workshop Manual).
- Check lines of refrigerant circuit. If a hose or pipe is kinked or constricted, replace this component.
- If no faults can be detected, clean the refrigerant circuit (flush with refrigerant R1234yf ⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#))

Concluding work

- Charge the refrigerant circuit ⇒ ["2.6 Charging the refrigerant circuit", page 155](#)
- Repeat the test
⇒ ["2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212](#) .



Note

Observe the notes ⇒ [page 247](#) .

Possible deviation from the specified value during the pressure test

- High pressure does not rise or or rises only slightly above the pressure when the engine is stationary.
- Low pressure does not fall or falls only slightly.
- The evaporator in the heater and air conditioning unit (and the evaporator for cooling the high-voltage components) do not achieve the required cooling output.

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ No actuation of air conditioner compressor, air conditioner compressor is not driven.
- ◆ One of the valves installed in the refrigerant circuit is faulty or not working properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Constriction or blockage in the refrigerant circuit (e.g. in the refrigerant line between the service connection on the "low-pressure side" and the air conditioner compressor).
- Check actuation and function of air conditioner compressor and repair ⇒ Vehicle diagnostic tester in "Guided Fault Finding"
- Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the circuit⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Depending on the result, repair actuation or replace the faulty component (air conditioner compressor, shut-off valve, expansion valve)⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Check lines of the refrigerant circuit. If a hose or pipe is kinked or constricted, replace this component ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Feel the refrigerant circuit with your hand for a drop in temperature (location of a constriction). If there is a blockage, clean the refrigerant circuit (flush with refrigerant R1234yf)
⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#)
- If you detect a fault in the air conditioner compressor, replace the compressor
⇒ ["1.5 Replacing components", page 78](#)
- If no faults can be detected, clean the refrigerant circuit (flush with refrigerant R1234yf)
⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#))

Concluding work

- Charge the refrigerant circuit ⇒ ["2.6 Charging the refrigerant circuit", page 155](#)
- Repeat the test
⇒ ["2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212](#) .



Note

Observe the notes ⇒ [page 247](#) .

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Possible deviation from the specified value during the pressure test

- High pressure rises above the specified value,
- Low pressure quickly drops to the specified value,
- The evaporator in the front heater and air conditioning unit (and/or the evaporator for cooling the high-voltage components) do not achieve the required cooling output.

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ Faulty actuation or function of air conditioner compressor.
- ◆ One of the valves installed in the refrigerant circuit is faulty or not working properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual)
- ◆ Constriction or blockage in the refrigerant circuit.
- ◆ Faulty expansion valve.
- Check actuation and function of air conditioner compressor and repair ⇒ Vehicle diagnostic tester in “Guided Fault Finding”
- Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the circuit⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Check lines of the refrigerant circuit. If a hose or pipe is kinked or constricted, replace this component ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Feel the refrigerant circuit with your hand for a drop in temperature (location of a constriction). If there is a blockage, clean the refrigerant circuit (flush with refrigerant R1234yf)
⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#)

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#) .

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Note

- ◆ *In the event of this fault, the evaporator may ice up even through the quantity of refrigerant in the circuit is OK.*
- ◆ *If the expansion valve on the evaporator in the heater and air conditioning unit or the shut-off valve installed in front of it is faulty (continuously closed or does not open far enough), the air conditioner compressor is actuated at maximum output and the low pressure falls to the specified value or lower (the air conditioner compressor extracts refrigerant out of the low-pressure side). However, since no (or too little) refrigerant can flow through the expansion valve, the cooling output is not achieved and the high pressure may not rise, or only a little, as no energy turnover is available ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *If the expansion valve upstream of the evaporator for cooling the high-voltage components is faulty (or function and actuation are faulty), continuously closed or does not open far enough, here too the air conditioner compressor is actuated at maximum output (the heat exchanger does not achieve the required temperatures). The pressure on the low-pressure only drops to the specified value or lower if simultaneously no cooling output is demanded in the front heater and air conditioning unit. The air conditioner compressor extracts refrigerant out of the low-pressure side of both evaporators. However, since no refrigerant can flow through the expansion valve in the front heater and air conditioning unit and the evaporator for cooling the high-voltage components does not achieve cooling output (there is a fault in the area of the evaporator for cooling the high-voltage battery), the electric air conditioner compressor is actuated at a higher speed. However, since no refrigerant can be supplied, the pressure on the low-pressure side falls below the specified value. In addition, the high pressure may not rise, or only a little, as no energy turnover is available. The same applies if a valve in the refrigerant circuit is not OK, there is a fault in the connection of the evaporator for cooling the high-voltage components in the coolant circuit of the high-voltage system, or a pump or valve installed there is not OK. Then, the heat exchanger for the high-voltage battery is cooled, but the cooled coolant does not reach the high-voltage components that require cooling ⇒ Vehicle diagnostic tester in "Guided Fault Finding" and ⇒ Heating, air conditioner; Rep. gr. 87 ; Coolant circuit (vehicle-specific Workshop Manual).*
- ◆ *Further notes ⇒ [page 247](#) .*

Possible deviation from the specified value during the pressure test

- High pressure and low pressure initially normal. After some time the high pressure rises above the specified value and the low pressure drops to the specified value or lower
- The evaporator in the heater and air conditioning unit (and/or the evaporator for cooling the high-voltage components) do not or no longer achieve the required cooling output.

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ A pressure/temperature sender or temperature sensors mounted on or in the refrigerant circuit delivers incorrect values⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- ◆ Faulty actuation of air conditioner compressor ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.
- ◆ One of the valves installed in the refrigerant circuit is faulty or not working properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Moisture in the refrigerant circuit.
- Check the measured values of the various pressure/temperature senders and temperature sensors when the air conditioner is in operation, replace components with incorrect measured values⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- Check actuation and function of air conditioner compressor and repair ⇒ Vehicle diagnostic tester in “Guided Fault Finding”
- Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the circuit⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- If no faults can be detected, clean the refrigerant circuit (flush with refrigerant R1234yf ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#)).

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#) .



Note

Observe the notes ⇒ [page 247](#) .

Possible deviation from the specified value during the pressure test

- High pressure and low pressure initially normal. After a longer driving time, the low pressure drops below the specified value (the evaporator in the heater and air conditioning unit ices up).

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ A pressure/temperature sender or temperature sensors mounted on or in the refrigerant circuit delivers incorrect values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- ◆ Faulty actuation of air conditioner compressor ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ One of the valves installed in the refrigerant circuit is faulty or not working properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ A pressure/temperature sender or temperature sensors mounted on or in the refrigerant circuit delivers incorrect values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- ◆ Moisture in the refrigerant circuit.
 - Check the measured values of the various pressure/temperature senders and temperature sensors when the air conditioner is in operation, replace components with incorrect measured values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
 - Check actuation and function of air conditioner compressor and repair ⇒ Vehicle diagnostic tester in "Guided Fault Finding"
 - Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the circuit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
 - If no faults can be detected, replace the desiccant bag/desiccant cartridge (or reservoir/receiver) and evacuate the refrigerant circuit for at least three hours.

Concluding work

- Charge the refrigerant circuit ⇒ ["2.6 Charging the refrigerant circuit", page 155](#)
- Repeat the test
⇒ ["2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212](#) .



Note

- ◆ *First of all, it is not necessary to clean the refrigerant circuit (flush with refrigerant R1234yf) for this problem ⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#)), because there is generally only a small amount of moisture in the system, which can be removed by extended evacuation.*
- ◆ *If a problem involving moisture in the refrigerant circuit only occurs after a lengthy operating period or only infrequently (low pressure drops below specification and evaporator ices up), it is sufficient to replace the dryer in the receiver (adjust quantity of refrigerant oil). The refrigerant circuit is then to be evacuated for at least 3 hours.*
- ◆ *With this fault, the evaporator may ice up although the quantity of refrigerant in the circuit is OK.*
- ◆ *A fault in the evaporator output temperature sender ⇒ [G263](#) and/or a pressure/temperature sender may also cause the refrigerant circuit to ice up. Therefore, if this problem arises also pay attention to the measured values of the various pressure/temperature senders in the refrigerant circuit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific Workshop Manual).*
- ◆ *Further notes ⇒ [page 247](#) .*

Possible deviation from the specified value during the pressure test
• High pressure normal, • Low pressure too low, • The evaporator in the heater and air conditioning unit (and/or the evaporator for cooling the high-voltage components) do not achieve the required cooling output.
Possible causes of deviations from the specified value and how to rectify them
♦ Too little refrigerant in the circuit ♦ Faulty actuation or function of air conditioner compressor ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode. ♦ One of the valves installed in the refrigerant circuit is faulty or not working properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). ♦ A pressure/temperature sender or temperature sensors mounted on or in the refrigerant circuit delivers incorrect values⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner . – Check the measured values of the various pressure/temperature senders and temperature sensors when the air conditioner is in operation, replace components with incorrect measured values⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner . If no faults can be detected, extract refrigerant. – Extract refrigerant from the refrigerant circuit ⇒ "2.4 Draining the refrigerant circuit", page 146 . – If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g less) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ "1.4 Locating leaks", page 69 – The extracted quantity of refrigerant roughly corresponds to the specified capacity. Check the actuation of the air conditioner compressor and installed shut-off valves, if no faults are detected ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual) – Charge the refrigerant circuit ⇒ "2.6 Charging the refrigerant circuit", page 155 – Repeat the test ⇒ "2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212 . – Check actuation and function of air conditioner compressor and repair ⇒ Vehicle diagnostic tester in "Guided Fault Finding" – Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the circuit⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). – Depending on the result, repair actuation or replace the faulty component (air conditioner compressor, shut-off valve, expansion valve, pressure/temperature sender)⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual). – If no faults can be detected, clean the refrigerant circuit (flush with refrigerant R1234yf ⇒ "1.6 Cleaning the refrigerant circuit", page 95).
Concluding work
– Charge the refrigerant circuit ⇒ "2.6 Charging the refrigerant circuit", page 155 – Repeat the test ⇒ "2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212 .

**Note**

- ◆ *If the error "High pressure normal, low pressure too low" appears, please note the following: When this error occurs, the evaporator in the heater and air conditioning unit may ice up even if the quantity of refrigerant in the circuit is OK.*
- ◆ *If there is a fault in the air conditioner compressor (the air conditioner compressor is actuated at excessive speed by the air conditioner compressor control unit), it is not necessary to clean the refrigerant circuit (flush with refrigerant R1234yf ⇒ ["1.6 Cleaning the refrigerant circuit", page 95](#)). If this fault occurs, it is sufficient to replace the air conditioner compressor (note the quantity of refrigerant oil in the compressor and top up if necessary).*
- ◆ *If the expansion valve upstream of the evaporator for cooling the high-voltage components is faulty (or function and actuation are faulty), continuously closed or does not open far enough, here too the air conditioner compressor is actuated at maximum output (the heat exchanger does not achieve the required temperatures). The pressure on the low-pressure only drops to the specified value or lower if simultaneously no cooling output is demanded in the front heater and air conditioning unit. The air conditioner compressor extracts refrigerant out of the low-pressure side of both evaporators. However, since no refrigerant can flow through the expansion valve in the front heater and air conditioning unit and the evaporator for cooling the high-voltage components does not achieve cooling output (there is a fault in the area of the evaporator for cooling the high-voltage battery), the electric air conditioner compressor is actuated at a higher speed. However, since no refrigerant can be supplied, the pressure on the low-pressure side falls below the specified value. In addition, the high pressure may not rise, or only a little, as no energy turnover is available. The same applies if a valve in the refrigerant circuit is not OK, there is a fault in the connection of the evaporator for cooling the high-voltage components in the coolant circuit of the high-voltage system, or a pump or valve installed there is not OK. Then, the heat exchanger for the high-voltage battery is cooled, but the cooled coolant does not reach the high-voltage components that require cooling ⇒ [Vehicle diagnostic tester in "Guided Fault Finding" and ⇒ Heating, air conditioner; Rep. gr. 87 ; Coolant circuit \(vehicle-specific Workshop Manual\)](#).*
- ◆ *A fault in the evaporator output temperature sender - G263- and/or a pressure/temperature sender may also lead to this problem. Therefore, also pay attention to the measured values of the various pressure/temperature senders in the refrigerant circuit ⇒ [Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 00 ; Repair instructions; Checking cooling output \(vehicle-specific Workshop Manual\)](#).*
- ◆ *Further notes ⇒ [page 247](#).*

Possible deviation from the specified value during the pressure test

- High pressure normal or too high,
- Low pressure too high,
- The air conditioner compressor makes a noise (especially after switching on),
- The evaporator in the front heater and air conditioning unit and/or the evaporator for cooling the high-voltage components do not achieve the required cooling output.

Possible causes of deviations from the specified value and how to rectify them

- ◆ Faulty actuation of air conditioner compressor ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.
- ◆ One of the valves installed in the refrigerant circuit is faulty or not working properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ A pressure/temperature sender or temperature sensors mounted on or in the refrigerant circuit delivers incorrect values⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- ◆ Too much refrigerant in the circuit.
- ◆ Too much refrigerant oil in the circuit.
- Check the measured values of the various pressure/temperature senders and temperature sensors when the air conditioner is in operation, replace components with incorrect measured values⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- Check actuation and function of air conditioner compressor and repair ⇒ Vehicle diagnostic tester in “Guided Fault Finding”
- Check the function and actuation of the various valves and pressure/temperature senders installed in the refrigerant circuit by means of the pressure distribution in the circuit⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- If no faults can be detected, extract refrigerant from the refrigerant circuit.
- The extracted quantity of refrigerant is far greater than the specified capacity:
- Charge the refrigerant circuit, repeat the test.
- The extracted quantity of refrigerant roughly corresponds to the specified capacity:
- Check actuation and function of air conditioner compressor and valves installed in the refrigerant circuit (shut-off valves and expansion valves) ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode
- Depending on the result, repair actuation or replace the faulty component (shut-off valve, expansion valve or air conditioner compressor and receiver/dryer⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- If no faults can be detected, there may be too much refrigerant oil in the circuit, clean the refrigerant circuit (flush with refrigerant R1234yf ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#)).

Concluding work

- Charge the refrigerant circuit ⇒ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
⇒ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#) .



Note

- ◆ *This fault may also be caused by too much refrigerant oil in the circuit. Overfilling with refrigerant oil may occur if, for example, the air conditioner compressor has been replaced without adjusting the quantity of refrigerant oil.*
- ◆ *Further notes ⇒ [page 247](#) .*

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Possible deviation from the specified value during the pressure test

- High pressure and low pressure normal,
 - The evaporator in the heater and air conditioning unit (and the evaporator for cooling the high-voltage components) do not achieve the required cooling output.
- or
- High pressure and low pressure normal,
 - The air conditioner compressor makes a noise (especially after switching on),
 - The evaporator in the heater and air conditioning unit (and/or the evaporator for cooling the high-voltage components) do not achieve the required cooling output.

Possible causes of deviations from the specified value and how to rectify them

- ◆ A pressure/temperature sender or temperature sensors mounted on or in the refrigerant circuit delivers incorrect values⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- ◆ Faulty actuation of air conditioner compressor ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.
- ◆ One of the valves installed in the refrigerant circuit is faulty or not working properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- ◆ Too much refrigerant in the circuit.
- ◆ Faulty expansion valve for evaporator in front heater and air conditioning unit.
- ◆ Too much refrigerant oil in the circuit.
- Check the measured values of the various pressure/temperature senders and temperature sensors when the air conditioner is in operation, replace components with incorrect measured values⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- Check actuation and function of air conditioner compressor and repair ⇒ Vehicle diagnostic tester in “Guided Fault Finding”.
- Check the function and actuation of the various valves and pressure/temperature senders installed in the refrigerant circuit by means of the pressure distribution in the circuit⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- If no faults can be detected, extract refrigerant from the refrigerant circuit.
- The extracted quantity of refrigerant is far greater than the specified capacity:
- Charge the refrigerant circuit, repeat the test.
- The extracted quantity of refrigerant roughly corresponds to the specified capacity:
- Clean the refrigerant circuit (flush with refrigerant R1234yf ⇒ [“1.6 Cleaning the refrigerant circuit”, page 95](#)).
- Add the correct quantity of refrigerant oil to the circuit (refer to note).

Concluding work

Possible deviation from the specified value during the pressure test

- Charge the refrigerant circuit ➔ [“2.6 Charging the refrigerant circuit”, page 155](#)
- Repeat the test
➔ [“2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor”, page 212](#) .



Note

- ◆ *Overfilling with refrigerant oil may occur, for example, if the air conditioner compressor was replaced without adjusting the quantity of refrigerant oil accordingly.*
- ◆ *If the expansion valve for the evaporator in the heater and air conditioning unit or the evaporator for cooling the high-voltage battery is faulty (continuously open), the evaporator temperature (in the front heater or air conditioning unit) is no longer regulated such that only gaseous refrigerant exits the evaporator. Then, in certain operating conditions drops of liquid can be drawn from the air conditioner compressor, which then lead to noise (liquid cannot be compressed).*
- ◆ *If there is too much refrigerant oil in the circuit, you must drain the air conditioner compressor and replace the receiver. After cleaning (flushing with refrigerant R1234yf ➔ [“1.6 Cleaning the refrigerant circuit”, page 95](#)) the refrigerant circuit, charge the circuit with the correct quantity of refrigerant oil ➔ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual).*
- ◆ *Further notes ➔ [page 247](#) .*

Possible deviation from the specified value during the pressure test

- High pressure and low pressure normal,
- The evaporator in the front heater and air conditioning unit (and the evaporator for cooling the high-voltage components) achieve the required cooling output.
- The heat exchanger for heat pump operation does not achieve the required cooling output.

Possible causes of deviations from the specified value and how to rectify them

Possible deviation from the specified value during the pressure test

- ◆ A pressure/temperature sender or temperature sensors mounted on or in the refrigerant circuit delivers incorrect values⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- ◆ One of the pumps or valves in the coolant circuit of the high-voltage system or the engine is faulty or not working properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Coolant circuit (vehicle-specific Workshop Manual).
- ◆ Faulty actuation of air conditioner compressor ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ One of the valves installed in the refrigerant circuit is faulty or not working properly ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Check the measured values of the various pressure/temperature senders and temperature sensors when the air conditioner is in operation, replace components with incorrect measured values⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Overview of fitting locations - Air conditioner .
- Check the integration of the heat exchanger in the engine coolant circuit and the function and actuation of various pumps and valves ⇒ Heating, air conditioner; Rep. gr. 87 ; Coolant circuit (vehicle-specific Workshop Manual).
- Check actuation and function of air conditioner compressors and repair ⇒ Vehicle diagnostic tester in "Guided Fault Finding"
- Check the function and actuation of the various valves and pressure/temperature senders installed in the refrigerant circuit by means of the pressure distribution in the circuit⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual).
- Check function and actuation of components for cooling the high-voltage components⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of the air conditioner, the air conditioner compressor and battery regulation
- If no faults can be detected, extract refrigerant from the refrigerant circuit.
- Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Draining the refrigerant circuit", page 146](#) .
- If the quantity of extracted refrigerant is considerably less than the defined capacity (more than 100 g less) ⇒ Heating, air conditioner; Rep. gr. 00 ; Technical data (vehicle-specific Workshop Manual), search for and eliminate the leak ⇒ ["1.4 Locating leaks", page 69](#)
- The extracted quantity of refrigerant roughly corresponds to the specified capacity. Check the actuation of the air conditioner compressor and installed shut-off valves again, if no faults are detected ⇒ Heating, air conditioner; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific Workshop Manual)
- Charge the refrigerant circuit ⇒ ["2.6 Charging the refrigerant circuit", page 155](#)
- Repeat the test
⇒ ["2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212](#)

Concluding work

- Charge the refrigerant circuit ⇒ ["2.6 Charging the refrigerant circuit", page 155](#)
- Repeat the test
⇒ ["2.14.5 Checking pressures with the air conditioner switched on in vehicles with an electrically driven air conditioner compressor", page 212](#) .



Note

- ◆ *If the required cooling output of the evaporator in the front heater and air conditioning unit (and the evaporator for cooling the high-voltage components) is OK and there is a problem due to a lack of heating output at the heat exchanger for heat pump operation. The cause may lie in the coolant circuit of the high-voltage system or the engine coolant circuit. If the pumps and valves in the coolant circuit of the high-voltage system are not actuated correctly or are not functioning properly, the evaporator (heat exchanger) for the components of the high-voltage system cannot draw sufficient heat energy from the coolant. If the pumps and valves in the engine coolant circuit are not actuated correctly or are not functioning properly, the heat exchanger for heat pump functions is unable to transfer the drawn heat energy to the coolant that is flowing to the heat exchanger in the heater and air conditioning unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" und ⇒ Heating, air conditioner; Rep. gr. 87 ; Coolant circuit (vehicle-specific Workshop Manual).*
- ◆ Further notes ⇒ [page 247](#) .



3 Test equipment and tools

⇒ **"3.1 Tools and materials that can be purchased from the sales centre or importer", page 264**

⇒ **"3.2 Tools and materials that are available from specialist re-tailers", page 265**

⇒ **"3.3 Tools that you can produce yourself", page 265**

3.1 Tools and materials that can be purchased from the sales centre or importer

Tools and materials can be purchased via the "Electronic parts catalogue (ETKA)" ⇒ Electronic parts catalogue .

Overview
Air conditioner service station with flushing device – With integrated program for flushing the refrigerant circuit with refrigerant R1234yf and associated flushing device – With integrated analyser for detecting impurities in refrigerant R1234yf
Refrigerant R1234yf ⇒ Electronic parts catalogue
Extractor device (for refrigerant R1234yf) - Dry ice box ⇒ Electronic parts catalogue
Volkswagen/Audi car set adapter case ⇒ Electronic parts catalogue – For connecting the air conditioner service station to the refrigerant circuit for flushing and for bypassing removed components during flushing – For connecting certain components to a pressure hose for blowing through with compressed air or nitrogen
Leak detector for R1234yf/R134a ⇒ Electronic parts catalogue
Combination fine filter unit for compressed air system with oil, dirt and water separator (as commonly used for painting systems)⇒ Electronic parts catalogue .
Seals (different versions, ensure correct assignment) ⇒ Electronic parts catalogue
Refrigerant oil (different versions, ensure correct assignment)⇒ Electronic parts catalogue
Leak detection system with the following contents ⇒ Electronic parts catalogue : ◆ Cleaning agents ◆ UV leak detection lamp ◆ Replacement bulb for leak detection lamp ◆ Safety goggles ◆ Sticker ◆ Protective gloves ◆ System case
Tracer refill cartridge ⇒ Electronic parts catalogue
Refrigerant line release tools with quick release couplings ⇒ Electronic parts catalogue
Dismantling tool for refrigerant line quick release couplings ⇒ Electronic parts catalogue
Socket attachments for removing and installing valves ⇒ Electronic parts catalogue

3.2 Tools and materials that are available from specialist retailers



Note

This list provides an overview of the test equipment, tools and materials required for expert repair of the refrigerant circuit.

Overview
Condenser fin comb
Filler hoses, thread 5/8"-18 UNF
Filler hoses, external thread M12 x 1.5-6G to SAE J639 (included with air conditioner service station).
Cylinder connection piece for refrigerant pressure cylinder and sealing ring with quick release coupling connection or threaded connection (included with air conditioner service station).
Valve caps 5/8"-18 UNF
Pressure gauge set with pressure reducer for nitrogen
Quick release coupling adapter for service connections (included with air conditioner service station).
Open-ring spanner, size according to bolted joints at refrigerant lines
Connecting nipple for conical seal 5/8"-18 UNF
Compressed-air gun with rubber end piece
Hand shut-off valve 5/8"-18 UNF
Recycling cylinder for contaminated refrigerant R1234yf (from your gas supplier)
Digital thermometer
Protective gloves
Safety goggles
Dry ice as pellets (from your gas supplier or the internet)

3.3 Tools that you can produce yourself



Note

This list provides an overview of the test equipment, tools and materials required for expert repair of the refrigerant circuit.

Charging hose with connection to workshop compressed air system

A - Charging hose 5/8" - 18 UNF** (version with large ID)

B - Connection for workshop compressed air system ** (always use filter)

** Tools and materials that are available from specialist retailers.

