Workshop Manual

Audi 100 1991 ➤ , Audi 80 1992 ➤ ,
Audi A1 2011 ➤ , Audi A2 2001 ➤ ,
Audi A3 1997 ➤ , Audi A3 2004 ➤ ,
Audi A4 1995 ➤ , Audi A4 2001 ➤ ,
Audi A4 2008 ➤ ,
Audi A4 Cabriolet 2003 ➤ ,
Audi A5 Cabriolet 2009 ➤ ,
Audi A5 Coupé 2008 ➤ ,
Audi A5 Sportback 2010 ➤ ,
Audi A6 1995 ➤ , Audi A6 1998 ➤ ,
Audi A6 2005 ➤ ,
Audi A7 Sportback 2011 ➤ ,
Audi A8 1994 ➤ , Audi A8 2003 ➤ ,
Audi A8 2010 ➤ , Audi Cabriolet 1991 ➤ ,
Audi Q5 2008 ➤ , Audi Q7 2007 ➤ ,
Audi R8 2007 ➤ , Audi TT 1999 ➤ ,
Audi TT 2007 ➤

Air conditioner with refrigerant R134a

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List of Workshop Manual Repair GroupsList of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

Repair Group

87 - Air conditioning system

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.

Contents

87 – Air conditioning system

1 General information on air conditioning systems

1.1 Introduction

This manual is intended to provide foremen and mechanics with the basic knowledge needed to ensure reliable and successful repairs.

Note

This requires careful study of the manual, coupled with suitable training on automotive air conditioning systems (with a qualification test if applicable) and the ability to apply the acquired expertise in practice.

This document is a compact reference work which should be kept at the workplace. It should also be available for presentation to the responsible supervisory agency on request.

1.2 Other reference material

- Workshop manual for model-specific servicing work ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
- Technical Service Handbook (TPI) outlining action to be taken to rectify current problems
- Self-study programmes, e.g. ⇒ Self-study programme No. 208 ; Air conditioning systems in motor vehicles
- Video training courses for dealerships

- List of special tools and workshop equipment required for servicing air conditioning systems ⇒ Workshop equipment catalogue
- Service Organisation Handbook, Vol. „1“ „Additional equipment“ ⇒ Audi ServiceNet, Handbooks
- Air conditioner with refrigerant R12 Workshop Manual (for vehicles manufactured up to model year 1993; this Workshop Manual is available in hardcopy form only)

1.3 Principles of air conditioning systems

1.3.1 Physical principles

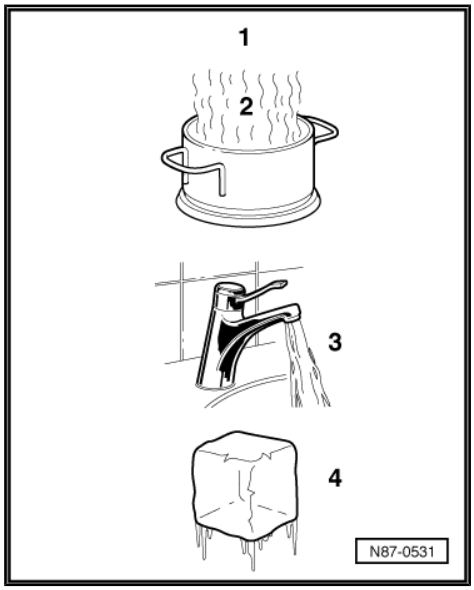
The four familiar states of water apply to air conditioning refrigerants, too.

1 - Gas (invisible)

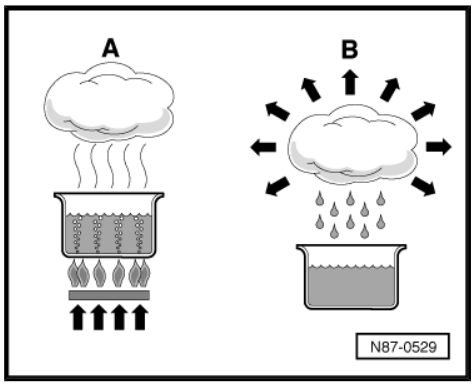
2 - Vapour

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 fast moving molecules of a warmer substance give off some of their energy to the cooler and thus slower molecules. As a result, the molecular motion of the warmer substance slows down and that of the colder substance is accelerated. This process continues until the molecules of both substances are moving at the same speed. They are then at the same temperature and no further heat exchange takes place.

1.3.2 Pressure and boiling point

The boiling point given in tables for a liquid is always referenced to an atmospheric pressure of 1 bar. If the pressure acting on a liquid changes, its boiling point also changes.

Note

Pressure may be given in various units: 1 MPa (megapascal) corresponds to 10 bar gauge pressure or 145 psi; 1 bar absolute pressure corresponds to 0 bar gauge pressure, which is roughly equivalent to atmospheric pressure.

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

The vapour pressure curves for water and refrigerant R134a show for example that, at constant pressure, reducing the temperature changes vapour to liquid (in the condenser) or that, for instance, reducing pressure causes the refrigerant to change from the liquid to the vapour state (in the evaporator).

Vapour pressure curve for water

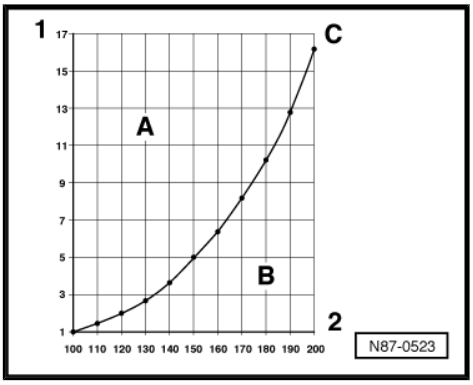
A - Liquid

B - Gaseous

C - Vapour pressure curve for water

1 - Pressure acting on liquid in bar (absolute)

2 - Temperature in °C



Vapour pressure curve for refrigerant R134a

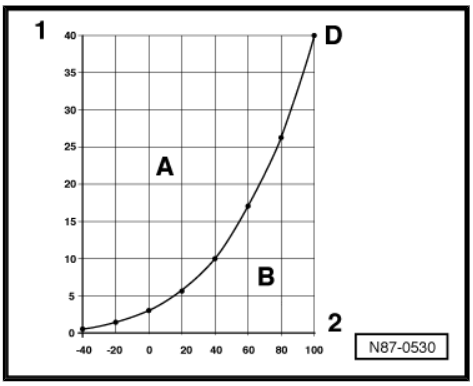
A - Liquid

B - Gaseous

D - Vapour pressure curve for refrigerant R134a

1 - Pressure acting on liquid in bar (absolute)

2 - Temperature in °C



1.3.3 Vapour pressure table for refrigerant R134a

The vapour pressure table for every refrigerant is published in literature for refrigeration system 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.

As there is a known characteristic vapour pressure table for every refrigerant, the type of refrigerant can be identified by way of pressure and temperature measurement.

Note

- *At absolute pressure, „0 bar“ corresponds to an absolute vacuum. Normal atmospheric pressure corresponds to „1 bar“ absolute pressure. On the scales of most pressure gauges, „0 bar“ corresponds to an absolute pressure of 1 bar (this is indicated by the value „-1 bar“ below „0“).*
- *Pressure may be given in various units: 1 MPa (megapascal) corresponds to 10 bar gauge pressure or 145 psi; 1 bar absolute pressure corresponds to 0 bar gauge pressure, which is roughly equivalent to atmospheric pressure.*

Temperature in °C	Pressure in bar (gauge pressure), R134a
-45	-0,61
-40	-0,49
-35	-0,34
-30	-0,16
-25	0,06
-20	0,32
-15	0,63
-10	1,00
-5	1,43
0	1,92
5	2,49
10	3,13
15	3,90
20	4,70
25	5,63
30	6,70
35	7,83
40	9,10
45	10,54
50	12,11
55	13,83
60	15,72
65	17,79
70	20,05
75	22,52
80	25,21
85	28,14
90	31,34

1.4 Refrigerant R134a

Vehicle air conditioning systems make use of the vaporisation and condensation process. These systems employ a substance with a low boiling point, referred to as refrigerant.

The refrigerant used is tetrafluoroethane R134a, which boils at -26.5°C at a vapour pressure of „1 bar“.

- Physical properties of refrigerant R134a ⇒ page 5

1.4.1 Physical properties of refrigerant R134a

Chemical formula	CH2F–CF3 or CF3–CH2F
Chemical designation	Tetrafluoroethane
Boiling point at 1 bar	-26.5 °C
Solidification point	-101.6 °C
Critical temperature	100.6 °C
Critical pressure	40.56 bar (absolute)

1.4.2 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 above its critical point is always in the gaseous state.

At temperatures below the critical point, all types of refrigerant in pressure vessels exhibit both a liquid and a gas phase, i.e. there is a layer of gas above the liquid.

As long as both liquid and gas are present in the vessel, the pressure is governed by ambient temperature ⇒ page 3 „Vapour pressure table“.

Note

Different types of refrigerant must never be mixed. The refrigerant specified for the respective air conditioning system must be used exclusively.

1.4.3 Environmental aspects of refrigerant R134a

- R134a is a fluorocarbon and contains no chlorine.
- R134a has a shorter atmospheric lifespan than refrigerant R12.
- R134a does not damage the ozone layer, the ozone depletion potential is zero.
- The global warming potential (GWP) of R134a is 1300 (the GWP of carbon dioxide = 1).
- The global warming effect of R134a is ten times less than that of refrigerant R12.

1.5 Properties of refrigerant R134a

- Charge factor ⇒ page 7
- Tracing leaks ⇒ page 7

1.5.1 Trade names and designations

The refrigerant R134a is currently available under the following trade names:

- H-FKW 134a
- SUVA 134a
- KLEA 134a

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 designations Frigen and Freon are trade names. They also apply to refrigerants which should not be used in vehicles.*

1.5.2 Colour

Like water, refrigerants are colourless in both vapour and liquid form. 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). Liquid refrigerant R134a may have a coloured (milky) appearance in a sight glass. This cloudiness is caused by partially dissolved refrigerant oil and does not indicate a fault.

1.5.3 Vapour pressure

In a partially filled, closed vessel, the quantity of refrigerant evaporating from the surface equals the quantity returning to the liquid state as vapour particles condense. This state of equilibrium occurs under the influence of pressure and is often called vapour pressure. Vapour pressure is dependent on temperature ⇒ page 3 „Vapour pressure table“.

1.5.4 Physical properties of R134a

As the vapour pressure curves of R134a and other refrigerants are sometimes very similar, unequivocal identification cannot be made simply on the basis of pressure.

When using R134a, the air conditioner compressor is lubricated by means of special synthetic refrigerant oils, e.g. PAG oils (polyalkylene glycol oils).

1.5.5 Reaction with metals

In its pure state, refrigerant R134a is chemically stable and does not corrode iron or aluminium.

However, contamination of the refrigerant, e.g. with chlorine compounds, leads to the corrosion of certain metals and plastics. This can result in blockage, leaks or deposits at the air conditioner compressor piston.

1.5.6 Critical temperature/critical pressure

The refrigerant R134a remains chemically stable up to a gas pressure of 39.5 bar (corresponding to a temperature of 101 °C). Above this temperature, the refrigerant decomposes (refer to "Combustibility").

1.5.7 Water content

Only very small amounts of water are soluble in liquid refrigerant. On the other hand, refrigerant vapour and water vapour mix in any ratio.

Any water in the refrigerant circuit will be entrained in droplet form once the dryer in the receiver or reservoir has absorbed as little as approx. 7 g of water. This water flows as far as the expansion valve nozzle or the restrictor and turns to ice. The air conditioner will then no longer provide any cooling effect.

Water causes irreparable damage to the air conditioner because at high pressures and temperatures it combines with other impurities to form acids.

1.5.8 Combustibility

Refrigerant is non-flammable. In fact it has a fire-inhibiting or fire-extinguishing effect. Refrigerant decomposes when exposed to flames or red-hot surfaces. UV light (produced for example during electric welding) also causes refrigerant decomposition. The resultant decomposition products are toxic and must not be inhaled. However, these chemicals irritate the mucous membranes, giving adequate warning of their presence.

1.5.9 Charge factor

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 forces are 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 maximum permissible capacity is calculated by multiplying this "charge factor" by the internal volume of the vessel. The figure for the refrigerant used in motor vehicles is 1.15 kg/litre.

1.5.10 Tracing leaks

External damage, for example, can cause a leak in the refrigerant circuit. 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. For example, a leak detector for R12 refrigerant is not appropriate for R134a, as R134a refrigerant has no chlorine atoms and the leak detector therefore does not respond.

1.6 Refrigerant oil

Refrigerant oil mixes with the refrigerant (about 20 - 40 %, depending on compressor type and amount of refrigerant) and circulates constantly in the system, lubricating the moving parts.

Special synthetic refrigerant oils, e.g. polyalkylene glycol (PAG) oil, are used in conjunction with R134a air conditioning systems. This is necessary as mineral oil, for example, does not mix with

R134a. In addition, the materials of the R134a air conditioning system could be corroded as a result of mixture flowing through the refrigerant circuit under pressure at high temperatures or breakdown of the lubricating film in the air conditioner compressor. The use of non-approved oils can lead to the failure of the air conditioning system; exclusive use is therefore to be made of authorised oils.

⇒ Electronic parts catalogue

Type of oil for R134a in motor vehicles: PAG. (polyalkylene glycol)

Note

- *Do not store refrigerant oils in open containers as they are extremely hygroscopic (water-absorbing).*
- *Always keep oil containers sealed.*
- *Do not re-use old refrigerant oil. It must be disposed of as used oil of unknown origin ⇒ Audi-ServiceNet, HSO Environmental Protection .*
- *Ester-based oils are only intended for use with large systems (not for motor vehicle air conditioners).*

- Properties of refrigerant oil ⇒ page 8

1.6.1 Properties of refrigerant oil

The most important properties are a high degree of solubility with refrigerant, good lubricity, absence of acid and minimal water content. It is therefore only permissible to use certain specified oils. For a list of approved refrigerant oils and capacities, refer to ⇒ page 164 .

PAG oils, which are appropriate for refrigerant R134a, are highly hygroscopic and do not mix with other oils. Opened containers should therefore be closed again immediately to prevent ingress of moisture. Moisture and acids promote the ageing of refrigerant oil, causing it to become dark, viscous and corrosive towards metals.

Note

- *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 ⇒ Audi-ServiceNet, HSO Environmental Protection .*
- *Only oil approved for the air conditioner compressor is to be used for refrigerant circuits containing refrigerant R134a ⇒ Electronic parts catalogue and capacities ⇒ page 164 .*

1.7 How air conditioning works

The temperature in the passenger compartment depends on the amount of heat radiated into the vehicle 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 con-

ditioner compressor increases the heat content and temperature of the refrigerant. Its temperature is then substantially higher than that of the surrounding air.

The hot refrigerant flows with its heat content to the condenser, where the refrigerant dissipates its heat to the surrounding air via the condenser due to the temperature gradient between the refrigerant and the surrounding air.

The refrigerant thus acts as a heat transfer medium. As it is reused, the refrigerant is returned to the evaporator.

For this reason all air conditioning systems are based on the refrigerant circulation principle. There are however differences as regards the units used.

- Comfort of vehicle occupants ⇒ page 9
- Environmental aspects ⇒ page 9

1.7.1 Comfort of vehicle occupants

A basic requirement for concentration and safe driving is a feeling of comfort in the passenger compartment. Especially when conditions are hot and humid, a good level of comfort can only be achieved with air conditioning. Comfort can of course also be enhanced by opening windows/the sun roof or increasing the air output. Such a course of action is however associated with certain drawbacks for the occupants of the vehicle, e.g. more noise, draughts, exhaust fumes and unfiltered pollen (unpleasant for allergy sufferers).

Climate control together with a good heating and ventilation system concept can create a sense of wellbeing and comfort by regulating the temperature, humidity and air circulation in the passenger compartment to suit ambient conditions, with the vehicle both stationary and moving.

Other important advantages of air conditioning:

- Purification of the air supplied to the passenger compartment (dust and pollen, for example, are washed out by the moist fins of the evaporator and removed with the condensate).
- Temperatures in a mid-size car (example: after short travelling time, ambient 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

1.7.2 Environmental aspects

Since about 1992, the air conditioning systems of newly manufactured cars have been successively changed to refrigerant R134a. This refrigerant contains no chlorine and therefore does not deplete the ozone layer.

Up until roughly 1992, refrigerant R12 was used for air conditioning systems. Due to its chlorine atoms, this CFC had a high ozone depletion potential as well as potential for intensifying the greenhouse effect.

Conversion programmes are available for old existing systems filled with the ozone-depleting substance R12 ⇒ Workshop Manual for air conditioners with refrigerant R12 (this Workshop Manual is available in hardcopy form only).

For environmental reasons, refrigerants must not be released into the atmosphere ⇒ page 40 (see the relevant environmental legislation).

1.8 General work safety

- In accordance with regulations of the German industrial liability insurance association, VBG 20, (other regulations may apply in other countries)
- Heed the workplace-specific instructions ⇒ Audi-ServiceNet, HSO Environmental Protection , which are to be displayed at refrigerant workplaces.

1.9 Product properties

Refrigerants used in motor vehicle air conditioning systems belong to the new generation of refrigerants based on chlorine-free, partially fluorinated hydrocarbons (H-FKW, R134a; other names may be used in other countries).

With regard to their physical properties, these are refrigerants which have been liquefied under pressure. They are subject to the regulations governing pressure vessels and may only be used in approved and appropriately marked containers.

Specific requirements must be observed to ensure safe and proper handling:

1.10 Handling refrigerant

If refrigerant vessels are opened, the contents may escape in liquid or vapour form. The higher the pressure in the vessel, the more vigourous the process.

The pressure level is governed by two factors:

- The type of refrigerant in the vessel. „Rule: The lower the boiling point, the higher the pressure.“
- The temperature level. „Rule: The higher the temperature, the higher the pressure.“

WARNING

- *Do not open vessels containing refrigerant.*

Wear safety goggles

Put on safety goggles to prevent refrigerant getting into the eyes, as this could cause severe injury through frostbite.

Wear protective gloves and apron

Grease and oils dissolve readily in refrigerants. They would therefore damage the protective layer of grease if allowed to come into contact with the skin. Degreased skin is however sensitive to the cold and germs.

Do not allow liquid refrigerant to come into contact with the skin

The refrigerant draws heat for evaporation from the surrounding area - even if this is the skin. This may give rise to extremely low temperatures and result in local frostbite (boiling point of R134a: -26.5 °C at ambient pressure).

Do not inhale refrigerant vapours

If refrigerant vapour escapes in concentrated form, it mixes with the surrounding air and displaces the oxygen necessary for breathing.

Smoking is absolutely prohibited

A burning cigarette can cause refrigerant to decompose. The resultant substances are toxic and must not be inhaled.

Welding and soldering on refrigeration systems

Before performing welding, brazing or soldering work on vehicles in the vicinity of air conditioning system components, extract refrigerant and remove any remaining refrigerant by blowing out with nitrogen.

The products of decomposition of the refrigerant arising from the effect of heat are not only toxic, but also highly corrosive and can therefore damage pipes and sections of the system. The principal substance is hydrogen fluoride.

Pungent odour

A pungent odour indicates that the products of decomposition mentioned above have already formed. Avoid inhaling these substances under all circumstances, as otherwise the airways, lungs and other organs could be damaged.

First aid

- Following accidental contact with eyes or mucous membranes, immediately rinse with copious amounts of running water and consult an eye specialist.
- Following accidental contact with the skin, immediately remove clothing affected and rinse skin with copious amounts of water.
- Following accidental inhalation of concentrated refrigerant vapours, the person concerned must be taken immediately into the open air. Call a doctor. Administer oxygen in the event of breathing difficulties. If the person affected is having great difficulty breathing or is not breathing at all, tilt back head and administer artificial respiration.

◆ Handling pressure vessels ⇒ page 11

1.11 Handling pressure vessels

Secure vessels to prevent them falling over.

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

Pressure vessels must never be thrown.

If dropped, the vessels could be so severely deformed that they rupture. The refrigerant evaporates immediately, liberating considerable force. Flying fragments of cylinders can cause severe injuries.

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

Valves may break off if cylinders are not properly transported.

Never store in the vicinity of radiators.

High temperatures may occur in such 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 avoid possible risk, pressure vessel regulations specify that vessels are not to be heated to in excess of 50 °C.

Do not heat in an uncontrolled manner

Do NOT heat with a naked flame. Local overheating can cause structural changes in the material of the vessel, which then reduce

its ability to withstand pressure. There is also a danger of refrigerant decomposition due to localised overheating.

Sealing empty vessels

Empty refrigerant vessels must always be sealed to prevent the ingress of moisture. Moisture causes steel containers to rust. This weakens the vessel walls. In addition, any rust particles which enter refrigeration systems from storage vessels will cause malfunctioning.

1.12 Safety regulations for working with extraction and charging systems

- Before connecting the charging system to the air conditioning system, ensure that the shut-off valves are closed.
- Before disconnecting the charging system from the air conditioning system, ensure that the process has been completed so that no refrigerant can escape into the atmosphere.
- Once the purified refrigerant from the charging system has been transferred to an external compressed-gas cylinder, close the hand shut-off valves at the cylinder and charging system.
- Do not expose the charging system to moisture or use it in a wet environment.
- Disconnect from power supply before performing service work on the charging system.
- An extension cable should not normally be used because it can increase the fire hazard. If the use of an extension cable is unavoidable, the minimum cross-section should be 2.5 mm^2.
- In case of fire, remove external cylinder.
- Entrained oil from the air conditioning system drawn off by the suction unit into the measurement vessel supplied is subsequently to be transferred to a sealable container, as it contains a small quantity of refrigerant which must not be released into the environment.
- Following shutdown, the air conditioner service station must be secured to stop it rolling away.

1.13 Safety measures for working on vehicles with air conditioning system and for handling refrigerant R134a

WARNING

- *It is advisable to keep an eye bath to hand.*
- *Should liquid refrigerant come into contact with the eyes, rinse them thoroughly with water for about 15 minutes. Then administer eye drops and consult a doctor immediately even if no pain is felt.*
- *The doctor must be informed that the frostbite was caused by refrigerant R134a. Should refrigerant come into contact with other parts of the body despite compliance with the safety regulations, these must likewise be rinsed immediately for approximately 15 minutes with cold water.*
- *Work may only be performed on the refrigerant circuit of an air conditioning system in well ventilated areas. Switch on workshop extraction systems, if available.*
- *Refrigerant must not be stored in low-level areas (e.g. cellars) and their exits or light wells.*

- Welding, brazing and soldering work must not be performed on components of air conditioning system when charged. 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:

Exposure to heat gives rise to considerable pressure in the system, which could cause the pressure relief valve to open.

Remedy:

– Discharge refrigerant circuit using air conditioner service station.

Note

Damaged or leaking components of the air conditioning system are not to be repaired by welding or soldering. They must always be replaced.

Refrigerant vessels (e.g. charging cylinders of air conditioner service station) must never be subjected to excessive heat or exposed to direct sunlight.

Remedy:

– Vessels must never be completely filled with liquid refrigerant. Without sufficient room for expansion (gas cushion), vessels will rupture with explosive effect in the event of an increase in temperature ⇒ page 5 .

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

Remedy:

– Evacuate systems and containers before charging with refrigerant.

1.14 Basic rules for working on refrigerant circuit

- General notes ⇒ page 14
- Cleaning refrigerant circuit ⇒ page 14 .
- Additionally for vehicles with air conditioner compressor with no magnetic clutch (with air conditioner compressor regulating valve -N280-) ⇒ page 15
- O-rings ⇒ page 15

1.14.1 General notes

- Heed the workplace-specific instructions ⇒ Audi-ServiceNet, HSO Environmental Protection .
- Ensure absolute cleanliness when working.
- Wear safety goggles and gloves when working with refrigerant and nitrogen.
- Switch on workshop extraction systems, if available.
- Always use air conditioner service station to discharge refrigerant circuit, then unfasten screw connections and renew defective components.
- Use caps to seal off opened assemblies and hoses to prevent the ingress of moisture and dirt.
- Use only tools and materials intended for refrigerant R134a.
- Seal opened refrigerant oil containers to protect against moisture.

Note

- *After completing service work, screw sealing caps (with seals) onto all connections with valves and service connections.*
- *Before starting up the air conditioning system, heed the vehicle-specific capacities ⇒ page 144 .*
- *Do not top up refrigerant in circuit; discharge existing refrigerant and re-charge system.*

1.14.2 Cleaning refrigerant circuit

The refrigerant circuit must be flushed out with refrigerant R134a ⇒ page 59 (or blown out with compressed air and nitrogen ⇒ page 55) in the following cases:

– If moisture or dirt has ingressed into the refrigerant circuit (e.g. following an accident).
– If the refrigerant oil is dark and viscous.
– If there is too much refrigerant oil in the refrigerant circuit after compressor replacement.
– If the air conditioner compressor has to be replaced on account of „internal“ damage (e.g. noise or no output).

Note

When blowing out components with compressed air and nitrogen, always extract the gas mixture escaping from the components with suitable extraction units (workshop extraction system).

1.14.3 Additionally for vehicles with air conditioner compressor with no magnetic clutch (with air conditioner compressor regulating valve -N280-)

- The engine is only to be started following complete assembly of the refrigerant circuit (constant air conditioner compressor operation).
- If the engine has to be operated with the refrigerant circuit empty, only do so for as long as absolutely essential and avoid high engine speeds.

1.14.4 O-rings

- ♦ Make exclusive use of seals which are resistant to refrigerant R134a and the related refrigerant oils. Colour coding of O-ring seals is no longer employed. Black and coloured O-rings are used.
- ♦ Pay attention to the correct inside diameter of the seals used ⇒ Electronic parts catalogue , ⇒ Heating, air conditioning; Rep. gr. 87 and / or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- ♦ Seals may only be used once.
- ♦ Before fitting, moisten seals slightly with refrigerant oil (PAG oil).

1.15 Before using air conditioner after system has been re-charged

- Give the air conditioner compressor approx. 10 turns by hand by way of the magnetic clutch plate or the pulley.
- Start the engine with the air conditioning system switched off (air conditioning system magnetic clutch -N25- and air conditioner compressor regulating valve -N280- are not actuated).
- Switch on the air conditioner compressor once the idling speed has stabilised and run it for at least 10 minutes at idle in the maximum cooling output setting.

2 General information on refrigerant circuit

2.1 Components of refrigerant circuit

- All components of the refrigerant circuit submitted for quality observation are always to be sealed (use the original sealing caps of the replacement part).
- Renew damaged or leaking components of refrigerant circuit ⇒ page 136 .

Note

The following replacement parts (air conditioner compressor, reservoir, evaporator and condenser) have so far been filled with nitrogen gas. This charge is being gradually discontinued. Consequently, no or only very slight pressure equalisation is perceptible on unscrewing the sealing plugs from the replacement part.

2.2 Arrangement of the refrigerant circuit components and their influence on the high and low-pressure ends

High-pressure end: Condenser, receiver and restrictor or expansion valve to separate the high and low-pressure liquid ends.

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.

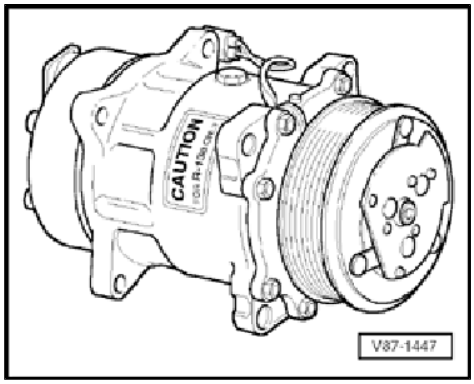
Excess pressure occurs if too much refrigerant or refrigerant oil is used, the condenser is contaminated, the radiator fan is defective, the system is blocked or in the event of moisture in the refrigerant circuit (icing-up of restrictor or expansion valve).

Low-pressure end: Evaporator, evaporator temperature sensor and air conditioner compressor to separate the high and low-pressure gas ends.

A drop in system pressure can be caused by a loss of refrigerant, the restrictor or expansion valve (constrictions), a defective air conditioner compressor or an iced-up evaporator.

- Air conditioner compressor ⇒ page 18
- Condenser ⇒ page 19
- Evaporator ⇒ page 19
- Reservoir ⇒ page 19
- Restrictor ⇒ page 20
- Receiver ⇒ page 21
- Expansion valve ⇒ page 22
- Refrigerant line with internal heat exchanger ⇒ page 22
- Quick-release couplings on refrigerant line ⇒ page 23
- O-rings ⇒ page 24
- Pipes and hoses of refrigerant circuit ⇒ page 24
- Pressure relief valve ⇒ page 25

2.2.1 Air conditioner compressor



The air conditioner compressor is driven by the engine via a poly V-belt or a drive shaft.

Air conditioner compressor with magnetic clutch:

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

Air conditioner compressor with no magnetic clutch:

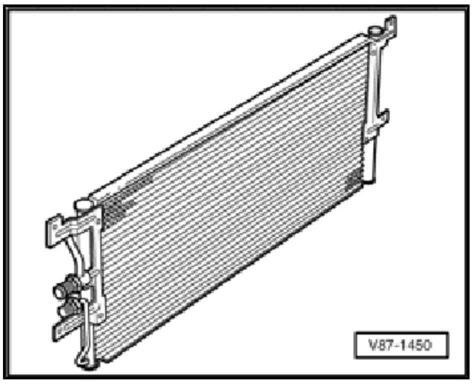
An overload safeguard attached to the pulley or fitted in the drive unit of the air conditioner compressor is triggered if the air conditioner compressor is not running smoothly in order to protect the belt drive against overload.

The air conditioner compressor draws in refrigerant gas from the evaporator, compresses it and conveys it to the condenser.

Note

- *The air conditioner compressor contains refrigerant oil which mixes with refrigerant R134a at all temperatures.*
- *The rating plate indicates the refrigerant for which the air conditioner compressor is designed. A valve regulates the pressure on the low-pressure side within the specified range (control characteristic).*
- *A regulating valve is actuated externally on air conditioner compressors with no magnetic clutch.*
- *On air conditioner compressors with no magnetic clutch, the engine is only to be started following complete assembly of the refrigerant circuit.*
- *To prevent air conditioner compressor damage if the refrigerant circuit is empty, the magnetic clutch is deactivated and the air conditioner compressor regulating valve -N280- no longer actuated (air conditioner compressor idles with engine).*
- *If the refrigerant circuit is empty, an air conditioner compressor with no air conditioning system magnetic clutch -N25- (with air conditioner compressor regulating valve -N280-) is switched to internal lubrication by way of a valve.*
- *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.*

2.2.2 Condenser



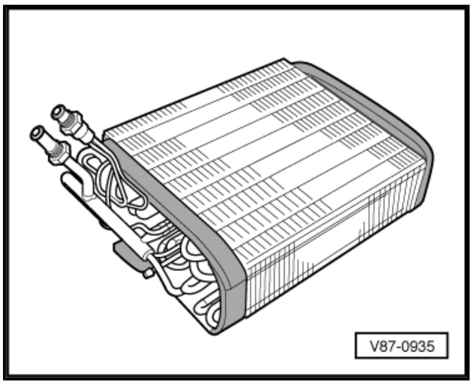
The condenser dissipates heat from the compressed refrigerant gas to the surrounding air.

During this process, the refrigerant gas condenses to form liquid.

Note

Depending on the design of the refrigerant circuit, the receiver may be attached to the condenser or installed in (integrated into) the condenser ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .

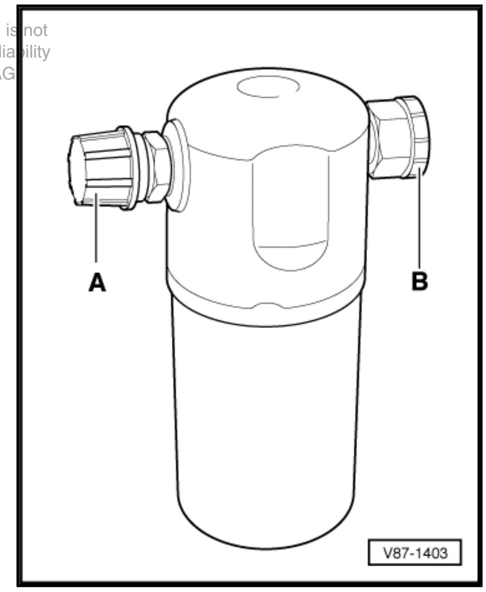
2.2.3 Evaporator



The liquid refrigerant evaporates in the coiled pipes of the evaporator. The heat required for this is extracted from the air flowing past the evaporator fins. The air cools down. The refrigerant evaporates and is drawn in by the air conditioner compressor together with the heat absorbed.

A defined quantity of refrigerant is supplied to the evaporator by way of a restrictor or expansion valve. In systems with an expansion valve the flow rate is regulated such that only gaseous refrigerant emerges at the evaporator outlet.

2.2.4 Reservoir



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.

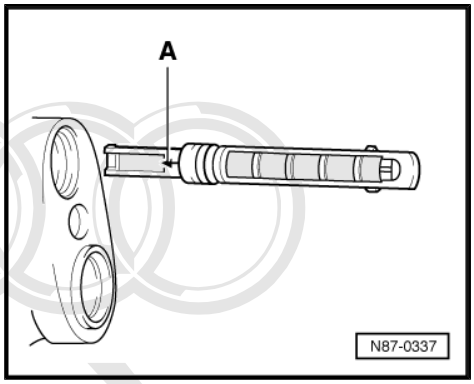
Gaseous refrigerant with oil is drawn in by the air conditioner compressor.

Note

- *Renew reservoir if refrigerant circuit has been open for a relatively long period and moisture has ingressed, or if replacement is stipulated due to a specific complaint* *⇒ page 136* *.*
- *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).*

2.2.5 Restrictor

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. A strainer is provided upstream of the constriction to trap dirt. The strainer downstream of the constriction is designed to atomise the refrigerant before it enters the evaporator.

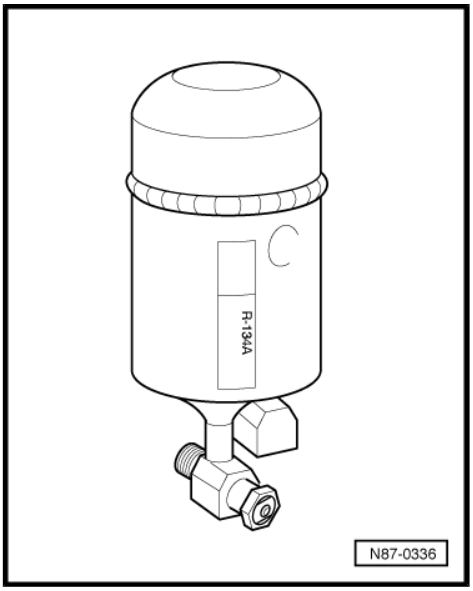


Note

- *Arrow -A- on restrictor faces evaporator.*
- *Always replace after opening the circuit.*
- *Different versions exist; heed the applicable notes in the various service information booklets ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*

2.2.6 Receiver

The receiver collects the droplets of liquid and conveys them in a continuous stream to the expansion valve. Any moisture ingressing into the refrigerant circuit during assembly is collected by a dryer in the receiver.

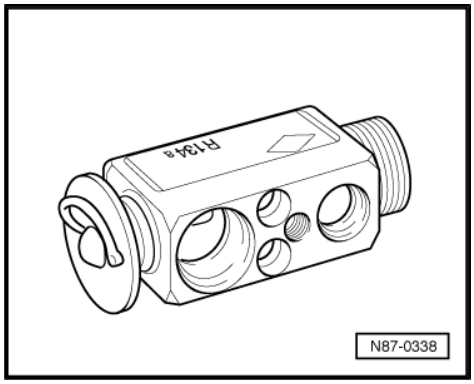


Note

- *Renew receiver if refrigerant circuit has been open for a relatively long period and moisture has ingressed, or if replacement is stipulated due to a specific complaint ⇒ page 136 .*
- *Do not remove the sealing plugs until immediately prior to installation.*
- *If the receiver is not sealed, the desiccant bag soon becomes saturated with moisture and thus unusable.*
- *When installing, observe arrow indicating direction of flow (if applicable).*
- *Depending on the design of the refrigerant circuit, the receiver may also be attached to the condenser or installed in (integrated into) the condenser ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *The procedure for dealing with problems differs depending on the version of the receiver / dryer cartridge. 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 into the condenser and it is not possible to replace the receiver/dryer cartridge separately, it may be necessary to replace the entire condenser ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *Depending on the design of the refrigerant circuit, the desiccant bag (dryer cartridge) may also be installed in the condenser ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*

2.2.7 Expansion valve

The expansion valve atomises the refrigerant flowing in and controls the flow rate in line with the quantity of heat transferred such that it does not become gaseous before reaching the evaporator outlet.

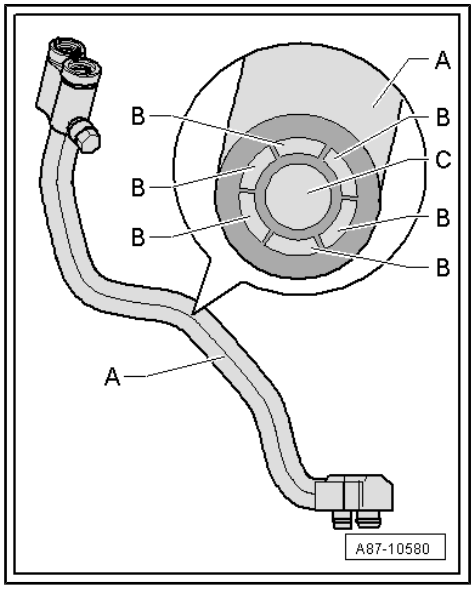


Note

- *Pay attention to the correct part number on replacing the expansion valve ⇒ Electronic parts catalogue .*
- *Different characteristic curves matched to the appropriate circuit ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *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.*

2.2.8 Refrigerant line with internal heat exchanger

In this refrigerant line, the hot refrigerant (liquid) flowing through the high-pressure side gives off energy to the cold refrigerant (gaseous or vaporous) flowing through the low-pressure side, thus enhancing the efficiency of the air conditioner.



Note

This illustration shows a refrigerant pipe with an internal heat exchanger as fitted for example on the Audi A4 2008 > and the Audi A5 Coupé 2008 > ⇒ Air conditioning; Rep. gr. 87 (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).

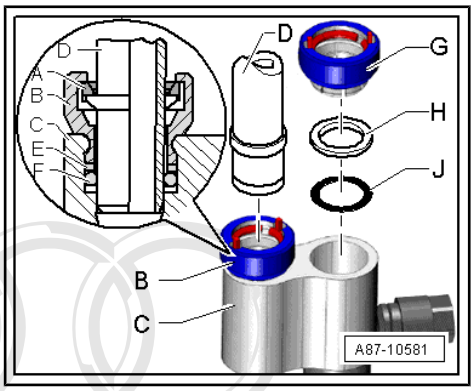
2.2.9 Quick-release couplings on refrigerant line

WARNING

Only release and open the quick-release couplings after completely discharging the refrigerant circuit.

Note

- *This illustration shows the quick-release couplings with a refrigerant pipe with an internal heat exchanger as fitted for example on the Audi A4 2008 > and the Audi A5 Coupé 2008 > ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *Removal of the refrigerant line -D- involves opening the retaining ring -A- with the air conditioner line release tool -T40149/- for example ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *Following removal of the applicable refrigerant pipe, the quick-release couplings -B- and -G- are to be replaced together with the corresponding support ring -E- or -H- and the corresponding O-ring -F- or -J- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*



A - Retaining ring (in quick-release coupling, high-pressure side)

B - Quick-release coupling with retaining ring („high-pressure side“)

C - Refrigerant pipe with an internal heat exchanger

D - Refrigerant line („high-pressure side“)

E - Support ring („high-pressure side“)

F - O-ring („high-pressure side“)

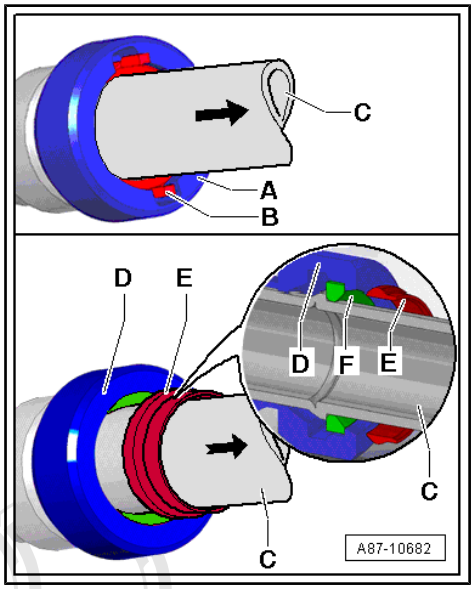
G - Quick-release coupling with retaining ring („low-pressure side“)

H - Support ring („low-pressure side“)

J - O-ring („low-pressure side“)

Note

- ♦
- ♦ *There are different versions -A- and -D- of the quick-release couplings. With both versions of these quick-release couplings, the refrigerant lines -C- can be released in the identical manner using the air conditioner line release tool -T40149/1- for example and removed.*
- ♦ *With the quick-release coupling -A- fitted at the start of production, the pins -B- become visible after fitting the refrigerant line -C- if the locked refrigerant line -C- is pulled in arrow direction.*
- ♦ *With the quick-release coupling -A- to be gradually introduced as of Model Year 2010, the refrigerant line -C- is fitted in the same manner as for the 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-.*



2.2.10 O-rings

These rings seal the joints between the individual components of the refrigerant circuit.

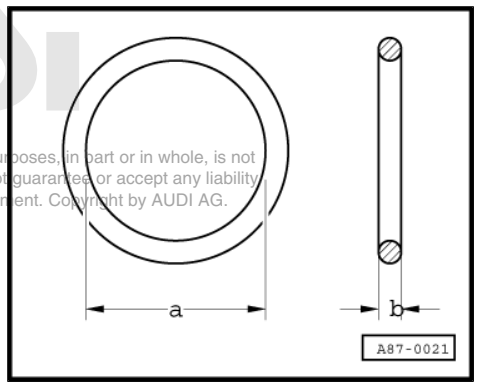
Only O-rings resistant to R134a refrigerant and the related refrigerant oils are to be used. This is guaranteed if genuine replacement parts are used.

O-rings:

– Use only once.

– Observe correct diameters -a- and -b-.

– Moisten with refrigerant oil before fitting ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .



Note

The colour coding of O-rings for R134a refrigerant circuits has been discontinued. Use is made of black and coloured O-rings ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

2.2.11 Pipes and hoses of refrigerant circuit

The mixture of refrigerant oil and refrigerant R134a corrodes certain metals (e.g. copper) and alloys and dissolves certain hose materials. Therefore, always use genuine replacement parts.

The pipes and hoses are held together by bolted joints or by way of special connectors.

Note

Observe specified torques for bolted joints and use the specified release tools for connectors.

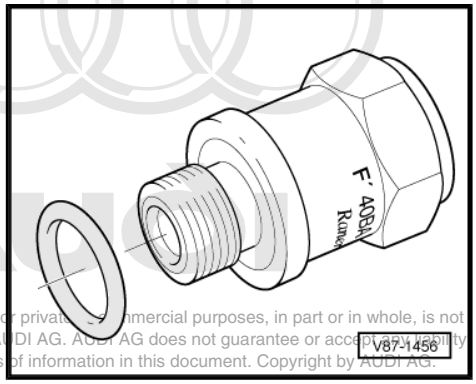
2.2.12 Pressure relief valve

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

The valve opens at a pressure of approx. 38 bar and closes again when the pressure has dropped (approx. 30 bar).

Not all the refrigerant escapes.

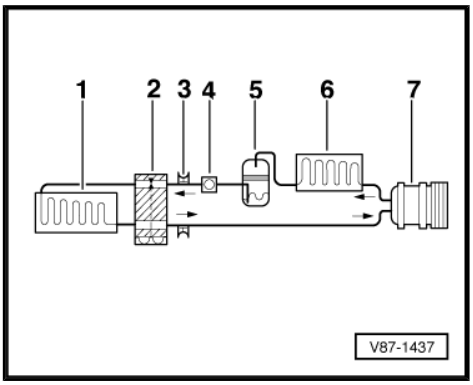
Certain versions feature a transparent plastic disc which breaks off as soon as the valve responds.



2.3 Design of refrigerant circuit

- Refrigerant circuit with expansion valve and evaporator ⇒ page 25
- Refrigerant circuit with restrictor and reservoir ⇒ page 25

2.3.1 Refrigerant circuit with expansion valve and evaporator

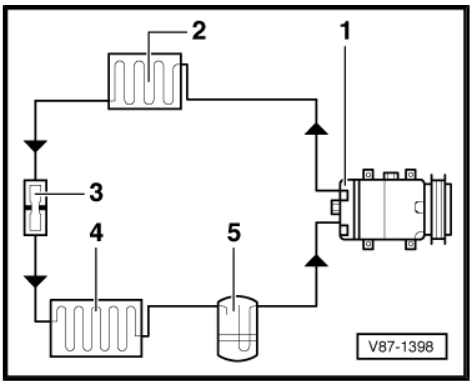


1 - Evaporator
2 - Expansion valve
3 - Valve for extraction, charging and measurement
4 - Sight glass (not fitted with R134a circuits)
5 - Receiver with dryer
6 - Condenser
7 - Air conditioner compressor

Note

Arrows show direction of refrigerant flow.

2.3.2 Refrigerant circuit with restrictor and reservoir



1 - Air conditioner compressor
2 - Condenser
3 - Restrictor
4 - Evaporator
5 - Reservoir

Note

Arrows show direction of refrigerant flow.

2.4 Connections for quick-release coupling in refrigerant circuit

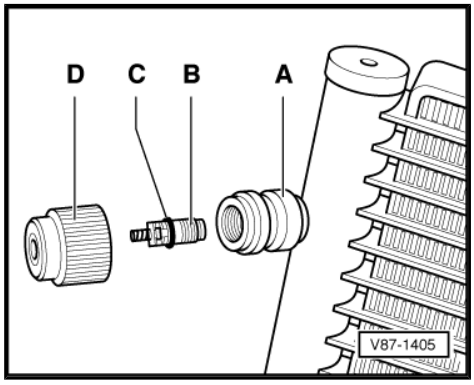
- Only valves and connections resistant to R134a refrigerant and the related refrigerant oils are to be used.
- There are different connections (outer diameter) for high and low-pressure sides.
- Discharge refrigerant circuit before removing valves or valve cores.
- Always screw on sealing caps.

Layout in vehicle ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific Workshop Manual).

♦ Connections with Schrader valve (needle valve) ⇒ page 26

♦ Connections with primary sealing valve (ball valve) ⇒ page 27

2.4.1 Connections with Schrader valve (needle valve)



♦ -A- Service connection (soldered in)

♦ -B- Valve core (designation: Schrader valve or needle valve)

♦ -C- O-ring (for valve)

♦ -D- Sealing cap with seal

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 core -B- with the refrigerant circuit drained, make use of an adapter from the socket - T10364- for example.*

♦ *Take care when tightening valve core -B- (low torque).*

♦ *There are different versions of these valves and the tightening torques therefore also differ. The tightening torque for a valve insert -B- with a VG5 thread (5.2 x 0.7 mm, tyre valve) is 0.4 Nm +- 0.1 Nm. For a valve insert with an M6 x 0.75 mm thread, the tightening torque is 0.9 Nm +- 0.1 Nm and for a valve insert with an M8 x 1.0 mm thread it is 2.0 Nm +- 0.2 Nm.*

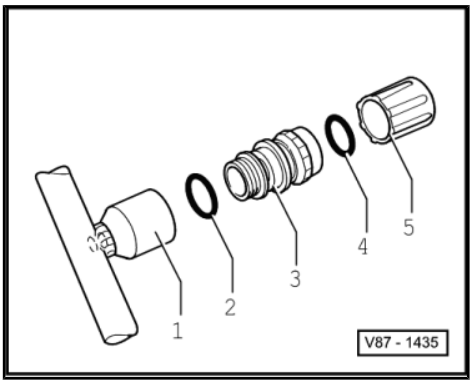
♦ *There are different versions of these valves, the valve cores and the corresponding sealing caps. Attention is to be paid to the correct version of the valve core and correct assignment of the sealing caps ⇒ Electronic parts catalogue .*

2.4.2 Connections with primary sealing valve (ball valve)

WARNING

Before unscrewing connection, connect air conditioner service station and extract refrigerant. The refrigerant circuit must be empty; danger of injury.

Connection with high-pressure valve



1 - Connection with internal thread (soldered in)

2 - O-ring (version and identification: black or coloured ⇒ Electronic parts catalogue)

3 - Valve with external thread and groove for O-ring (designation: Ball valve)

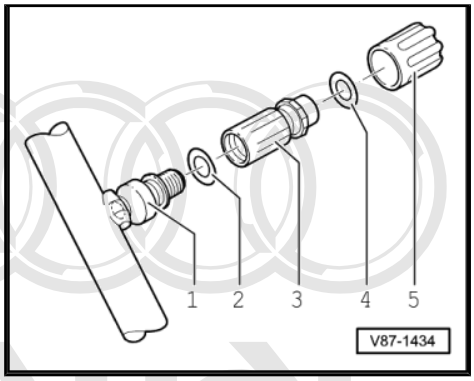
4 - Seal for sealing cap

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. The tightening torque for the valves -3- used at present with an M12 x 1.5 mm external thread is 9 Nm +- 1 Nm.*
- *There are different versions of these valves and the corresponding sealing caps. Attention is to be paid to the correct version of the valve and correct assignment of the sealing cap ⇒ Electronic parts catalogue .*

Connection with low-pressure valve



1 - Connection with external thread and groove for O-ring (soldered in)

2 - O-ring (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. The tightening torque for the valves -3- used at present with an M10 x 1.25 mm internal thread is 9 Nm +- 1 Nm.*
- *There are different versions of these valves and the corresponding sealing caps. Attention is to be paid to the correct version of the valve and correct assignment of the sealing cap ⇒ Electronic parts catalogue .*

2.5 Switches and senders in refrigerant circuit and related connections

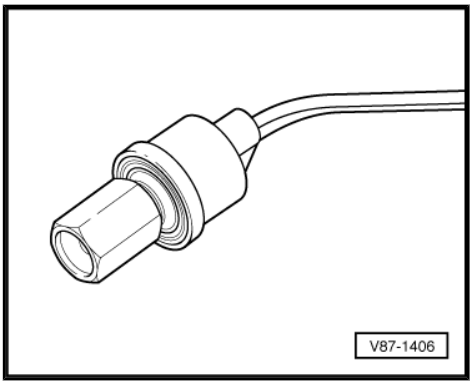
Note

Refer to vehicle-specific refrigerant circuit for switching pressures, switch removal/installation and switch layout/design ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

- High-pressure switch for air conditioning system -F23- ⇒ page 29
- High-pressure switch for magnetic clutch -F118- ⇒ page 29
- Low-pressure switch for air conditioning system -F73- ⇒ page 29
- Air conditioning system pressure switch -F129- ⇒ page 30
- High-pressure sender -G65- ⇒ page 30
- Refrigerant pressure and temperature sender -G395- ⇒ page 31
- Connections with valve for refrigerant circuit switches ⇒ page 29
- Air conditioner compressor regulating valve -N280- ⇒ page 31
- Air conditioning system compressor speed sender -G111- ⇒ page 32

♦ Refrigerant temperature sender -G454- ⇒ page 32

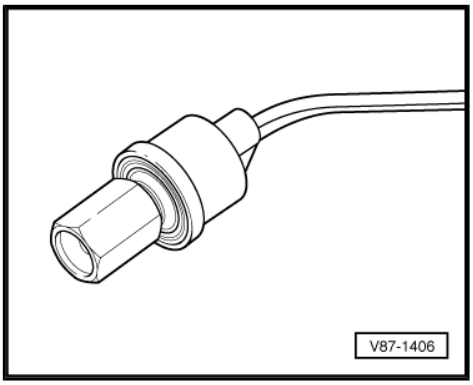
2.5.1 High-pressure switch for air conditioning system -F23-



Function:

Switches the radiator fan up to the next speed setting in the event of a pressure increase in the refrigerant circuit (approx. 16 bar).

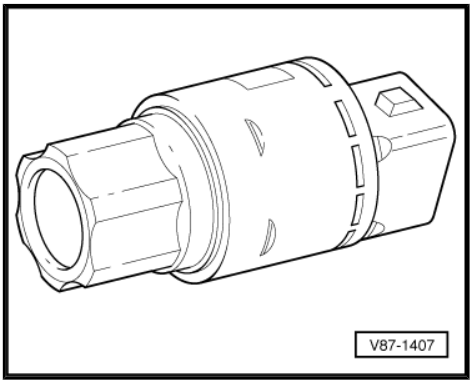
2.5.2 High-pressure switch for magnetic clutch -F118-



Function:

Switches off the air conditioner compressor in the event of excess pressure in the refrigerant circuit (approx. 32 bar).

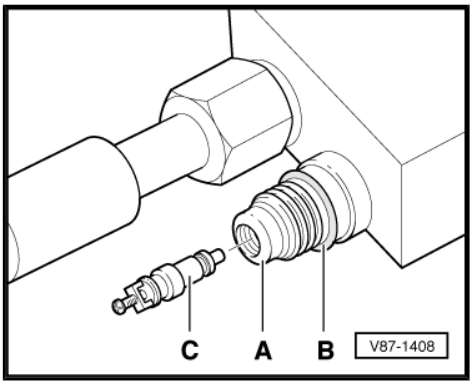
2.5.3 Low-pressure switch for air conditioning system -F73-



Function:

Switches off the air conditioner compressor in the event of a pressure drop in the refrigerant circuit (approx. 2 bar).

2.5.4 Connections with valve for refrigerant circuit switches



- There are different threads for switches on high and low-pressure sides.
- Only valves and O-rings resistant to R134a refrigerant and the related refrigerant oils are to be used.

A - Connection (soldered in)

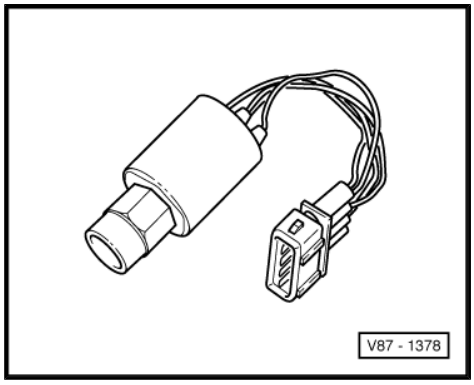
B - O-ring

C - Valve (with O-ring)

Note

To remove and install the valve core -C- with the refrigerant circuit drained, make use of an adapter from the socket -T10364- for example (tightening torque ⇒ page 26).

2.5.5 Air conditioning system pressure switch -F129-



This pressure switch has 3 functions:

1. Switches the radiator fan up to the next speed setting in the event of a pressure increase (approx. 16 bar) in the refrigerant circuit.

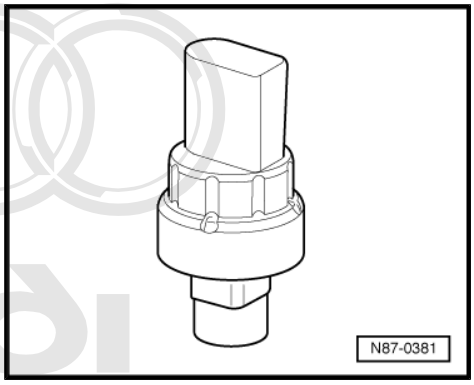
2. Switches off the air conditioner in the event of excessive pressure (approx. 32 bar) caused for example by inadequate engine cooling.

3. Switches off the air conditioner in the event of insufficient pressure (approx. 2 bar) caused for example by a loss of refrigerant.

Note

The air conditioning system pressure switch -F129- replaces the high-pressure switch for air conditioning system -F23- , the low-pressure switch for air conditioning system -F73- and the high-pressure switch for magnetic clutch -F118- .

2.5.6 High-pressure sender -G65-



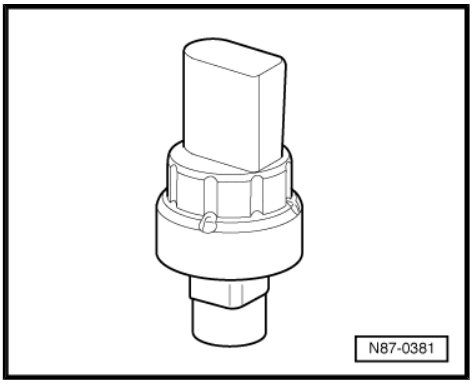
The high-pressure sender -G65- is fitted instead of the air conditioning system pressure switch -F129- or the refrigerant pressure and temperature sender -G395- .

The refrigerant pressure and temperature sender -G395- („grey“ housing at present) and the high-pressure sender -G65- („black“ housing at present) currently only differ in terms of the housing colour and attention is therefore to be paid to the correct assignment on replacement (part number ⇒ Electronic parts catalogue). As these two senders emit different signals, the relevant control unit can only evaluate the signal to which it has been matched ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

The high-pressure sender -G65- generates a square-wave signal or data telegram when voltage is applied. This signal changes with the pressure in the system.

The downstream control units (radiator fan control unit, engine control unit, operating and display unit for Climatronic air conditioning system -E87- , Climatronic control unit -J255- etc.) use this signal to calculate the pressure in the refrigerant circuit and to actuate the radiator fans and the air conditioning system magnetic clutch -N25- accordingly or to modify actuation of the air conditioner compressor regulating valve -N280- ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

2.5.7 Refrigerant pressure and temperature sender -G395-



The refrigerant pressure and temperature sender -G395- is fitted instead of the high-pressure sender -G65- .

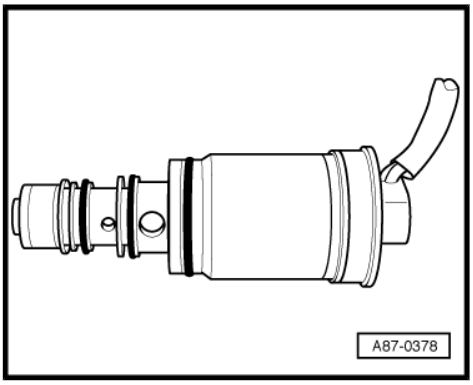
The refrigerant pressure and temperature sender -G395- („grey“ housing at present) and the high-pressure sender -G65- („black“ housing at present) currently only differ outwardly in terms of the housing colour and attention is therefore to be paid to the correct assignment on replacement (part number ⇒ Electronic parts catalogue). As these two senders emit different signals, the relevant control unit can only evaluate the signal to which it has been matched ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

When voltage is applied, the refrigerant pressure and temperature sender -G395- exchanges information via the air conditioner data bus („Lin bus“) with the corresponding control unit. The relevant control unit uses this information to calculate the pressure and temperature in the refrigerant circuit and any faults detected are signalled to the control unit.

The temperature measured by the refrigerant pressure and temperature sender -G395- differs on account of the design of -G395- and the fitting location from the actual temperature of the refrigerant in the refrigerant circuit. It is therefore not evaluated at present by all control units and used for air conditioner control ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

This information is used for example by the operating and display unit, Climatronic control unit -J255- to calculate the pressure in the refrigerant circuit and to actuate the downstream control units (radiator fan control unit, engine control unit etc.) by way of the data bus. These control units then regulate, for example, the radiator fans and engine accordingly ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

2.5.8 Air conditioner compressor regulating valve -N280-

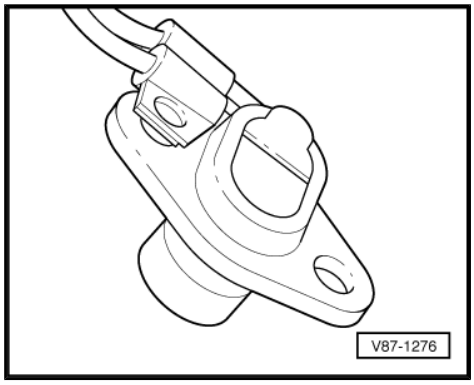


The regulating valve is installed in the air conditioner compressor. It is actuated by the operating and display unit for Climatronic air conditioning system -E87- or the Climatronic control unit -J255- (possibly via the data bus and an additional control unit depending on the vehicle) ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual). The pressure in the low-pressure side is influenced by way of 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 separately.

2.5.9 Air conditioning system compressor speed sender -G111-



Inductive sender

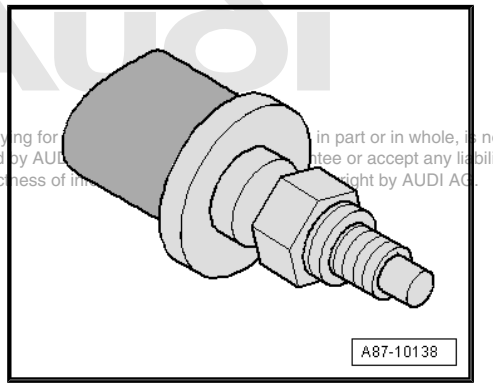
The sender pulses (4 per compressor revolution) and the engine speed enable the operating and display unit for Climatronic air conditioning system -E87- or the Climatronic control unit -J255- to calculate the belt slip.

If the belt slip exceeds a specified value, the air conditioner compressor is switched off by the control unit via the magnetic clutch.

Note

- *Fitted in Audi vehicles with compressor driven via poly V-belt and Zexel compressor ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

2.5.10 Refrigerant temperature sender -G454-



The refrigerant temperature sender (with a temperature-sensitive resistor) is installed, for example, in the high-pressure pipe next to the air conditioner compressor.

In the refrigerant circuit, there is a direct relationship between temperature and pressure. If there is insufficient refrigerant in the circuit, the temperature in the refrigerant circuit during air conditioner operation will increase more sharply than envisaged for this pressure.

Note

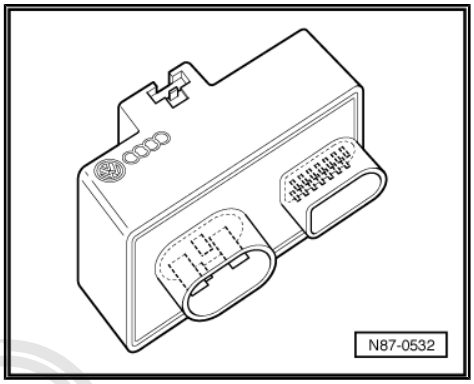
- *Fitted, for example, on the Audi Q7 with certain engines ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations*
- *The operating and display unit, Climatronic control unit -J255- evaluates the pressure and the temperature in the refrigerant circuit and switches off the air conditioner compressor if the temperature increases above the value stored for this pressure ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Vehicle diagnostic tester („Self-diagnosis“ or „Guided fault-finding“ function for the air conditioner).*

2.6 Electrical components not installed in refrigerant circuit

- Radiator fan control unit -J293- ⇒ page 33

2.6.1 Radiator fan control unit -J293-

This control unit activates and deactivates the magnetic clutch and thus the air conditioner compressor. It switches the radiator fans and calculates the pressure in the refrigerant circuit on vehicles with a high-pressure sender -G65- . Refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations, ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).



2.7 Pressures and temperatures in refrigerant circuit

Caution

- ***When working on the refrigerant circuit, observe generally valid safety precautions and pressure vessel regulations.***

The pressures and temperatures in the refrigerant circuit depend on the instantaneous operating statuses (e.g. engine speed, radiator fan speed 1, 2, or 3, engine temperature, air conditioner compressor on or off) as well as environmental influences (e.g. ambient temperature, 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 this reason, the values given in the following table are only intended as a rough guide. They are attained at an engine speed of 1500 to 2000 rpm and an ambient temperature of 20 °C after about 20 minutes.

Refer to the vehicle-specific refrigerant circuit for the pressure gauge set measurement connections ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

At 20 °C with the engine not running, the pressure in the refrigerant circuit is 4.7 bar ⇒ page 3 (vapour pressure table).

Note

Pressure may be given in various units: 1 MPa (megapascal) corresponds to 10 bar gauge pressure or 145 psi; 1 bar absolute pressure corresponds to 0 bar gauge pressure, which is roughly equivalent to atmospheric pressure.

- Refrigerant circuit with expansion valve ⇒ page 33
- Refrigerant circuit with restrictor and reservoir ⇒ page 35

2.7.1 Refrigerant circuit with expansion valve

HP – High-pressure side of refrigerant circuit

LP – Low-pressure side of refrigerant circuit

Component	State of refrigerant	Pressure (bar)	Temperature in degrees centigrade
-1- Evaporator, from inlet to outlet	Vapour	approx. 1.2 bar [1)]1	approx. -7 °C [2)]2
-2- Expansion valve	Liquid, expanded to vapour	approx. 14 bar	approx. +55 °C (high-pressure end), reduced to -7 °C (low-pressure end)
-3- High-pressure switch / high-pressure sender	Liquid	approx. 14 bar	approx. +55 °C
-4- Service connection/ high-pressure end and -5- Receiver	Liquid	approx. 14 bar	approx. +55 °C
-6- Condenser	From gas (at inlet) via vapour to liquid (at outlet)	approx. 14 bar	From approx. +65 °C (at inlet) to approx. +55 °C (at outlet)
-7- Pressure relief valve and -8- Air conditioner compressor/high-pressure end	Gas	approx. 14 bar	approx. +65 °C
-9- Air conditioner compressor/low-pressure end	Gas	approx. 1.2 bar [1)]1	approx. -1 °C [2)]2
-10- Damping chamber (not fitted on all vehicles) and -11- Service connection/ low-pressure end	Gas	approx. 1.2 bar [1)]1	approx. -1 °C [2)]2

1) 1 - The pressure in a refrigerant circuit with a regulating air conditioner compressor is maintained at approx. 2 bar absolute (corresponding to approx. 1 bar gauge) despite varying heat transfer and fluctuating engine speeds. This however only applies within the output range of the air conditioner compressor. If the output limits of the air conditioner compressor are exceeded, the pressure will increase
⇒ page 103 .

2) 2 - The temperature in a refrigerant circuit with a regulating air conditioner compressor is maintained within the regulating range of the air conditioner compressor despite varying heat transfer and fluctuating engine speeds. This however only applies within the output range of the air conditioner compressor. If the output limits of the air conditioner compressor are exceeded, the temperature will increase
⇒ page 103 .

Note

- *Non self-regulating air conditioner compressors are switched off by the relevant control unit via the air conditioner compressor regulating valve -N280- at evaporator temperatures below 0 °C.*
- *On vehicles with air conditioner compressor regulating valve -N280- the pressure on the low pressure end is altered by actuating the valve.*
- *On vehicles with two evaporators and two expansion valves, the temperature and the pressure in the refrigerant circuit correspond to those on vehicles with only one evaporator and one expansion valve (parallel connection).*
- *Depending on the design of the refrigerant circuit, a component with an internal heat exchanger may be fitted (e.g. on the Audi A4 2008 > and the Audi A5 Coupé 2008 > a refrigerant pipe with an internal heat exchanger). In the internal heat exchanger, the hot refrigerant (liquid) flowing through the high-pressure side gives off energy to the cold refrigerant (gaseous or vaporous) flowing through the low-pressure side, thus enhancing the efficiency of the air conditioner ⇒ page 22 .*

Arrows show direction of refrigerant flow.

HP – High-pressure side of refrigerant circuit

LP – Low-pressure side of refrigerant circuit

1 - Evaporator

2 - Expansion valve

3 - High-pressure switch / high-pressure sender

- ❑ Different versions depending on vehicle

4 - Service connection/high-pressure end

5 - Receiver

- ❑ Different versions depending on vehicle

6 - Condenser

7 - High-pressure safety valve

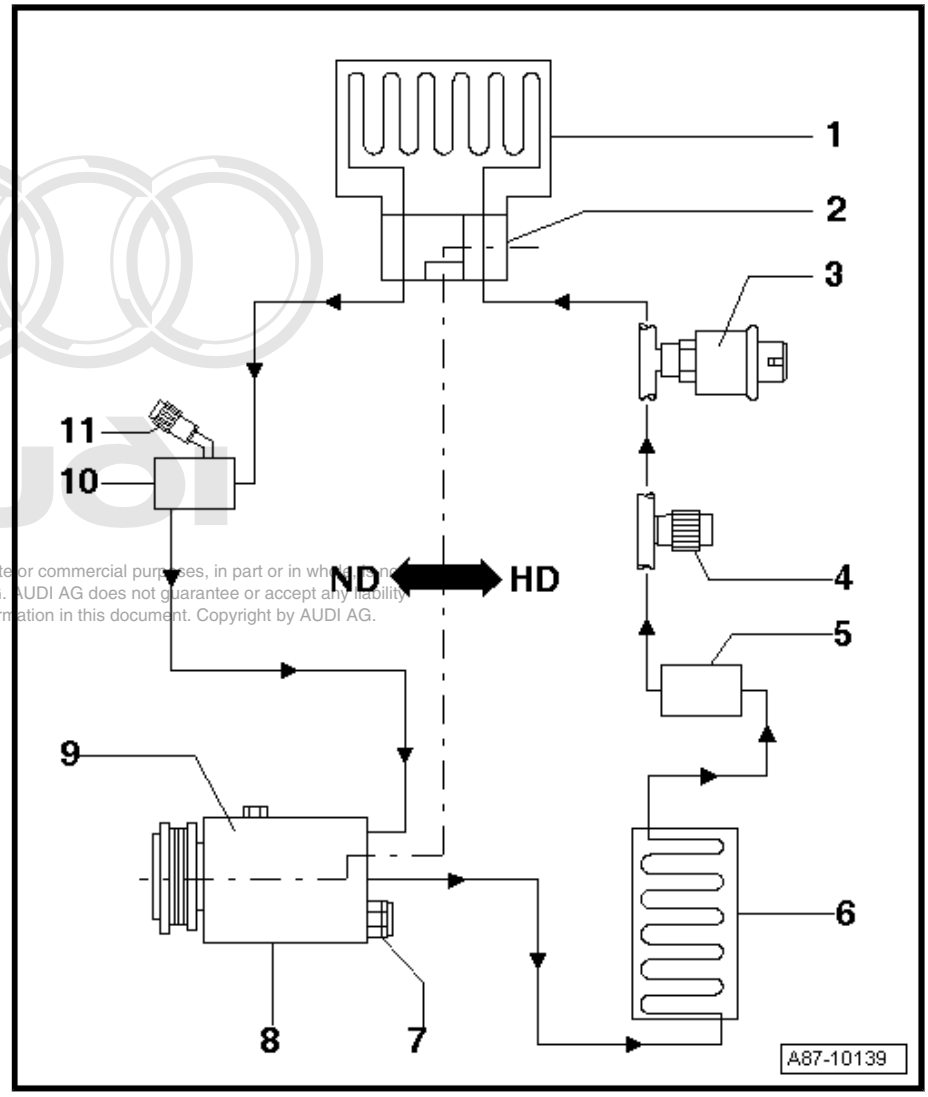
8 - Air conditioner compressor/ high-pressure end

9 - Air conditioner compressor/ low-pressure end

10 - Damping chamber

- ❑ Not fitted on all vehicles

11 - Service connection/low-pressure end



2.7.2 Refrigerant circuit with restrictor and reservoir

HP – High-pressure side of refrigerant circuit

LP – Low-pressure side of refrigerant circuit

Component	State of refrigerant	Pressure (bar)	Temperature in degrees centigrade
-1- Air conditioner compressor/high-pressure end	Gas	Up to 20 bar	Up to +70 °C
-2- Condenser	From gas to vapour to liquid	Up to 20 bar	Up to +70 °C
-3- Restrictor	From liquid to vapour	HP end up to 20 bar LP end greater than 1.0 bar	HP end up to +60 °C LP end warmer than -4 °C
-4- Evaporator	From vapour to gas	Greater than 1.0 bar	Warmer than -4 °C
-5- Reservoir	Gas		

Component	State of refrigerant	Pressure (bar)	Temperature in degrees centigrade
-6- Air conditioner compressor/low-pressure end	Gas		

The pressures on the low-pressure end are maintained at approx. 2 bar absolute (corresponding to approx. 1 bar gauge) by the „regulating“ air conditioner compressor even at varying engine speeds. This however only applies within the output range of the air conditioner compressor. If the output limits of the air conditioner compressor are exceeded, refer to ⇒ page 103 .

Note

On vehicles with air conditioner compressor regulating valve - N280- the pressure on the low pressure end is altered by actuating the valve.

Arrows show direction of refrigerant flow.

HP – High-pressure side of refrigerant circuit

LP – Low-pressure side of refrigerant circuit

1 - Air conditioner compressor/ high-pressure end

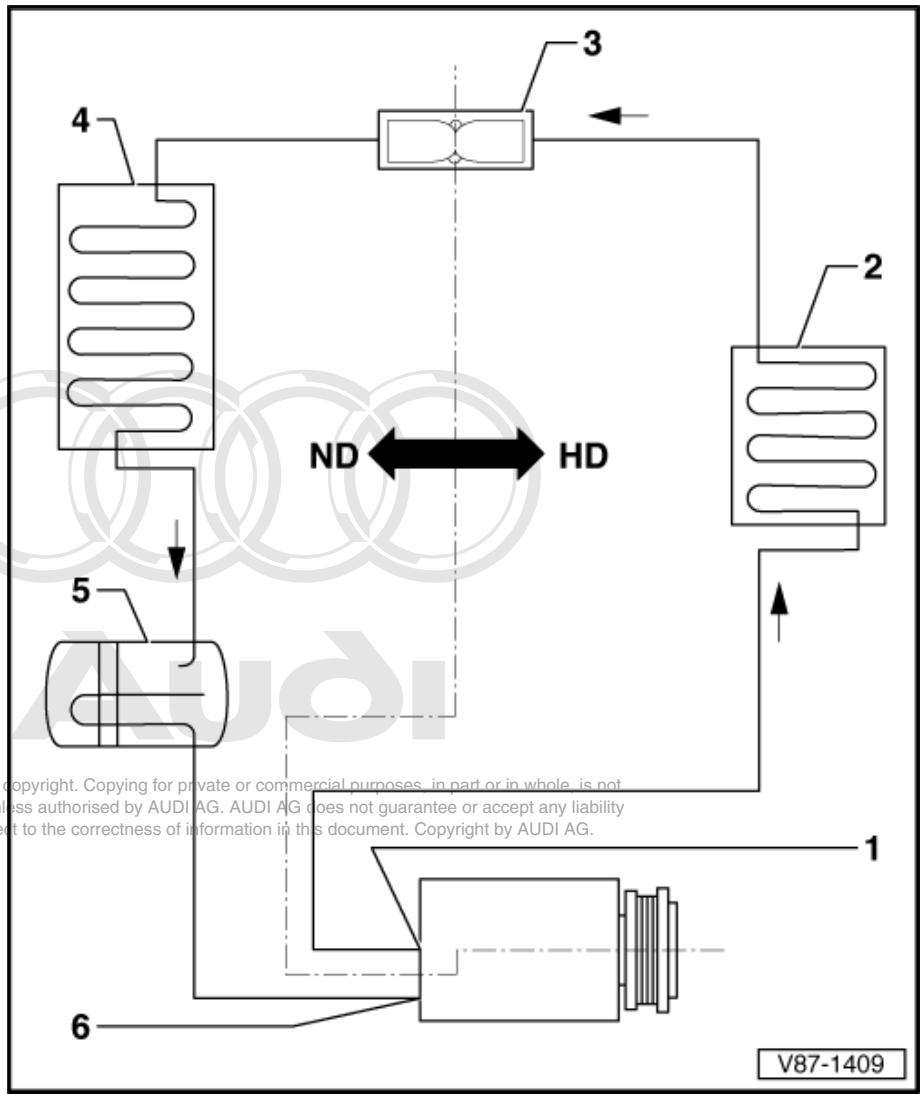
2 - Condenser

3 - Restrictor

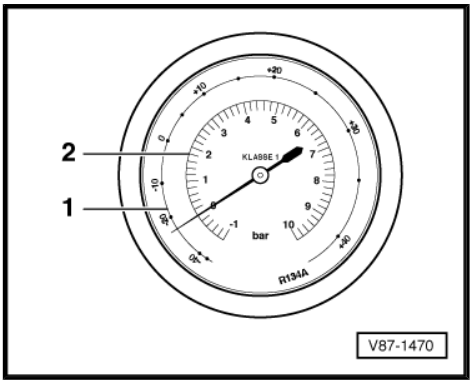
4 - Evaporator

5 - Reservoir

6 - Air conditioner compressor/ low-pressure end



2.8 Test and measurement operations which can be performed with a pressure gauge



Pressure gauge scales

1 - Temperature scale for refrigerant R134a CF3– CH2F or CH2F– CF3

2 - Pressure scale

Note

Pressure may be given in various units: 1 MPa (megapascal) corresponds to 10 bar gauge pressure or 145 psi; 1 bar absolute pressure corresponds to 0 bar gauge pressure, which is roughly equivalent to atmospheric pressure.

In addition to the pressure scale, pressure gauges may have one or more temperature scales. The scale values for R134a are assigned according to the vapour pressure table. As different refrigerants develop different vapour pressures at the same temperature, each temperature scale is marked for the appropriate refrigerant.

- Pressure gauges permit the following test and measurement operations ⇒ page 37 .

2.8.1 Pressure gauges permit the following test and measurement operations

Refrigerant circuit pressure and temperature measurements

- The high-pressure gauge measures the pressure and temperature propagated evenly from the air conditioner compressor outlet via the condenser to the constriction (restrictor or expansion valve) when the air conditioning system is switched on.
- The low-pressure gauge measures the pressure and temperature propagated evenly from the constriction (restrictor or expansion valve) via the evaporator to the inlet of the air conditioner compressor when the air conditioning system is switched on.

Note

The relationship between pressure and temperature indicated on the pressure gauges only exists in a refrigerant circuit containing 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 R134a is present in a closed vessel or in the refrigerant circuit if the temperature indicated on the pressure gauge corresponds to the temperature of the refrigerant (standing liquid 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.

2.9 Air conditioner service and recycling units

Air conditioner service units for the extraction, cleaning and transfer of refrigerant for motor vehicle air conditioning systems are currently available from various manufacturers.

Only certain air conditioner service stations (with appropriate additional equipment and various adapters if applicable) can be used for flushing the refrigerant circuit ⇒ page 59 .

- Classification of extraction systems ⇒ page 38
- Charging systems that do not require a permit ⇒ page 38

2.9.1 Classification of extraction systems

Note

- *The air conditioner service and recycling units used in motor vehicle workshops are extraction and charging systems that do not require a permit (Group „3“) but which should only be operated by qualified personnel. Instructions for unit operation and maintenance can be found in the relevant manufacturer's documentation.*
- *Extraction and charging systems of groups „1“ and „2“ are not used in motor vehicle workshops.*

Group „3“ extraction and charging systems:

Mobile extraction and charging systems for filling compressed-gas vessels permanently connected to the system

The refrigerant or refrigerant/oil mixture is transferred to compressed-gas vessels which are permanently connected to the mobile systems. In line with § 3 Para. 5 No. 3 of the German pressure vessel regulations (different regulations may apply in other countries), compressed-gas vessels are classified as pressure vessels in this case.

The charging systems:

– Do not require a permit.
– Do not require expert testing, as the gas is transferred to compressed-gas vessels which are classed as being pressure vessels (by contrast, a permit is required for the system for filling compressed-gas vessels from these pressure vessels for transfer to other parties and testing is mandatory).

2.9.2 Charging systems that do not require a permit

Charging systems not requiring a permit are ones used for transferring compressed gases to mobile compressed-gas vessels for internal use only.

Note:

Some air conditioner service units are charging systems not requiring a permit. When working with such equipment, the refrig-

erant is not transferred to mobile compressed-gas vessels, but rather into a permanently installed charging cylinder with visible level gauge and float switch.

Recommendation:

It is advisable to use a portable cylinder with visible level gauge and high-pressure safety valve for surplus refrigerant for internal use.

TRG 402 (technical regulations for compressed gases) must be observed when filling other compressed-gas vessels with compressed gases.

2.10 Repair notes for refrigerant circuit

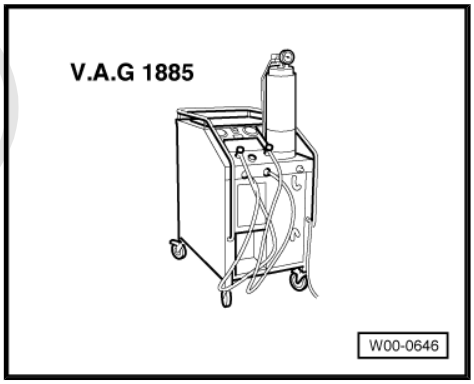
WARNING

- *When working on the refrigerant circuit, observe generally valid safety precautions and pressure vessel regulations.*

Special tools and accessories:

The performance of proper workmanlike repairs on an air conditioning system

- Requires the use of special tools and materials as listed on ⇒ page 189 .
- Requires compliance with the basic instructions for use of leak detectors ⇒ page 87 .
- Requires expert knowledge.



Note

Releasing refrigerant into the environment is prohibited ⇒ page 40 (laws and regulations).

3 Laws and regulations

Note

The laws and regulations listed below are applicable in Germany. Different or additional laws and regulations may apply in other countries.

3.1 Laws and regulations

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.

One aspect of the Kyoto protocol is the definition of the worldwide climate protection targets. 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.

A number of laws of relevance to the automobile industry have been passed at European level for example. In Germany for example, the climate protection regulation on chemicals additionally came into force on 1st August 2008 to set down the European legislation more precisely.

- Regulation (EC) no. 2037/2000
- Regulation (EC) no. 842/2006
- Regulation (EC) no. 706/2007
- Regulation (EC) no. 307/2008
- Directive 2006/40/EC
- Climate protection regulation on chemicals, recycling and refuse law (for Germany).

Maintenance and repair work on air conditioner refrigerant circuits

Anyone performing maintenance and repair work on motor vehicle air conditioning systems must have received the relevant instruction or attended a training course and be able to furnish certification of the appropriate qualifications. Other or additional regulations may apply in countries outside the European Community.

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.
- A record should be kept of the quantities used during operation and for maintenance work ⇒ Audi-ServiceNet, HSO Environmental Protection to be able to submit certification of use to the relevant authorities on request. According to a regulation of the European parliament from 2005, it is no longer necessary to keep a record sheet 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 acceptance of return of the substances and preparations listed in these regulations may only be undertaken by persons with the necessary expert knowledge and technical equipment.

Criminal offences and infringements of the law

- An infringement in terms of the regulations and laws mentioned above is constituted by any wilful or negligent action during the operation, maintenance or shutdown of items containing the refrigerants mentioned which allows substances contained in these to escape into the atmosphere contrary to the state of the art or by the wilful or negligent contravention of the applicable regulations and laws mentioned above.

TRG (technical regulations for compressed gases) 400, 401, 402

Note

Only excerpts from the TRG are given in the following (sections applicable to motor vehicle manufacturers and workshops).

- TRG 400 (general regulations for charging systems)
  - Definition of terms and explanatory notes
  - Charging systems
  - Charging systems are systems for filling mobile compressed-gas vessels. The charging system includes the premises and facilities concerned.
  - Charging systems requiring a permit

Note

- *Charging systems requiring a permit are ones used to transfer compressed gases to mobile compressed-gas vessels for supplying to third parties.*
- *Charging systems not requiring a permit are ones used for transferring compressed gases to mobile compressed-gas vessels for internal use only.*

- TRG 401 (installation of charging systems)
  - Does not apply to vehicle manufacturers or workshops.
- TRG 402 (operation of charging systems)
  - Employees and the instruction of employees

Note

Employees are to be given instruction on the following topics before beginning work and at regular, appropriate intervals, however at least once a year:

- Hazards specifically associated with handling compressed gases
- Safety regulations, particularly the applicable TRG
- Procedures in the event of malfunction, damage and accidents

- The use of fire-extinguishing and protective equipment
- Operation and maintenance of the charging system on the basis of the instructions for use

– Charging systems may only be operated and maintained by persons:

– Aged 18 and above

– Possessing the necessary technical knowledge.

– Who can be relied upon to work diligently.

Note

Work under supervision may also be performed by persons who fail to comply with the above-mentioned prerequisites.

Charging (a special TRG applies to vessels from other countries and charging of these).

- A compressed-gas vessel is only to be filled with the compressed gas declared on it and the quantity must comply with the stipulated pressure, weight or volume data (refer to pressure vessel regulations).
- In the case of vessels approved for use with several types of compressed gas, the compressed gas with which it is to be filled and - if the compressed gas has a tc ≥ -10 °C (tc = critical temperature) - the maximum permissible charging weight in line with TRG 104 must be marked on the vessel prior to connection for filling.
- Compressed-gas vessels marked with the maximum permissible charge pressure in bar at 15 °C must be filled manometrically. If, at the time of filling, the temperature is not 15 °C, the pressure corresponding to the prevailing temperature must be established; it must be ensured that the permissible charge pressure at 15 °C is not exceeded in the compressed-gas vessel. The charged vessels must be checked by way of random pressure measurements to determine possible overfilling.
- Compressed-gas vessels on which the maximum permissible capacity is indicated by the net weight (filling weight, permissible weight of fill) in kilograms must be filled gravimetrically. The vessels must be weighed during filling and subsequently subjected to a weight check on special scales to detect possible overfilling. Scales used for this purpose must be calibrated.
- Under certain conditions, gases with a tc ≥ +70 °C may be transferred volumetrically from compressed-gas vessels with a maximum volume of 150 l to compressed-gas vessels with a volume of max. 1000 ccm. The stipulations of the TRG apply to the transfer of liquefied gas to cylinders used by workmen.
- The following TRG apply to vessels in vehicles:

– TRG 101 to gases with a tc ≥ +70 °C.

– TRG 102 or TRG 103 to industrial gas mixtures with a tc ≥ +70 °C:

– Liquefied extremely low-temperature compressed gases (refer to TRG 103) may also be filled volumetrically (with the exception of vessels in vehicles) if the charging system and/or the vessels is/are equipped with devices for measuring or limiting the volume of the charge and for measuring the temperature of the charge. When filling volumetrically, it must be ensured that the permissible charge weight indicated on the

vessel is not exceeded. To determine possible overfilling, the charged vessels are to be checked gravimetrically on calibrated scales or volumetrically, provided that the compressed gases are not highly toxic. Volumetric checking requires the use of appropriate equipment with completely separate charging and checking devices.

- Charging and check measurements must be performed by different people. Check measurements must be performed immediately upon completion of the filling process.
- Overfilled vessels must be discharged immediately and safely until the permissible filling quantity is reached. The compressed-gas fill must then be determined again.
- Items 4 to 7 do not apply to vessels for liquefied, extremely low-temperature compressed gases which are neither flammable nor toxic; this does not affect the provisions of road traffic legislation.
- When filling compressed gas vessels with liquified gases at charging temperatures ≤ -20 °C, the compressed gas vessel (if the vessel material has not been tested for temperatures ≤ -20 °C) is not to be released from the charging system for transportation until the vessel wall temperature is ≥ +20 °C.

Recycling and refuse law

- Regulations and rules for the handling and disposal of refrigerants and refrigerant oils can be found in the climate protection regulation on chemicals and in the recycling and refuse law (applicable in Germany, different regulations and rules may apply in other countries).

Disposal of refrigerant

Refrigerants intended for disposal are to be transferred to marked recycling containers, observing the permissible filling quantity. In Germany, reference should be made for example to the climate protection regulation on chemicals and the recycling and refuse law (different regulations and rules may apply in other countries).

Disposal of refrigerant oil

Used refrigerant oils from systems employing halogenated hydrocarbons are to be disposed of as waste requiring special monitoring. They are not to be mixed with other oils or substances. Proper storage and disposal must be ensured in line with local regulations. In Germany, reference should be made for example to the climate protection regulation on chemicals and the recycling and refuse law (different regulations and rules may apply in other countries) ⇒ Audi-ServiceNet, HSO Environmental Protection .

- Conversion of an R12 refrigerant circuit to an R134a refrigerant circuit and servicing (retrofit) ⇒ page 44
- Keeping refrigerant records ⇒ page 44

3.1.1 Conversion of an R12 refrigerant circuit to an R134a refrigerant circuit and servicing (retrofit)

Note

- *For environmental reasons and on account of the corresponding legislation, refrigerant R12 can no longer be manufactured or supplied. Refrigerant R134a has been developed as a replacement for R12.*
- *Air conditioning systems developed and designed for refrigerant R12 cannot however simply be charged with refrigerant R134a. To ensure trouble-free operation of the air conditioning system even after conversion, various components of the refrigerant circuit must be renewed.*
- *A precise description of the conversion procedure and information on the servicing of converted refrigerant circuits can be found in ⇒ Workshop Manual: Air conditioner with refrigerant R12 Parts 2 and 3 (this Workshop Manual is only available in hardcopy form).*

3.1.2 Keeping refrigerant records

The environmental statistics law requires records to be kept on the use of refrigerants exceeding a certain quantity per year.

Consequently, motor vehicle workshops may well have to provide the relevant local authorities with information on their use of refrigerant. It is therefore advisable to keep a record sheet ⇒ AudiServiceNet, HSO Environmental Protection .

Note

On the basis of a regulation of the European parliament from 2005, it is generally no longer necessary in the EC to keep a record sheet for the quantity of refrigerant handled in motor vehicle workshops. Other regulations may apply in countries not belonging to the EC.

4 Refrigerant circuit

- Important repair notes for air conditioning systems ⇒ page 45
- Conversion of refrigerant circuits from refrigerant R12 to R134a ⇒ page 45 .
- Working with the air conditioner service station ⇒ page 46 .
- Blowing out the refrigerant circuit with compressed air and nitrogen ⇒ page 55 .
- Flushing (cleaning) the refrigerant circuit with refrigerant R134a ⇒ page 59 .
- Determination of refrigerant circuit leaks ⇒ page 87 .

4.1 Important repair notes for air conditioning systems

- Air conditioners for refrigerant R12 may only be filled with refrigerant R134a if certain prerequisites are satisfied ⇒ page 44 and ⇒ Workshop Manual: Air conditioner with refrigerant R12 Part 2 and 3 . This Workshop Manual is only available in hardcopy form.
- The refrigerant oils specifically developed for R134a and R12 refrigerant circuits are never to be mixed.
- Air conditioner service stations which come into contact with the refrigerant should only be used for the intended refrigerant.
- The components of an R134a refrigerant circuit are accordingly labelled, marked with green stickers or designed (e.g. a different thread) such that interchange with components for refrigerant R12 is not possible.
- The refrigerant being used is indicated by a label affixed to the lock carrier in the engine compartment or in the plenum chamber.
- Never mix various refrigerants.

Note

When working on the refrigerant circuit, always pay attention the information given in the Sections on „Safety measures“ ⇒ page 13 and „Basic rules for working on refrigerant circuit“ ⇒ page 14 .

4.2 Converting refrigerant circuits from refrigerant R12 to refrigerant R134a

CFC refrigerants are no longer used in the automotive industry.

For conversion of refrigerant circuits from R12 to R134a and servicing converted circuits, refer to

⇒ Workshop Manual: Air conditioner with refrigerant R12 Parts 2 and 3 (this Workshop Manual is only available in printed form).

4.3 Working with the air conditioner service station

Caution

- *If there is a possibility that chemical substances (sealing additives) for sealing leaks have been added to the refrigerant circuit from which the refrigerant is to be extracted, do not connect the air conditioner service station to this refrigerant circuit and do not extract the refrigerant.*
- *Chemical substances (sealing additives) for sealing leaks form deposits in the refrigerant circuit which will impair operation of the air conditioning system and lead to failure of the system (and of the air conditioner service station).*
- *Customers should be informed that the air conditioner in their vehicle contains substances not approved by Audi and that the system can therefore not be discharged and serviced by your workshop.*

Note

- *Audi does not permit the use of chemical substances (sealing additives) to seal leaks in the refrigerant circuit.*
- *Chemical substances (sealing additives) for sealing leaks in the refrigerant circuit generally react with the ambient air or the humidity contained in it. They cause malfunctioning of valves and other components with which they come into contact on account of deposits in the refrigerant circuit (and in the air conditioner service station being used). These deposits cannot be completely removed from the components.*
- *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.*
- *On the accessories market, vessels with integrated filters are available which are supposed to intercept these chemical substances (additives used to seal leaks). As Audi objects to the use of these substances, no statement can be made regarding the effectiveness and the interception rate of these filters.*

- Important notes for working with the air conditioner service station ⇒ page 47 .
- Connection of the air conditioner service station for measurement and testing ⇒ page 47 .
- Refrigerant circuit discharge using the air conditioner service station ⇒ page 48 .
- Refrigerant circuit evacuation using the air conditioner service station ⇒ page 49 .
- Refrigerant circuit charging using the air conditioner service station ⇒ page 53 .
- Air conditioner start-up after charging ⇒ page 53 .
- Pouring refrigerant into the charging cylinder or storage vessel of the air conditioner service station ⇒ page 54 .
- Air conditioner service station drainage ⇒ page 55 .

4.3.1 Important notes for working with the air conditioner service station

The following must be heeded with regard to operation of air conditioner service stations (e.g. V.A.G 1885; for currently available air conditioner service stations, refer to ⇒ V.A.G workshop equipment catalogue):

– 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 flush the refrigerant circuit, the dryers and filters fitted must be renewed more frequently ⇒ page 55 .

– Use is only to be made of refrigerant oils which are also approved for the vehicle-specific refrigerant circuit (if applicable, add the refrigerant oil directly to the refrigerant circuit) ⇒ Electronic parts catalogue .

In cases of doubt about the composition of the refrigerant extracted from the refrigerant circuit, this is not to be re-used even after cleaning in the air conditioner service station.

– In such cases, the air conditioner service station is to be drained ⇒ page 99 , the system cleaned if necessary and the filters, dryers and refrigerant oil replaced.

– In Germany, for example, contaminated refrigerant can be returned to the refrigerant supplier in so-called recycling bottles for recycling or ecological disposal (other or additional regulations may apply in other countries).

Commercially available air conditioner service stations can be classified in 2 groups:

♦ Air conditioner service stations which clean the refrigerant extracted from a vehicle for re-use (so-called extraction and recycling stations), e.g. V.A.G 1885 (for currently available air conditioner service stations, refer to ⇒ V.A.G workshop equipment catalogue).

♦ Air conditioner service stations which transfer extracted refrigerant to recycling containers (for large-scale recycling); these are referred to as extraction systems.

4.3.2 Connecting air conditioner service station for measuring and testing

• Work procedure may vary depending on the type of tools selected; therefore it is important to observe the tool-specific operating instructions.

Note

The work procedure must always be performed as described in the operating instructions of the air conditioner service station.

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

– Switch off ignition.

– Connect air conditioner service station to power supply.

– Unscrew the sealing caps from the service connections or the connections with valve (refer to vehicle-specific refrigerant circuit) ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

– Evacuate the charging hoses if necessary.

– Connect quick-release coupling to service connection of refrigerant circuit.

WARNING

- ***Do not open the valves on the low or high-pressure end with the engine running, as otherwise the air conditioner compressor or the air conditioner service station could be destroyed by a short circuit between the high and low-pressure ends of the refrigerant circuit if the air conditioning system is switched on.***

– Only screw the handwheel 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).

– Start the engine and perform the intended tests and measurements.

– Compare the values determined to the specified measured values ⇒ page 103 .

– Before detaching quick-release coupling, close it by screwing out handwheel.

Vehicles with one service connection only:

Note

Screw the valve adapters -V.A.G 1785/9- , -V.A.G 1785/10- or the adapter set -V.A.G 1786- to the refrigerant circuit connections with valve and bleed the charging hoses during connection to the adapters (only a faintly audible escape of refrigerant gas is permitted) ⇒ page 99 .

– The charging hose must be fitted with a valve opener to open the valve in the valve adapter.

4.3.3 Discharging refrigerant circuit with air conditioner service station

- Work procedure may vary depending on the type of tools selected; it is therefore important to observe the tool-specific operating instructions.
- The refrigerant circuit must be discharged if you intend to remove parts of the refrigerant circuit, if there is any doubt about the quantity of refrigerant in the circuit or if safety precautions require you to do so.
- All the necessary usage information for working with the refrigerant air conditioner service station can be found in the air conditioner service station operating instructions.

Discharging:

– Switch off the ignition.

– Connect the air conditioner service station in line with the operating instructions to the vehicle service connections (refer to vehicle-specific refrigerant circuit) and start up the service station ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

Note

- *There is a possibility of refrigerant oil being extracted from the refrigerant circuit together with the refrigerant. To ensure air conditioner compressor lubrication, the refrigerant oil in the circuit must be topped up with fresh oil* *⇒ page 144* *.*
- *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.*

4.3.4 Evacuating refrigerant circuit with air conditioner service station

- The work procedure must always be performed as described in the operating instructions of the air conditioner service station.
- Quantity of refrigerant oil in refrigerant circuit checked and if necessary corrected ⇒ page 144 .
- Quantity of refrigerant in air conditioner service station checked

The refrigerant circuit must be evacuated before it is filled with refrigerant. Moisture is also extracted from the circuit.

Leaks can be detected on evacuating the refrigerant circuit.

Evacuating:

Caution

- ***Do not start the engine during the evacuating procedure and while there is a vacuum in the refrigerant circuit.***
- ***The air conditioner compressor may be damaged if the engine is started whilst there is a vacuum in the refrigerant circuit.***
- ***Always charge the refrigerant circuit before starting the engine.***

– Switch off ignition.

– Connect air conditioner service station to power supply.
– Connect the charging hoses of the air conditioner service station to the vehicle refrigerant circuit with quick-release coupling adapters (refer to vehicle-specific refrigerant circuit) ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
– Screw in the handwheel of the quick-release coupling adapters to the extent required to reliably open the valves of the service connections (take care not to open the valve too far).

Note

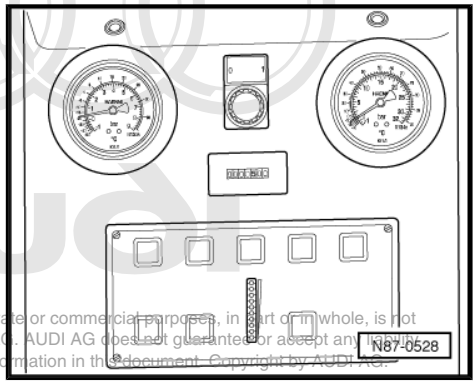
If you intend to measured the pressure on only one side of the refrigerant circuit after charging the system (on vehicles with a service connection), use the valve adapter and filler hose with valve opener *⇒ page 99* *.*

– Switch on the air conditioner service station and evacuate the refrigerant circuit for at least 30 minutes. In this process, the pressure reading must be less than 10 mbar absolute (corresponding to a vacuum of 990 mbar).

Note

On the air conditioner service station V.A.G 1885 (for currently available air conditioner service stations, refer to ⇒ V.A.G workshop equipment catalogue), the two green LEDs light at this pressure for example.

– Switch off air conditioner service station and allow to stand for at least 1 hour.
• If the vacuum display (LED chain) does not change, the system is free of leaks and can be charged.



Note

- *With V.A.G 1885 for example (for currently available air conditioner service stations, refer to ⇒ V.A.G workshop equipment catalogue), a current vacuum display (LED) is only obtained after pressing the Evacuation button again.*
- *If, with this air conditioner service station, the upper (green) LEDs do not light immediately after switching on, either the refrigerant circuit is leaking or there is still residual moisture/ refrigerant in the circuit.*

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

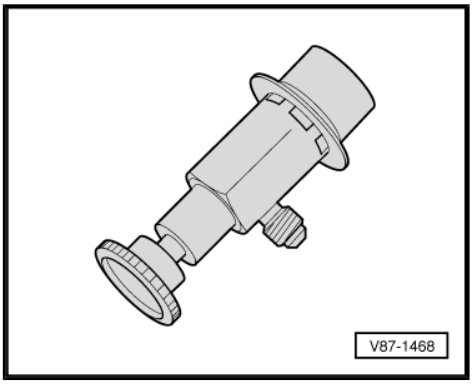
- The pressure in the refrigerant circuit only increases slowly following evacuation, e.g. due to the evaporation of refrigerant from the refrigerant oil.

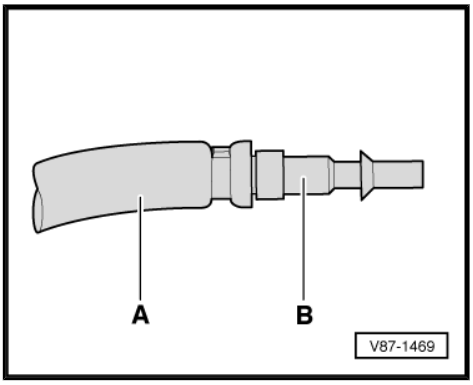
– If it is not certain whether the refrigerant circuit is really leakproof, repeat evacuation and observe the vacuum display over a lengthy period. Charging can only be performed once the vacuum is maintained.

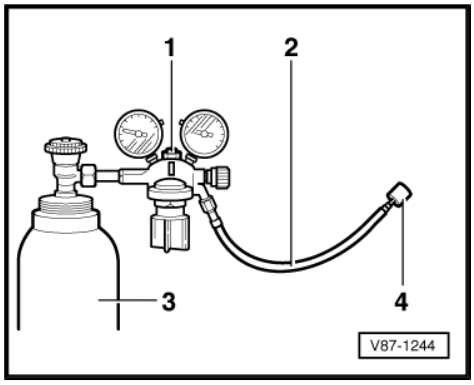
– It it is certain that there are no leaks in the refrigerant circuit, charging can be performed.

- In the event of a leak of such a magnitude that the ingress of air on evacuation is already sufficient to prevent the air conditioner service station generating an adequate vacuum or the vacuum gauge already indicates the ingress of air and the loss of vacuum immediately after switching off the air conditioner service station.

– Determine the leakage location in the refrigerant circuit as follows:







Note

- *A major leak can be determined for example by building up a pressure of max. 15 bar in the refrigerant circuit with pure, dry compressed air or with nitrogen ⇒ page 55 . If the leak is of sufficient magnitude, the leakage location will be revealed by the noise of the gas escaping.*
- *Apply the compressed air or the nitrogen to the closed refrigerant circuit by way of the service connection to which a quick-release coupling adapter for service connections has been attached.*
- *The quick-release coupling adapter for service connections can be connected to the workshop compressed air system using for example a modified charging hose -A- (e.g. with a 5/8"-18 UNF thread, depending on the thread at the quick-release coupling adapter) and an appropriate adapter -B- ⇒ page 195 . To prevent the ingress of moisture, oil and dirt from the workshop compressed air system into the air conditioner refrigerant circuit, additional use is to be made for example of a combined fine filter unit for compressed air systems (oil, dirt and water separator as used for painting facilities), which is to be fitted between the compressed air system and the charging hose -A- ⇒ Workshop equipment catalogue .*
- *By using a pressure gauge set with pressure reducer for nitrogen (maximum reducing pressure: 15 bar) -1-, a compressed air cylinder -3- filled with nitrogen can be connected by way of a charging hose -2- (e.g. with a 5/8"-18 UNF thread) to the service connection (to which a quick-release coupling adapter for service connections has been attached) at the closed refrigerant circuit ⇒ page 194 .*

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

WARNING

- ***Maximum permissible operating pressure 15 bar***
- ***For leak detection with nitrogen always work with pressure reducers for nitrogen cylinders.***

– Determine the leakage location by way of the noise caused by the escaping gas at this point.

– Eliminate the leakage.

– Evacuate and again observe the vacuum display over a period of hours. Charging may only be carried out if vacuum is maintained.

- In the event of a leakage of a magnitude permitting the ingress of no or very little air and the air conditioner service station can generate an adequate vacuum. The vacuum display does not increase or only increases very slowly after switching off the air conditioner service station, indicating that air is only ingressing and vacuum is being lost through a minor leak.

– Pour 100 g of refrigerant into the circuit and use an electronic leak detector to locate and eliminate any leak ⇒ page 88 or pour in refrigerant with UV contrast medium and use the leak detection system VAS 6201 to search for and eliminate the leak in the refrigerant circuit ⇒ page 89 .

– Discharge the refrigerant circuit if necessary ⇒ page 48 .

– 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.

4.3.5 Charging refrigerant circuit with air conditioner service station

Note

The entire refrigerant charge can be added to either the high or low-pressure side ⇒ page 144 .

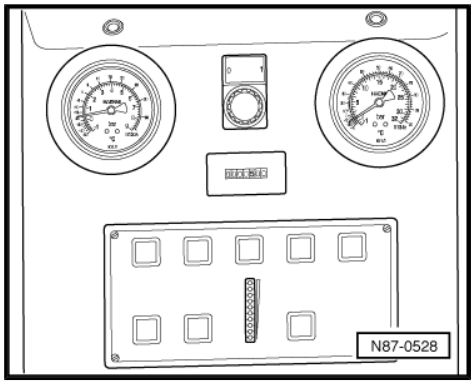
- The work procedure must always be performed as described in the operating instructions of the air conditioner service station.
- Before pouring in refrigerant, correct the quantity of refrigerant oil ⇒ page 144 .
- When charging the refrigerant circuit, the air conditioner service station must be on the same level as the vehicle in which the refrigerant circuit is to be charged (maximum difference 50 cm). Depending on the design of the air conditioner service station , an excessive difference in height could lead to differences between the quantity of refrigerant displayed and that actually poured in. The filling accuracy of the air conditioner service station may vary.

– Switch off ignition.
– Evacuate refrigerant circuit with air conditioner service station ⇒ page 49 .
– Unscrew handwheel at quick-release coupling adapter (to close it).
– Allow refrigerant to flow into filler hose.
– Take the charging cylinder reading.
– Screw in handwheel at quick-release coupling adapter (to open it) and charge with the specified quantity of refrigerant.
– Switch off air conditioner service station.

4.3.6 Starting up air conditioner after charging

Note

If it has been removed, give the air conditioner compressor approx. 10 turns by hand prior to initial start-up to prevent damage caused by fluid lock when first switched on (any oil in the air conditioner compressor cylinder is forced out by the cranking action).



- Start the engine with the air conditioner compressor switched off (version with magnetic clutch).
- Set the air conditioner compressor to minimum output, "Econ" or A/C off mode (version with no magnetic clutch with a regulating valve).
- 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 pressures in refrigerant circuit with air conditioner service station.
- Switch off engine.
- Screw out handwheel on quick-release coupling adapter.
- Detach the charging hoses from the refrigerant circuit.
- Screw the sealing caps back on.

4.3.7 Pouring refrigerant into reservoir (charging cylinder or storage vessel) of air conditioner service station

- The work procedure must always be performed as described in the operating instructions of the air conditioner service station.
- A certain quantity of refrigerant is specified as charge for each air conditioning system. To ensure that neither too much nor too little refrigerant is added (either would reduce the cooling output), the charging cylinder has a scale indicating the weight for example.
- The volume of a refrigerant changes as a function of pressure. The scale must therefore be set according to the pressure in the charging cylinder.

Note

Do not completely empty the charging cylinder or storage vessel, as the liquid column boundary layer cannot be traced in the indicator tube during filling (outside visible range).

WARNING

Do not overfill. A completely filled charging cylinder or storage vessel will explode when the temperature rises.

4.3.8 Discharging air conditioner service station

Note

- *If it is necessary to drain the air conditioner service station (e.g. due to extraction of contaminated refrigerant), all filters and dryers must always be replaced (do not remove filter and dryer from the air-tight packaging until immediately before installation to minimise moisture absorption).*
- *Refrigerant containers filled with contaminated used refrigerant are referred to as „Recycling containers".*
- *Always evacuate recycling containers before initial filling with refrigerant (if there is air in a refrigerant container it is not to be filled with refrigerant).*
- *Do not mix various types of refrigerant (refrigerant mixtures cannot be recycled and must be disposed of). If there is any doubt about the composition of the contents of the container, the refrigerant recycling company must be informed.*

Caution

- ***When filling recycling containers (compressed-gas vessels), observe the applicable regulations, technical rules and laws.***
- ***Recycling containers must never be overfilled. The gas cushion in overfilled recycling containers is not sufficient to absorb the liquid expansion caused by the influence of heat. There is a risk of rupturing.***
- ***To ensure safety, make exclusive use of recycling containers fitted with a safety valve.***
- ***Recycling containers must be weighed on calibrated scales during the filling process. The maximum permissible capacity is 75 % (charge factor 0.75) of the charge weight indicated on the recycling container (the possibility of refrigerant oil entering the recycling container along with the refrigerant cannot be ruled out).***

4.4 Blowing out refrigerant circuit with compressed air and 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 flush the refrigerant circuit with refrigerant R134a or to blow it out with compressed air and nitrogen.

Note

- *Blowing out the refrigerant circuit with compressed air and nitrogen usually involves far more work than flushing with refrigerant R134a. Flushing with refrigerant R134a also provides far better cleaning of the components. Flushing should therefore always be employed in the event of complaints (blowing out should only be applied when dealing with certain problems and for particular components).*
- *Under certain conditions it may, for example, be sufficient to blow out specific components (e.g. individual refrigerant pipes or refrigerant hoses) with compressed air and nitrogen (for instance to force old refrigerant oil out of individual components following removal).*
- *Certain impurities are impossible or difficult to remove properly from the refrigerant circuit using compressed air. Such impurities can be removed for example by flushing with refrigerant R134a* *⇒ page 59* *.*
- *A maximum working pressure of 15 bar is not to be exceeded when blowing out (corresponds to the pressure prevailing in a charged refrigerant circuit at an ambient temperature of approx. 60 °C; use pressure reducer for compressed air as well if applicable).*

WARNING

- ***Always work with pressure reducers for nitrogen cylinders (max. working pressure 15 bar).***
- ***Use appropriate extraction units to draw off gas mixture escaping from components.***

– Always flush or blow out components in direction opposite to refrigerant flow.

Note

The restrictor, expansion valve, air conditioner compressor, receiver and reservoir cannot be flushed with compressed air and nitrogen.

– In the case of condensers fitted with a dryer cartridge in the integrated receiver, this cartridge is to be removed.

Note

- *In the case of condensers with an integrated receiver / dryer cartridge which cannot be renewed separately, the condenser is to be replaced after flushing.*
- *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.*

– First flush out the old refrigerant oil and dirt with compressed air and then use nitrogen to remove the moisture from the components.

– For adapter for connecting pressure hose to refrigerant circuit, refer to ⇒ page 99 .

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

– The compressed air must be passed through a compressed-air purifier for cleaning and drying. Use is therefore to be made of filters and dryers for compressed air (included in the scope of delivery as tool for painting work) ⇒ Workshop equipment and special tools catalogue .
– For refrigerant pipes with a thread or union nut at the connection, make use of adapters from the adapter set for refrigerant circuit -V.A.G 1785- (adapter -V.A.G 1785/1- to adapter -V.A.G 1785/8-) for connection of the 5/8" -18 UNF charging hoses (some of these adapters are also contained in the VW/Audi passenger vehicle adapter set -VAS 6338/1-).
– For refrigerant pipes with no thread or union nut at connection (for connecting adapters), use adapters from adapter set for refrigerant circuits -VAS 6338/1- or commercially available blow-out gun with rubber mouthpiece.

Note

- *The refrigerant circuit is only to be blown out with compressed air and then nitrogen if no means of flushing the refrigerant circuit are available or if flushing of individual components would involve too much work (blowing minor impurities and small quantities of moisture out of refrigerant pipes for example is not particularly time-consuming).*
- *Compressed air/nitrogen emerging from the components is to be drawn off by way of an appropriate system (e.g. workshop extraction system).*

The refrigerant circuit (or individual components) is/are to be blown out if no means of flushing are available or if flushing seems inappropriate

– In the event of dirt or other impurities in individual circuit components
– If the vacuum reading is not maintained on evacuating a leak-free refrigerant circuit (pressure build-up due to moisture in refrigerant circuit)
– If the refrigerant circuit has been left open for longer than the normal assembly time (e.g. following an accident)
– If pressure and temperature measurements in the refrigerant circuit indicate the likelihood of moisture
– If there are doubts about the amount of refrigerant oil in the refrigerant circuit
– If the air conditioner compressor has to be replaced on account of internal damage (e.g. noise or no output)
– If stipulated by the vehicle-specific Workshop Manual after renewing certain components

Note

Certain impurities and old refrigerant oil are impossible or difficult to remove properly from the refrigerant circuit using compressed air. Such impurities can be removed for example by flushing with refrigerant R134a ⇒ page 59 .

- Blowing out refrigerant circuit ⇒ page 58

4.4.1 Blowing out refrigerant circuit

Note

- *In the case of vehicles on which the refrigerant lines have no threads for connection of adapters V.A.G -1785- , use is to be made, for example, for blowing out the individual components of a blow-out gun with rubber mouthpiece or an adapter from the VW/Audi passenger vehicle adapter set -VAS 6338/1- . 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 pipe (large diameter) after detaching the expansion valve or removing the restrictor.*
- *Always flush or blow out components in direction opposite to refrigerant flow.*

- *Check expansion valve and renew if dirty or corroded.*
- *If dark, sticky deposits cannot be removed with compressed air, flush the components concerned with refrigerant R134a or renew.*
- *Thin, light grey deposits on the insides of pipes do not impair the function of the components.*
- *After flushing, always renew receiver or reservoir and restrictor. In the case of condensers fitted with a dryer cartridge in the integrated receiver, this cartridge is to be replaced.*
- *In the case of condensers with an integrated receiver / dryer cartridge which cannot be replaced separately or which is not available as a replacement part, the condenser must be replaced after flushing ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 .*
- *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 the vehicle-specific components (restrictor and reservoir, expansion valve and receiver or dryer cartridge) ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .

– Depending on the problem, replace the air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue or drain off the remaining refrigerant oil from the air conditioner compressor removed ⇒ page 136 (replace refrigerant circuit components) and add the specified quantity of fresh refrigerant oil again ⇒ page 164 (approved refrigerant oils and refrigerant oil capacities).

Note

- *Replacement compressors contain a certain specified quantity of refrigerant oil. For vehicles with two evaporators, it may be necessary to additionally add a certain quantity of refrigerant oil to the circuit ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ page 164 (approved refrigerant oils and refrigerant oil capacities).*
- *If the air conditioner compressor is not to be replaced, the refrigerant oil quantity in the air conditioner compressor must be topped up in line with the specified capacity (pour out refrigerant oil and add the specified quantity to the air conditioner compressor or the refrigerant circuit again) ⇒ page 136 (replace refrigerant circuit components) and ⇒ page 164 (approved refrigerant oils and refrigerant oil capacities).*

– Completely re-assemble the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

– Evacuate and charge the refrigerant circuit as specified ⇒ page 49 and ⇒ page 53 .

– Start up the air conditioner as specified ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ page 53 .

4.5 Flushing (cleaning) refrigerant circuit with refrigerant R134a

Caution

- ***If there is a possibility that chemical substances (sealing additives) for sealing leaks have been added to the refrigerant circuit to be flushed, do not connect the air conditioner service station to this refrigerant circuit and do not flush this refrigerant circuit.***
- ***Chemical substances (sealing additives) for sealing leaks form deposits in the refrigerant circuit which will impair operation of the air conditioning system and lead to failure of the system (and of the air conditioner service station).***
- ***Customers should be informed that the air conditioner in their vehicle contains substances not approved by Audi and that the system can therefore not be flushed and serviced by your workshop.***

Note

- *Audi does not permit the use of chemical substances (sealing additives) to seal leaks in the refrigerant circuit.*
- *Chemical substances (sealing additives) for sealing leaks in the refrigerant circuit generally react with the ambient air or the humidity contained in it. They cause malfunctioning of valves and other components with which they come into contact on account of deposits in the refrigerant circuit (and in the air conditioner service station being used). These deposits cannot be completely removed from the components affected (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.*

- 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 flush the refrigerant circuit with refrigerant R134a.

The refrigerant circuit is to be flushed:

- In there is any dirt or similar in the circuit.
- If the vacuum reading is not maintained on evacuating a leak-free refrigerant circuit (pressure build-up due to moisture in refrigerant circuit)
- If the refrigerant circuit has been left open for longer than the normal assembly time (e.g. following an accident)
- If pressure and temperature measurements in the refrigerant circuit indicate the likelihood of moisture
- If there are doubts about the amount of refrigerant oil in the refrigerant circuit
- If the air conditioner compressor has to be replaced on account of internal damage (e.g. noise or no output)
- If stipulated by the vehicle-specific Workshop Manual after renewing certain components

Tools required

- Air conditioner service station with flushing attachment (these air conditioner service stations feature the additional function „Flushing refrigerant circuit“ and the necessary flushing attachment for refrigerant circuits) ⇒ Workshop equipment and special tools catalogue
- Adapter set for refrigerant circuits -VAS 6338/1- ⇒ page 71 and ⇒ Workshop equipment and special tools catalogue
-

Note

- *If no air conditioner service station with flushing attachment is available ⇒ Workshop equipment and special tools catalogue and depending on the version of the air conditioner service station being used, the refrigerant circuit can also be flushed with this employing the refrigerant circuit flushing attachment ⇒ Workshop equipment and special tools catalogue , however flushing must then be performed manually.* *⇒ page 65*
- *Use can be made for vehicles with screw connections at the refrigerant circuit of the adapter -V.A.G 1785/7- and adapter -V.A.G 1785/8- from the VW/Audi passenger vehicle adapter set -VAS 6338/1- . Two adapters -V.A.G 1785/8- are required for a vehicle with screw connections at the air conditioner compressor and reservoir.*
- *The adapter set for refrigerant circuits -VAS 6338/1- also contains a short filler hose -VAS 6338/31- with 5/8 -18 UNF connections and a large inside diameter (commercially available).*

Preparation

– Discharge the refrigerant circuit ⇒ page 48 .

– Remove the air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

Vehicle with restrictor and reservoir

– Remove restrictor (vehicle-specific) and re-connect pipes ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific Workshop Manual).

– Remove the reservoir (vehicle-specific) and re-connect the pipes (for this purpose, make use of an adapter and the charging hose -VAS 6338/31- from the VW/Audi passenger vehicle adapter set -VAS 6338/1-) ⇒ page 71 , ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (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

– Remove the receiver (vehicle-specific, not necessary with all vehicles) and re-connect the pipes (for this purpose, make use of an adapter and the charging hose -VAS 6338/31- from the VW/Audi passenger vehicle adapter set -VAS 6338/1-) ⇒ page 71 , ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

Note

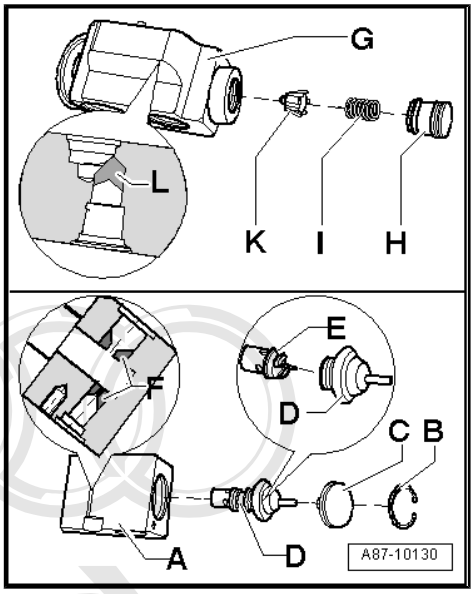
- *Depending on design, the receiver can be flushed (remove the fitted dryer cartridge if applicable) ⇒ page 71 , ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *If the receiver is attached to the condenser (e.g. on Audi A3 as of Model Year 2004), it is not removed for flushing (its design makes it suitable for flushing and it is only replaced after flushing) ⇒ page 71 and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *In the case of condensers with an integrated receiver / dryer cartridge which cannot be renewed separately or which are not available separately, the condenser is to be replaced after flushing. On these vehicles, the condenser is then to be replaced together with the receiver ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*
- *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.*

– On vehicles with a dryer cartridge in the receiver at the condenser (vehicle-specific), remove the dryer cartridge and reseal the opening at the receiver ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

– Remove the expansion valve (vehicle-specific) and replace it with an adapter from the VW/Audi passenger vehicle adapter set -VAS 6338/1- ⇒ page 71 , ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

Note

- *If there is no suitable adapter for the expansion valve in the VW/Audi passenger vehicle adapter set -VAS 6338/1- , the expansion valve removed can also be drilled open (the old expansion valve generally has to be replaced and is therefore no longer needed).*
- *Before drilling open, remove the control element and then drill open the expansion valve using a suitable drill bit for example (bit diameter e.g. 6.0 mm).*
- *There are different expansion valve versions with differing design. With version -A-, the parts -B-, -C- and -D- have to be removed for example. Then separate part -E- (control element) from part -D-. After doing so, use a suitable bit to drill open the expansion valve in area -F-.*
- *With version -G-, the parts -H-, -I- and -K- must be removed for example and the area -L- then drilled open using a suitable bit.*



– Remove swarf remnants from the expansion valve after drilling open.

– Re-install the parts -B-, -C- and -D- with version -A- or part -H- with version -G-.

Note

On vehicles with two evaporators, the circuit to the second evaporator is to be separated from the circuit of the first evaporator and flushed in a separate operation ⇒ page 71 , ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

Flushing

– Check the amount of refrigerant in the air conditioner service station, it must contain at least 7 kg of refrigerant R134a.

Note

If applicable, switch on the heater attached to the air conditioner service station for the refrigerant cylinder installed in the air conditioner service station prior to the first flushing operation (to increase the pressure in the refrigerant cylinder) and switch it off again before the first extraction operation during the flushing cycle.

– Discharge the used oil container of the air conditioner service station.

– Connect the supply hose (high-pressure end) of the air conditioner service station with an adapter to the low-pressure pipe to the air conditioner compressor (pipe with larger diameter) ⇒ page 71 .

– Connect the return hose (low-pressure or suction end) of the air conditioner service station to the outlet of the refrigerant circuit flushing attachment.

– Connect the inlet of the refrigerant circuit flushing attachment with an adapter to the high-pressure pipe to the air conditioner compressor (pipe with smaller diameter) ⇒ page 71 .

Note

- *The components are always flushed in the direction opposite to that of refrigerant flow during air conditioner operation ⇒ page 67 .*
- *When flushing, impurities from the refrigerant circuit ingress into the refrigerant circuit flushing attachment and the air conditioner service station, where they are retained in the built-in filters and dryer. Depending on the nature of the impurities, these components are to be replaced more frequently in line with the operating instructions for the air conditioner service station or the refrigerant circuit flushing attachment.*
- *Depending on the nature and severity of the contamination of the flushed refrigerant circuits, the filter in the refrigerant circuit flushing kit should be renewed 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. If applicable, clean this sight glass after flushing and flush the refrigerant circuit again in one operation as a check (one operation is then sufficient).*
- *Liquid refrigerant cannot be routed at the necessary rate through the expansion valve, restrictor and desiccant bag of certain receivers. These components are therefore to be removed and replaced with adapters if applicable ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *Adapters for connection of air conditioner service station and for bridging certain refrigerant circuit components ⇒ page 71 .*

– Switch on the air conditioner service station and flush the refrigerant circuit (duration approx. 1 to 1.5 hours for one flushing cycle with three flushing operations).

Note

- *The flushing operation is to be performed in line with the operating instructions for the air conditioner service station.*
- *Depending on the version of the air conditioner service station, the used oil container may only hold approx. 125 cm ^{3} of refrigerant oil. If a system with a larger refrigerant oil quantity is to be flushed, it may be necessary to empty the used oil container after the first flushing operation in a flushing cycle.*
- *Observe the refrigerant flowing back out of the refrigerant circuit into the air conditioner service station. Refrigerant circuit cleaning has not been completed until the refrigerant flowing through the inspection port of the refrigerant circuit flushing attachment 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).*
- *In the case of extremely severe contamination, it may be necessary to perform flushing twice (two flushing cycles with three flushing operations each).*

Sequence of flushing operation (sequence takes place automatically in line with air conditioner service station program)

- After switch-on, the flushing circuit (refrigerant circuit with connecting hoses and refrigerant circuit flushing attachment) is initially evacuated and the refrigerant circuit checked for leaks (depending on the version of the air conditioner service station, manual switching to next step may be necessary).
- A specified quantity of refrigerant (e.g. 5 kg) is added to the evacuated refrigerant circuit via the high-pressure end of the air conditioner service station (in the direction opposite to the normal flow direction during air conditioner operation and thus on the low-pressure end of the vehicle refrigerant circuit) or refrigerant is added until the refrigerant circuit and the inspection ports of the refrigerant circuit flushing attachment have been completely filled with liquid refrigerant (depending on the version of the air conditioner service station, the system detects that there has been no further inflow of refrigerant over a certain period for example).
- Once the specified quantity of refrigerant has been added, the heater of the refrigerant circuit flushing attachment may be switched on for example depending on the version of the air conditioner service station and the refrigerant circuit flushing attachment (only if the refrigerant is extracted in gaseous form from the refrigerant circuit flushing attachment).
- After the refrigerant has been extracted, the heater of the refrigerant circuit flushing attachment is switched off (if fitted). Depending on the version, the refrigerant circuit may be briefly evacuated again and, following evacuation, the refrigerant oil extracted from the refrigerant circuit is separated by the air conditioner service station.
- The refrigerant charging, extraction (and evacuation) process is repeated twice (in other words it is implemented a total of three times).
- Following extraction for the third time, the flushing circuit is evacuated depending on the version of the air conditioner service station.

– On completion of flushing, check the inspection port(s) of the refrigerant circuit flushing attachment. If these are contaminated, they are to be cleaned if necessary in line with the operating instructions for the refrigerant circuit flushing attachment or air conditioner service station. Flushing is then to be performed again as a check (one operation with a duration of approx. 30 min. is sufficient).
– Check the pressure in the refrigerant circuit. There must not be any positive pressure in the refrigerant circuit (evacuate briefly again if necessary).
– Detach the connections to the air conditioner service station from the vehicle refrigerant circuit (there must not be any positive pressure in the refrigerant circuit).
– Replace the vehicle-specific components (restrictor and reservoir, expansion valve and receiver or dryer cartridge in the receiver) ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .
– Depending on the problem, replace the air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue or drain off the remaining refrigerant oil from the air conditioner compressor removed ⇒ page 136 (replace refrigerant circuit components) and add the specified quantity of fresh refrigerant oil again ⇒ page 164 (approved refrigerant oils and refrigerant oil capacities).

Note

- *Replacement compressors contain a certain specified quantity of refrigerant oil. For vehicles with two evaporators, it may be necessary to additionally add a certain quantity of refrigerant oil to the circuit ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ page 164 (approved refrigerant oils and refrigerant oil capacities).*
- *If the air conditioner compressor is not to be replaced, the refrigerant oil quantity in the air conditioner compressor must be topped up in line with the specified capacity (pour out refrigerant oil and add the specified quantity to the air conditioner compressor or the refrigerant circuit again) ⇒ page 136 (replacing refrigerant circuit components) and ⇒ page 164 (approved refrigerant oils and refrigerant oil capacities).*

– Completely re-assemble the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
– Evacuate and charge the refrigerant circuit as specified ⇒ page 49 and ⇒ page 53 .
– Start up the air conditioner as specified ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ page 53 .

- Block diagrams for various flushing circuits ⇒ page 67
- Adapters for connecting flushing circuits ⇒ page 71

4.5.1 Block diagrams for various flushing circuits

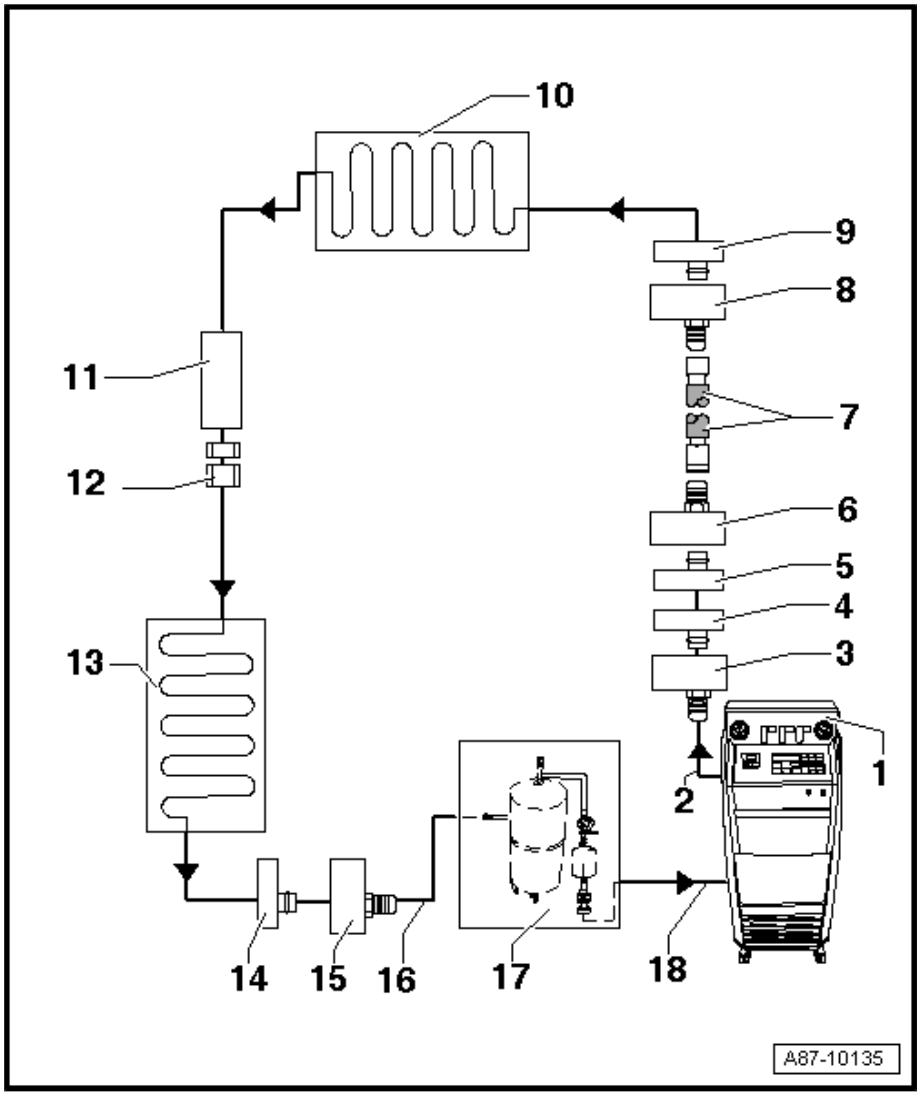
Note

- *The arrows in the following illustrations indicate the direction of refrigerant flow on flushing (during flushing, the refrigerant flows in the direction opposite to that in air conditioner operation; the high-pressure end of the air conditioner service station is thus connected to the low-pressure connection of the refrigerant circuit to the air conditioner compressor).*
- *The block diagrams illustrate a refrigerant circuit with restrictor and reservoir and a refrigerant circuit with expansion valve, receiver and a second evaporator (optional extra for certain vehicles).*
- *Depending on the design of the air conditioner service station, non-return valves may be fitted between the refrigerant circuit and the air conditioner service station (to guarantee the correct direction of refrigerant flow on flushing).*

Refrigerant circuit with restrictor and reservoir

Note

On vehicles with a restrictor and reservoir, the restrictor and reservoir are removed and the pipes unfastened to remove the restrictor are connected back together. The pipe connections to the reservoir removed are connected together with two adapters and the charging hose -VAS 6338/31- (from the VW/Audi passenger vehicle adapter set -VAS 6338/1-).



1 - Air conditioner service station

- With electronics and a flushing program, e.g. Air conditioner service station with flushing attachment ⇒ Workshop equipment and special tools catalogue
- If use is made of an air conditioner service station with no flushing program, the process is to be implemented manually (evacuation, 3x flushing with at least 4 kg of refrigerant each time, extraction of refrigerant again, evacuation).

2 - Refrigerant hose of air conditioner service station

- From the high-pressure end of the air conditioner service station (generally red coloured) to the connection for the low-pressure end of the air conditioner compressor at the refrigerant circuit (larger diameter)

3 - Adapter for connection (low-pressure side) at refrigerant circuit

- Different versions depending on vehicle ⇒ page 71
- From adapter set for refrigerant circuits -VAS 6338/1-

4 - Connection (low-pressure side) at refrigerant circuit

- Different versions depending on vehicle ⇒ page 71
- At the refrigerant pipe from the air conditioner compressor to the reservoir

5 - Connection to reservoir

- Different versions depending on vehicle ⇒ page 71
- At the refrigerant pipe from the air conditioner compressor to the reservoir

6 - Adapter for bridging reservoir after removal

- Different versions depending on vehicle ⇒ page 71
- From adapter set for refrigerant circuits -VAS 6338/1-

7 - Filler hose for refrigerant ⇒ page 71

- For example filler hose -VAS 6338/31- (from adapter set for refrigerant circuits -VAS 6338/1-)

8 - Adapter for bridging reservoir after removal

- Different versions depending on vehicle ⇒ page 71
- From adapter set for refrigerant circuits -VAS 6338/1-

9 - Connection to reservoir

- Different versions depending on vehicle ⇒ page 71

10 - Evaporator

11 - Fitting location for restrictor

- ❑ Restrictor removed.
- ❑ Remove the restrictor ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

12 - Bolt connection in refrigerant line

- ❑ Screw back together following restrictor removal ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

13 - Condenser

14 - Connection (high-pressure side) at refrigerant circuit

- ❑ Different versions depending on vehicle ⇒ page 71

15 - Adapter for connection (high-pressure side) at refrigerant circuit

- ❑ Different versions depending on vehicle ⇒ page 71
- ❑ From adapter set for refrigerant circuits -VAS 6338/1-

16 - Filler hose to flushing kit for refrigerant circuits

- ❑ From the high-pressure end connection of the air conditioner compressor at the refrigerant circuit (smaller diameter) to the inlet of the refrigerant circuit flushing attachment.

17 - Flushing kit for refrigerant circuits

- ❑ Different versions and different design of flushing kit for refrigerant circuits ⇒ Workshop equipment and special tools catalogue
- ❑ With filter, sight glass, safety valve, heater, refrigerant vessel etc. (depending on version)
- ❑ Depending on the design of the air conditioner service station and the refrigerant circuit flushing kit, a non-return valve may be fitted at the outlet of the refrigerant circuit flushing kit (to guarantee the correct direction of refrigerant flow when flushing).

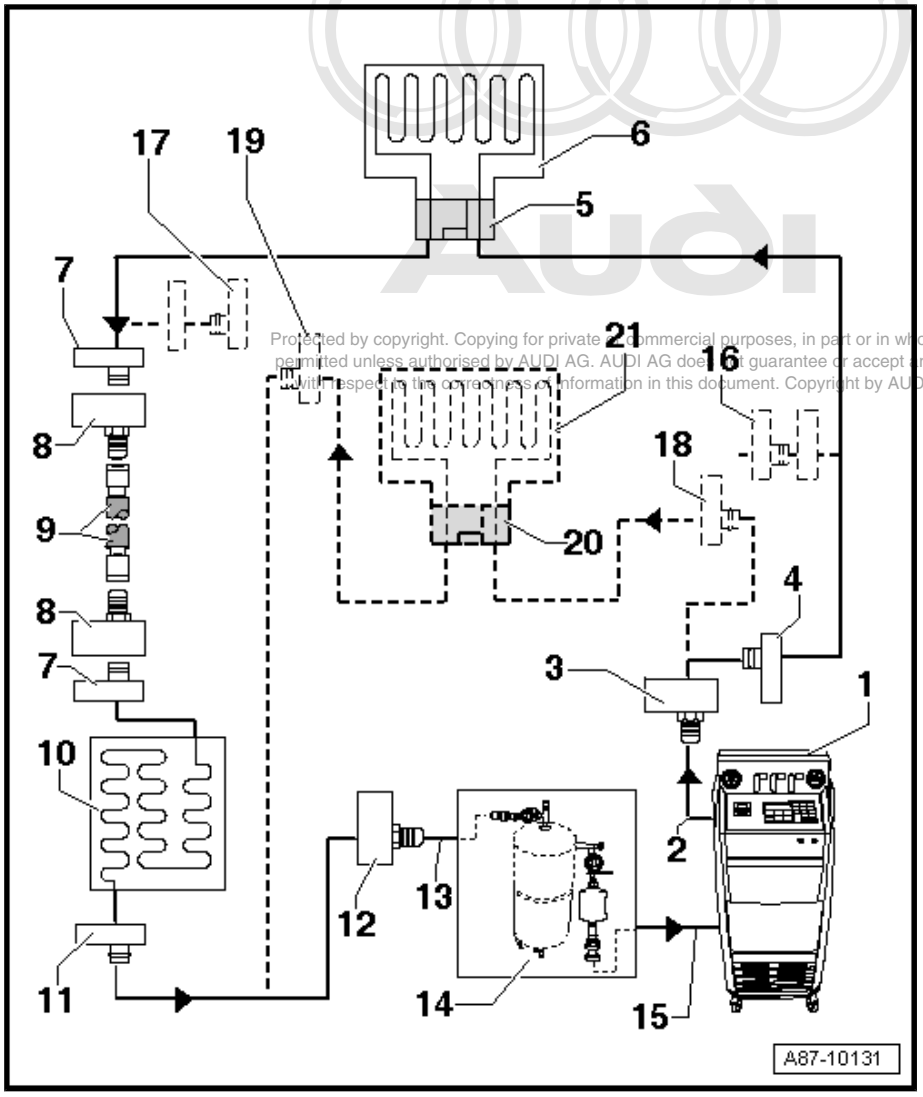
18 - Refrigerant hose of air conditioner service station

- ❑ From low-pressure side of air conditioner service station (usually blue) to outlet of flushing kit for refrigerant circuits

Refrigerant circuit with expansion valve, receiver and second evaporator

Note

- *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 pipe connections to the receiver are connected using two adapters and a filler hose.*
- *On vehicles with only one evaporator, the components from item „16“ onwards are not fitted / are not required.*



1 - Air conditioner service station

- With electronics and flushing program, Air conditioner service station with flushing kit ⇒ Workshop equipment and special tools catalogue
- If use is made of an air conditioner service station with no flushing program, the process is to be implemented manually (evacuation, 3x flushing with at least 4 kg of refrigerant each time, extraction of refrigerant again, evacuation).

2 - Refrigerant hose of air conditioner service station

- From the high-pressure end of the air conditioner service station (generally red coloured) to the connection for the low-pressure end of the air conditioner compressor at the refrigerant circuit (larger diameter)

3 - Adapter for connection (low-pressure side) at refrigerant circuit

- Different versions depending on vehicle ⇒ page 71
- From adapter set for refrigerant circuits -VAS 6338/1-

4 - Connection (low-pressure side) at refrigerant circuit

- Different versions depending on vehicle ⇒ page 71

5 - Adapter for removed expansion valve

- Different versions depending on vehicle ⇒ page 71
- From adapter set for refrigerant circuits -VAS 6338/1-

6 - Evaporator

7 - Connection to receiver

- Different versions depending on vehicle ⇒ page 71
- Not fitted on vehicles with a dryer cartridge in the receiver at the condenser or with a receiver installed in the condenser ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

8 - Adapter for bridging removed receiver

- Not necessary on all vehicles
- Different versions depending on vehicle ⇒ page 71
- From adapter set for refrigerant circuits -VAS 6338/1-

9 - Filler hose for refrigerant ⇒ page 71

- For example filler hose -VAS 6338/31- (from adapter set for refrigerant circuits -VAS 6338/1-)

10 - Condenser

- ❑ If a receiver with dryer cartridge is fitted at the condenser, the dryer cartridge must be removed (seal receiver at or in condenser again following removal) ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 vehicle-specific workshop manual).
- ❑ If the receiver is attached directly to the condenser, the receiver is only to be removed and replaced after flushing ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

Note

11 - Connection (high-pressure side) at refrigerant circuit

- ❑ Different versions depending on vehicle ⇒ page 71

12 - Adapter for connection (high-pressure side) at refrigerant circuit

- ❑ Different versions depending on vehicle ⇒ page 71
- ❑ From adapter set for refrigerant circuits -VAS 6338/1-

13 - Filler hose to flushing kit for refrigerant circuits

- ❑ From the high-pressure end connection of the air conditioner compressor at the refrigerant circuit (smaller diameter) to the inlet of the refrigerant circuit flushing attachment.

14 - Flushing kit for refrigerant circuits

- ❑ Different versions and different design of flushing kit for refrigerant circuits ⇒ Workshop equipment and special tools catalogue
- ❑ With filter, sight glass, safety valve, heater, refrigerant vessel etc. (depending on version)
- ❑ Depending on the design of the air conditioner service station and the refrigerant circuit flushing kit, a non-return valve may be fitted at the outlet of the refrigerant circuit flushing kit (to guarantee the correct direction of refrigerant flow when flushing).

15 - Refrigerant hose of air conditioner service station

- ❑ From low-pressure side of air conditioner service station (usually blue) to outlet of flushing kit for refrigerant circuits

16 - Adapter for sealing outlet to second evaporator

- ❑ Only required for certain vehicles with „second evaporator“ as optional extra
- ❑ From adapter set for refrigerant circuits -VAS 6338/1-

17 - Adapter for sealing outlet to second evaporator

- ❑ Only required for certain vehicles with „second evaporator“ as optional extra
- ❑ From adapter set for refrigerant circuits -VAS 6338/1-

18 - Connection (low-pressure side) at refrigerant circuit to second evaporator

- ❑ Different versions depending on vehicle ⇒ page 71
- ❑ Only fitted on certain vehicles with „second evaporator“ as optional extra

19 - Connection (high-pressure side) at refrigerant circuit to second evaporator

- ❑ Different versions depending on vehicle ⇒ page 71
- ❑ Only fitted on certain vehicles with „second evaporator“ as optional extra

20 - Adapter for expansion valve (removed) at second evaporator

- ❑ Different versions depending on vehicle ⇒ page 71
- ❑ Only required for certain vehicles with „second evaporator“ as optional extra
- ❑ From adapter set for refrigerant circuits -VAS 6338/1-

21 - Second evaporator

- ❑ Only fitted on certain vehicles with „second evaporator“ as optional extra

4.5.2 Adapters for connecting flushing circuits

♦ The following table lists the various adapters required for connecting the air conditioner service station to the refrigerant

circuit for flushing and for bridging the removed receiver or reservoir and expansion valve (vehicle-specific).

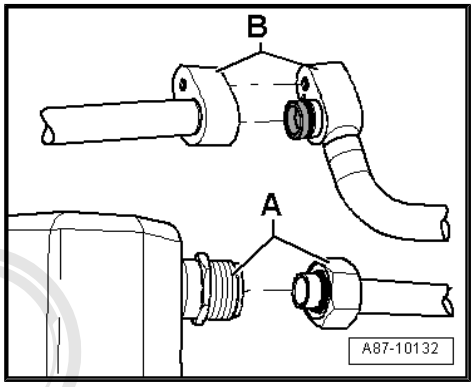
- Use a charging hose with 5/8 - 18 UNF connections (short version e.g. charging hose -VAS 6338/31-) to connect the two adapters fitted in place of the reservoir or receiver removed (contained in VW/Audi passenger vehicle adapter set -VAS 6338/1-).
- If a flushed refrigerant circuit is not supposed to be re-assembled immediately after flushing, leave the adapters in place at the connections and seal the connections at the adapters with the caps -VAS 6338/30- (from the adapter set for refrigerant circuits -VAS 6338/1-).
- Depending on the version of the air conditioner compressor and the production period, use may have been made of different connection and sealing methods at the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.

Block or screw connections

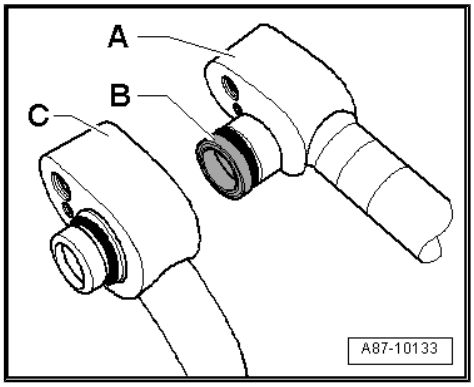
– Screw connection -A-

– Block connection -B-

Block connections with different types of seal



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



Audi A1 and Audi A2

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for reservoir/receiver connections	Other requirements
Audi A1 (8X_) 2011 ►	– Compressor manufacturer „Denso“, „Sanden“ or „Delphi“ ♦ Low-pressure end Adapter -VAS 6338/12- ♦ High-pressure end Adapter -VAS 6338/3- or Adapter -VAS 6338/2- (depending on the design of the compressor and the corresponding refrigerant line)	Different versions – Version 1 (integrated receiver at condenser): No adapter required, the desiccant bag is removed from the receiver at the condenser and the opening sealed off again for flushing. – Version 2 (receiver attached to condenser): No adapter required, the receiver is left in position (replaced after flushing)	Expansion valve removed and adapter -VAS 6338/34- fitted (or old expansion valve removed drilled open for flushing and re-installed) ⇒ page 63
Audi A2 (8Z_) 2001 ►	– Compressor manufacturer „Denso“ ♦ Adapter -VAS 6338/12- (low-pressure side) ♦ Adapter -VAS 6338/2- (high-pressure side)	Reservoir – Screw connection at inlet Adapter -VAS 6338/9- – Block connection with axial seal at outlet Adapter -VAS 6338/10-	- Restrictor removed, pipe connections re-assembled

Note

On the Audi A1, the receiver may be attached or integrated depending on the version of the condenser. The integrated receiver is fitted with a dryer cartridge which can be replaced separately. If the receiver is of the attached type (introduction not yet finalised), it must be replaced after flushing ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .

Audi A3 and Audi TT

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for reservoir/receiver connections	Other requirements
Audi A3 (8L_) 1997 ➤ Audi TT (8N_) 1999 ➤	– Compressor manufacturer „Sanden“ or „Zexel / Valeo“ ♦ Adapter -VAS 6338/7- (low-pressure side) ♦ Adapter -VAS 6338/2- (high-pressure side)	Receiver – Block connections with axial seal at inlet and outlet Adapter -VAS 6338/2- (2x required)	Expansion valve removed and Adapter -VAS 6338/19- fitted (or drilled-open expansion valve e.g. 6N0 820 679 C fitted ⇒ page 63)
Audi A3 (8P_) 2004 ➤ Audi TT (8J_) 2007 ➤	– Compressor manufacturer for Audi A3 „Sanden“, „Denso“, „Delphi“ or „Zexel / Valeo“ – Compressor manufacturer for Audi TT „Denso“ ♦ Adapter -VAS 6338/12- (low-pressure side) ♦ Adapter -VAS 6338/3- (high-pressure side)	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 63

Note

- *The design of the receiver on the Audi A3 and Audi TT differs depending on the condenser manufacturer. The Audi TT with 5-cyl. engine is fitted for example with a different type of condenser to vehicles with a 4 or 6-cyl. engine. 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. On vehicles fitted with this condenser, it may therefore be necessary to replace the entire condenser after rectifying any problems ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .*
- *In the case of condensers with an integrated receiver / dryer cartridge which cannot be renewed separately or which are not available separately, the condenser is to be replaced after flushing (together with the built-in dryer cartridge) ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*

Audi 80 ,Audi 90, Audi Coupé, Audi Cabriolet and Audi A4

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for reservoir connections	Other requirements
Audi 80 (8A_/ 8C_), Audi Coupé (8B_), Audi Cabriolet (8G_) ► 2002 Audi A4 (8D_) 1995►	– Compressor manufacturer „Zexel / Valeo“ (screw connections) ♦ Adapter - VAG 1785/8- (low-pressure side) ♦ Adapter - VAG 1785/7- (high-pressure side)	Reservoir with different connection versions ♦ Version „1“ – Screw connection at inlet Adapter - VAS 6338/9- – Screw connection at outlet Adapter - VAG 1785/8-	- Restrictor removed, pipe connections re-assembled
	– Compressor manufacturer „Denso“ (block connections with radial and axial seal) ♦ Adapter -VAS 6338/12- (low-pressure side) ♦ Adapter -VAS 6338/2- (high-pressure side)	♦ Version „2“ – Screw connection at inlet Adapter - VAS 6338/9- – Block connection with axial seal at outlet Adapter - VAS 6338/10-	
Audi A4 (8E_) 2001 ► Audi A4 Cabriolet (8H_) 2003 ►	– Compressor manufacturer „Denso“ (block connections with radial and axial seal) ♦ Adapter -VAS 6338/12- (low-pressure side) ♦ Adapter -VAS 6338/2- (high-pressure side)	Reservoir with different connection versions ♦ Version „1“ – Block connections with axial seal at inlet and outlet ♦ Adapter -VAS 6338/10- (2x required)	- Restrictor removed, pipe connections re-assembled

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for reservoir connections	Other requirements
	– Compressor manufacturer „Denso“ (block connections with radial seal) ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) ♦ Adapter -VAS 6338/12- (low-pressure side) ♦ Adapter -VAS 6338/3- (high-pressure side)	♦ Version „2“ – Block connections with radial seal at inlet and outlet ♦ Adapter -VAS 6338/8- (2x required)	
Audi A4 (8K_) 2008 ►	– Compressor manufacturer „Denso“ ♦ Adapter -VAS 6338/12- (low-pressure side) ♦ Adapter -VAS 6338/3- (high-pressure side)	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 63 – The refrigerant pipe with internal heat exchanger remains in position or is installed again after fitting the adapter.

Note

- *The design of the receiver on the Audi A4 (8K_) 2008 > differs depending on the condenser manufacturer ⇒ Air conditioning; Rep. gr. 87 . The receiver may be attached or integrated depending on the version of the condenser. The integrated receiver contains a dryer cartridge which is currently not always available as a replacement part. On vehicles fitted with this condenser, it may therefore be necessary to replace the entire condenser after rectifying any problems ⇒ Electronic parts catalogue .*
- *In the case of condensers with an integrated receiver / dryer cartridge which cannot be renewed separately or which are not available separately, the condenser is to be replaced after flushing (together with the built-in dryer cartridge) ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*

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

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for receiver connections	Other requirements
Audi A5 Coupé and Sportback (8T_) 2008 ➤ Audi Q5 (8R_) 2008 ➤ Audi A5 Cabriolet (8F_) 2009 ➤	– Compressor manufacturer „Denso“ ♦ Adapter -VAS 6338/12- (low-pressure side) ♦ Adapter -VAS 6338/3- (high-pressure side)	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 63 – The refrigerant pipe with internal heat exchanger remains in position or is installed again after fitting the adapter.

Note

- *The design of the receiver differs on these vehicles depending on the condenser manufacturer ⇒ Air conditioning; Rep. gr. 87 . The receiver may be attached or integrated depending on the version of the condenser. The integrated receiver contains a dryer cartridge which is currently not always available as a replacement part. On vehicles fitted with this condenser, it may therefore be necessary to replace the entire condenser after rectifying any problems ⇒ Electronic parts catalogue .*
- *In the case of condensers with an integrated receiver / dryer cartridge which cannot be renewed separately or which are not available separately, the condenser is to be replaced after flushing (together with the built-in dryer cartridge) ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*

Audi 100, Audi A6, Audi allroad and Audi V8

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for reservoir connections	Other requirements
Audi 100 / Audi A6 (4A_) ➤ 1998 Audi A6 (4B_) 1998 ➤ Audi allroad (4B_) ➤ 2005 Audi V8 (4C_) ➤ 1994	– Compressor manufacturer „Zexel / Valeo“ (screw connections) ◆ Adapter - VAG 1785/8- (low-pressure side) ◆ Adapter - VAG 1785/7- (high-pressure side)	Reservoir with different connection versions ◆ Version „1“ – Screw connection at inlet Adapter - VAS 6338/9- – Screw connection at outlet Adapter - VAG 1785/8-	- Restrictor removed, pipe connections re-assembled
	– Compressor manufacturer „Denso“ (block connections with radial and axial seal) ◆ Adapter -VAS 6338/12- (low-pressure side) ◆ Adapter -VAS 6338/2- (high-pressure side)	◆ Version „2“ – Screw connection at inlet Adapter - VAS 6338/9- – Block connection with axial seal at outlet Adapter - VAS 6338/10- ◆ Version „3“ – Block connections with axial seal at inlet and outlet Adapter -VAS 6338/10- (2x required)	
Audi A6 (4F_) 2005 ➤	– Compressor manufacturer „Denso“ (block connections with radial seal) ◆ Adapter -VAS 6338/12- (low-pressure side) ◆ Adapter -VAS 6338/3- (high-pressure side)	– Reservoir with block connections with radial seal at inlet and outlet ◆ Adapter -VAS 6338/8- (2x required)	- Restrictor removed, pipe connections re-assembled

Note

The specifications for the Audi A6 (4F_) 2005 ➤ also apply to the Audi S6 and Audi RS 6.

Audi A7

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for receiver connections	Other requirements
Audi A7 (4G_) 2011 ➢	– Compressor manufacturer „Denso“ ◆ Low-pressure end Adapter -VAS 6338/12- ◆ 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- fitted (or old expansion valve removed drilled open for flushing and re-installed ⇒ page 63).

Note

- *The design of the receiver differs on these vehicles depending on the condenser manufacturer ⇒ Air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*
- *In the case of condensers with an integrated receiver / dryer cartridge which cannot be renewed separately or which are not available separately, the condenser is to be replaced after flushing (together with the built-in dryer cartridge) ⇒ Air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*

Audi A8

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for reservoir connections	Other requirements
Audi A8 (4D_) 1994 ➤	– Compressor manufacturer „Zexel / Valeo“ (screw connections) ♦ Adapter - VAG 1785/8- (low-pressure side) ♦ Adapter - VAG 1785/7- (high-pressure side)	Reservoir with different connection versions ♦ Version „1“ – Screw connection at inlet Adapter - VAS 6338/9- – Screw connection at outlet Adapter - VAG 1785/8-	- Restrictor removed, pipe connections re-assembled
	– Compressor manufacturer „Denso“ (block connections with radial and axial seal) ♦ Low-pressure end Adapter -VAS 6338/12- ♦ High-pressure end Adapter -VAS 6338/2-	♦ Version „2“ – Screw connection at inlet Adapter - VAS 6338/9- – Block connection with axial seal at outlet Adapter - VAS 6338/10- ♦ Version „3“ – Block connections with axial seal at inlet and outlet Adapter -VAS 6338/10- (2x required)	
Audi A8 (4E_) 2003 ➤	– Compressor manufacturer „Denso“ (block connections with radial seal) ♦ Adapter -VAS 6338/12- (low-pressure side) ♦ Adapter -VAS 6338/3- (high-pressure side)	Reservoir – Block connections with radial seal at inlet and outlet ♦ Adapter -VAS 6338/8- (2x required)	- Restrictor removed, pipe connections re-assembled

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for reservoir connections	Other requirements
Audi A8 (4H_) 2010 ➤ ♦ Additionally for vehicles with 2 evaporators (4-zone air conditioner)	– Compressor manufacturer „Denso“ (block connections with radial seal) ♦ Low-pressure end Adapter -VAS 6338/12- ♦ 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 63).
		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-	

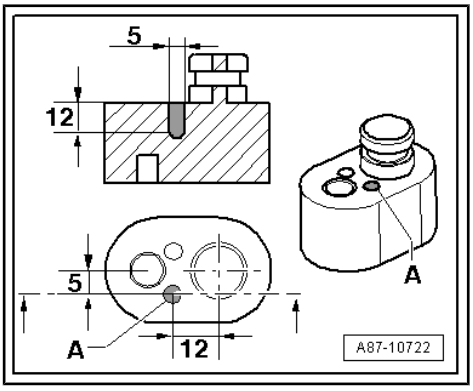
Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for reservoir connections	Other requirements
		For flushing the second evaporator and the corresponding lines ♦ Adapter -VAS 6338/3- for connecting the air conditioner service station to the „low-pressure end“ connection (to the second evaporator). ♦ Adapter -VAS 6338/4- for connecting the air conditioner service station to the „high-pressure end“ connection (to the second evaporator). • The adapter may have to be reworked (see below) to be able to connect the refrigerant line to the adapter -VAS 6338/3-	Expansion valve in refrigerant lines to second evaporator removed and adapter -VAS 6338/18- fitted (or old expansion valve removed drilled open for flushing and re-installed ⇒ page 63).

Note

- *On vehicles with two evaporators, the refrigerant circuit is flushed in two operations.*
- *At present the front and rear expansion valves have identical connections (only the control characteristic differs).*

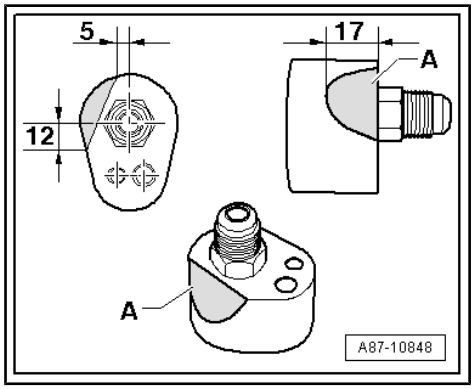
Making additional hole in adapters -VAS 6338/5- and -VAS 6338/11-

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



Reworking adapter -VAS 6338/3-

– 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).



Audi Q7

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for connections to receiver / to second evaporator	Other requirements
Audi Q7 (4L_) 2006 ➤ ♦ Vehicle with one evaporator (2 zone air conditioner)	– Compressor manufacturer „Denso“ (block connections with radial seal) ♦ Adapter -VAS 6338/12- (low-pressure side) ♦ Adapter -VAS 6338/3- (high-pressure side)	– No adapter required, the dryer is removed from the receiver at the condenser and the opening sealed off again.	Expansion valve removed and adapter -VAS 6338/17- or adapter -VAS 6338/33- fitted depending on version of expansion valve (or drilled-open expansion valve e.g. 7L0 820 712 A, 7H0 820 679 B or 7L0 820 679 C fitted ⇒ page 63) ⇒ Electronic parts catalogue .
♦ Additionally for vehicles with 2 evaporators (4-zone air conditioner)		For flushing circuit with evaporator in front air conditioning unit ♦ Adapter -VAS 6338/5- for sealing connection („low-pressure side“) to second evaporator ♦ Adapter -VAS 6338/11- for sealing connection („high-pressure side“) to second evaporator)	

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for connections to receiver / to second evaporator	Other requirements
		For flushing second evaporator and corresponding pipes ♦ Adapter -VAS 6338/3- for connecting the air conditioner service station to the „low-pressure end“ connection (to the second evaporator). ♦ Adapter -VAS 6338/4- for connecting the air conditioner service station to the „high-pressure end“ connection (to the second evaporator).	Expansion valve at second evaporator removed and Adapter -VAS 6338/17- fitted (or drilled-open expansion valve e.g. 7L0 820 712 A fitted ⇒ page 63) ⇒ Electronic parts catalogue

Note

On vehicles with two evaporators, the refrigerant circuit is flushed in two operations.

Audi R8

Vehicle	Adapters required for the connections to the air conditioner compressor	Adapters required for reservoir connections	Other requirements
Audi R8 (42_) 2008 ➤	– Compressor manufacturer „Denso“ (block connections with radial seal) ♦ Low-pressure end Adapter -VAS 6338/12- ♦ High-pressure end Adapter -VAS 6338/3-	Reservoir – Block connections with radial seal at inlet and outlet ♦ Adapter -VAS 6338/8- (2x required)	- Restrictor removed, pipe connections re-assembled

Note

- *On the Audi R8, the engine must be removed to replace the air conditioner compressor. For flushing the refrigerant circuit, the refrigerant pipes can however be detached without removing the air conditioner compressor ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *The two condensers are flushed in situ in the direction opposite to that of the refrigerant flow.*

4.6 Tracing leaks in refrigerant circuit

Note

- *Minor leaks can be detected with an electronic leak detector or UV leak detector lamp for example.*
- *This Workshop Manual describes two ways of tracing leaks in refrigerant circuits. These procedures have been tested and lead to a reliable result under the different usage conditions if they are performed correctly and in accordance with the specific complaint.*
- *There are numerous systems available on the market for the detection of refrigerant circuit leaks. Not all of these yield unequivocable results and, if not employed in the specified manner, may indicate leaks at various refrigerant circuit components although these are actually intact. In addition, certain procedures can lead to damage to components of refrigerant circuits.*

- Components found to be leaking are to be replaced and not repaired.
- Leaking refrigerant circuits are not to be filled with refrigerant. Empty refrigerant circuits are therefore to be evacuated before filling with refrigerant and checked for leaks in this process ⇒ page 49 .

Caution

- ***Audi does not permit the use of chemical substances (sealing additives) to seal leaks in the refrigerant circuit.***
- ***Chemical substances for sealing leaks form deposits in the refrigerant circuit which will impair operation of the air conditioning system and lead to failure of the system (and of the air conditioner service station).***

Note

Chemical substances (sealing additives) for sealing leaks in the refrigerant circuit generally react with the ambient air or the humidity contained in it. They cause malfunctioning of valves and other components with which they come into contact on account of deposits in the refrigerant circuit (and in the air conditioner service station being used). 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.

- ⇒ „4.6.1 Tracing refrigerant circuit leaks with electronic leak detector (e.g. V.A.G 1796)“, page 88 .
- ⇒ „4.6.2 Tracing leaks in refrigerant circuit with leak detection system VAS 6201“, page 89 .

4.6.1 Tracing refrigerant circuit leaks with electronic leak detector (e.g. V.A.G 1796)

Proceed as follows with a completely empty refrigerant circuit to avoid allowing more refrigerant than is absolutely necessary for leak detection to escape into the environment:

– Evacuate the refrigerant circuit using the air conditioner service station ⇒ page 49 .

Note

- *If evacuation already reveals a major leak, this is to be located and eliminated as described ⇒ page 49 .*
- *Continue as follows if evacuation does not reveal any leakage or if the leakage is so slight that it is not possible to determine the leakage location.*

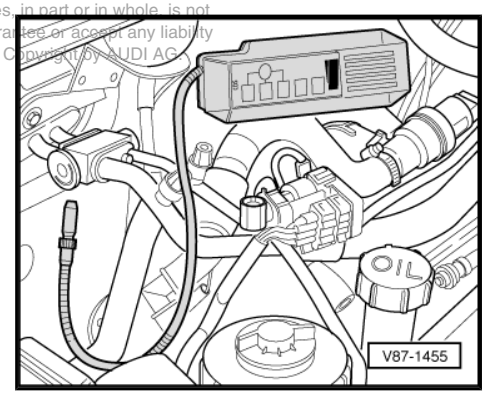
– Pour roughly 100 g of refrigerant into the evacuated refrigerant circuit.

Detecting leaks:

– Start up leak detector in line with relevant operating instructions.

– Always hold test probe beneath suspected leak.

Depending on the model, leak detection is indicated by an increase in clicking rate or a warning tone (refer to operating instructions for leak detector).



Note

- *Currents of air quickly disperse refrigerant gas. 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.*

4.6.2 Tracing leaks in refrigerant circuit with leak detection system VAS 6201

Note

- *Certain leaks are difficult or even impossible to find using an electronic leak detector. In such cases, the leak detection system VAS 6201 can be used.*
- *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. to distribute the additive throughout the refrigerant circuit (the air conditioner compressor must run). Depending on the extent of the leak, the leakage location may already become visible under UV light within this period.*
- *The refrigerant oil containing the additive (which shows up under UV light) can either be poured directly into the open circuit or pumped in with the circuit charged using the hand pump VAS 6201/1 (from the leak detection system VAS 6201) via the service connection on the low-pressure end.*
- *If the leak detection additive is applied via the service connection in the low-pressure side with the refrigerant circuit charged, a small quantity of additive remains in the service connection. This is to be carefully removed so as to avoid subsequent erroneous leak detection.*
- *If a component forming part of a circuit, into which the leak detection additive has been poured, has to be renewed, thoroughly clean joints with other components after assembling refrigerant circuit. Otherwise, the residual leak detection additive at the joint could be erroneously identified as a leakage location during subsequent leak localisation.*
- *On discharging the refrigerant circuit, refrigerant oil and thus also leak detection additive ingresses into the air conditioner service station. The refrigerant oil is removed from the refrigerant in the oil separator of the air conditioner service station and discharged from the air conditioner service station via the drain. The refrigerant oil drained off is not to be poured back in. It is to be replaced with fresh refrigerant oil.*
- *Heed the following if leak detection fluid has already been poured into a refrigerant circuit in the course of previous repair work: Only pour in fresh leak detection fluid if the refrigerant oil is replaced. If only a certain amount of refrigerant oil has been replaced, just add the corresponding quantity of leak detection fluid. After replacing 100 ml of refrigerant oil on a vehicle containing 250 ml for example, just add 1 ml (cm^3) 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.*

Proceed as follows with a completely empty refrigerant circuit to avoid allowing more refrigerant than is absolutely necessary for leak detection to escape into the environment when localising refrigerant circuit leaks:

– Evacuate the refrigerant circuit using the air conditioner service station ⇒ page 49 .

Note

- *If evacuation already reveals a major leak, this is to be located and eliminated as described ⇒ page 49 .*
- *Continue as follows if evacuation does not reveal any leakage or if the leakage is so slight that it is not possible to determine the leakage location.*

For leakage which cannot be determined by way of evacuation, refer to ⇒ page 90 .

Tools and other items required:

1 - Hand pump with low-pressure service hose, service coupling and non-return valve -VAS 6201/1-

2 - Cartridge -VAS 6201/2-

3 - Cleaning solution -VAS 6201/3-

4 - UV leak detection lamp -VAS 6201/4-

5 - UV-absorbing eye protection -VAS 6201/6-

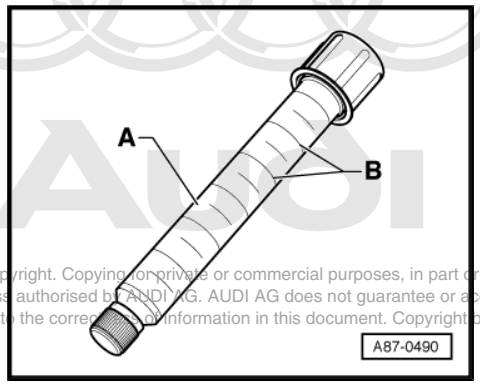
6 - Sticker -VAS 6201/7-

7 - Filler tube
VAS 6201/8

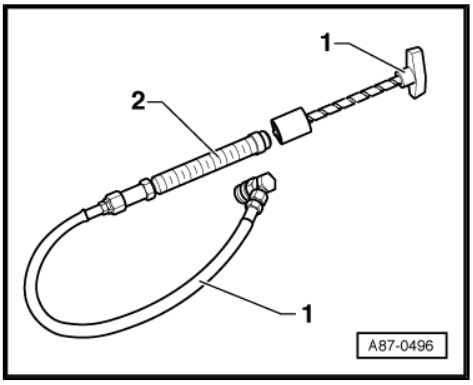
8 - Protective gloves -VAS 6201/9-

Pouring in leak detection additive with refrigerant circuit empty

The cartridge -A- contains 15.4 ml of leak detection additive (one unit -B- corresponds to 2.5 ml).



– Assemble hand pump -VAS 6201- , item -1- with cartridge, item -2- -VAS 6201/2- .
– Insert filler tube -VAS 6201/8- (⇒ page 90 item -7-) in hand pump.
– Open hand pump service valve.

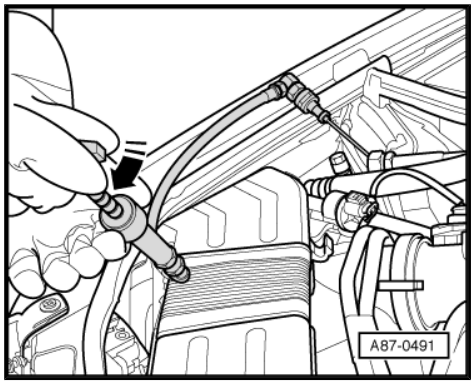


Note

- *When the refrigerant circuit is empty, the leak detection additive can be poured into the circuit via a service connection or an open connection.*
- *If the refrigerant circuit is empty, it may be better to apply the leak detection additive by way of a joint (e.g. if a joint has already been unfastened). In this way, no leak detection additive is left in the service connection and the connection does not have to be cleaned.*

- Application of leak detection additive to the refrigerant circuit by way of a service connection ⇒ page 93 .
- Application of leak detection additive to the refrigerant circuit by way of an open connection ⇒ page 92 .

Applying leak detection additive to the refrigerant circuit by way of an open connection



- Open the refrigerant circuit at a readily accessible connection.
- Cover the surrounding area with sheeting or absorbent paper.
- Hold filler tube upwards.
- Screw in the toggle of the hand pump until the leak detection additive emerges from the tube.
- Fill the refrigerant circuit with 2.5 $^{+}/_{-}$ 0.5 ml (millilitre = cm^3) of leak detection additive.

Note

Heed the following if leak detection fluid has already been poured into a refrigerant circuit in the course of previous repair work: Only pour in fresh leak detection fluid if the refrigerant oil is replaced. If only a certain amount of refrigerant oil has been replaced, just add the corresponding quantity of leak detection fluid. After replacing 100 ml of refrigerant oil on a vehicle containing 250 ml for example, just add 1 ml (cm^3) of leak detection additive.

- Renew O-ring at open connection.
- Assemble refrigerant circuit.
- Affix a sticker next to the service connections to indicate that leak detection fluid has been added to this refrigerant circuit.
- Evacuate and charge the refrigerant circuit as specified ⇒ page 49 and ⇒ page 53 .
- Start up the air conditioner.

Note

- *The air conditioner must be operated for at least 60 min. to distribute the additive throughout the refrigerant circuit (the air conditioner compressor must run). Depending on the extent of the leak, the leakage location may already become visible under UV light within this period.*
- *Depending on its magnitude and location, it may now take several days for sufficient refrigerant oil with additive to emerge to clearly localise the leakage point.*

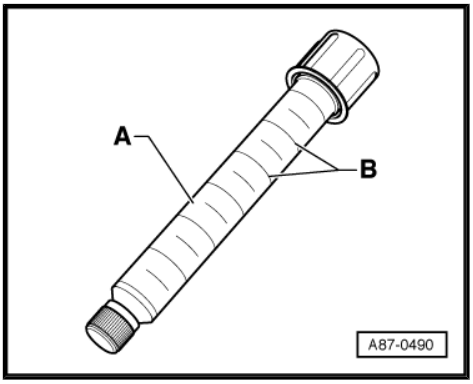
- Use a UV lamp VAS 6196/4 to locate the refrigerant circuit leak ⇒ page 95 .

Pouring in leak detection additive with refrigerant circuit charged

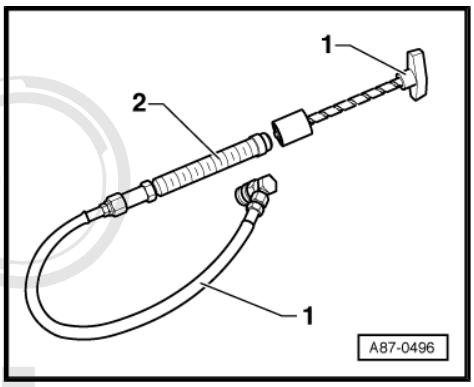
Note

- *Heed the following if leak detection fluid has already been poured into a refrigerant circuit in the course of previous repair work: Only pour in fresh leak detection fluid if the refrigerant oil is replaced. If only a certain amount of refrigerant oil has been replaced, just add the corresponding quantity of leak detection fluid. After replacing 100 ml of refrigerant oil on a vehicle containing 250 ml for example, just add 1 ml (cm^3) of leak detection additive.*
- *A small quantity of leak detection additive remains in the service connection. This is to be carefully removed so as to avoid subsequent erroneous leak detection.*

The cartridge -A- contains 15.4 ml of leak detection additive (one unit -B- corresponds to 2.5 ml).



- Switch off ignition.
- Detach cap from service connection on low-pressure side of refrigerant circuit.
- Assemble hand pump -VAS 6201- , item -1- with cartridge, item -2- -VAS 6201/2- .
- Insert the tube -VAS 6201/8- (⇒ page 90 item -7-) in the service coupling and open the service coupling by screwing in the handwheel. Hold the hose upwards and screw in the toggle of the hand pump until the leak detection additive starts to emerge from the tube.

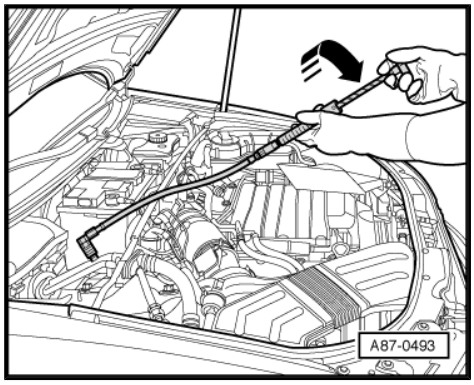


Note

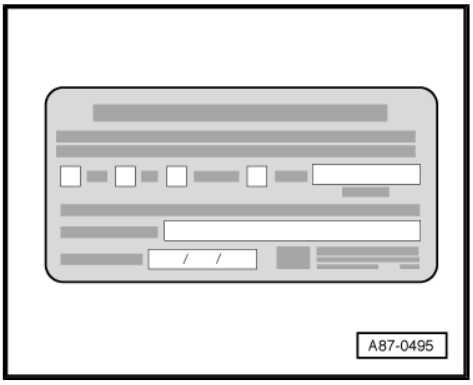
Make sure hand pump hose is completely filled with refrigerant.

- Close service coupling and remove filler tube from locking mechanism.

– Cover area around service connection on vehicle with sheeting or absorbent paper.
– Connect filler unit to refrigerant circuit service connection on vehicle.
– Open service connection by screwing in handwheel.
– Screw in the toggle of the hand pump to transfer 2.5 +/- 0.5 ml (millilitre= cm^3) of leak detection additive to the refrigerant circuit.



– Detach filler unit from service connection.
– Use absorbent paper, for example, to remove the residual leak detection additive from the service connection.
– Seal service connection with cap.
– If necessary, use cleaning solution to clean area around service connection.
– Affix sticker next to service connections to indicate that leak detection fluid has been added to the refrigerant circuit.
– Start up the air conditioner.



Note

- *The air conditioner must be operated for at least 60 min. to distribute the additive throughout the refrigerant circuit (the air conditioner compressor must run). Depending on the extent of the leak, the leakage location may already become visible under UV light within this period.*
- *Depending on its magnitude and location, it may now take several days for sufficient refrigerant oil with additive to emerge to clearly localise the leakage point.*

– Use a UV lamp VAS 6196/4 to locate the refrigerant circuit leak ⇒ page 95 .

Locating refrigerant circuit leaks with UV lamp VAS 6196/4

WARNING

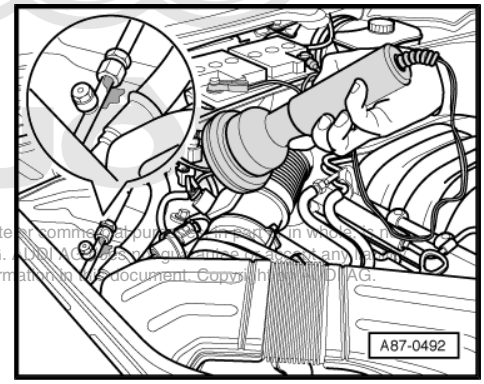
Never look into UV lamp.

Never point UV lamp at other people.

Note

- *After pouring in the leak detection additive, the air conditioner must be operated for at least 60 min. to distribute the additive throughout the refrigerant circuit (the air conditioner compressor must run). Depending on the extent of the leak, the leakage location may already become visible under UV light within this period.*
- *Depending on its magnitude and location, it may take several days for sufficient refrigerant oil with additive to emerge to clearly localise the leakage point.*
- *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 are not only designed to provide eye protection. They also make the additive more readily visible under UV light.*
- *Depending on the accessibility of various parts of the refrigerant circuit, it may be necessary to remove certain vehicle components (e.g. the bumper or air cleaner).*
- *Certain parts of the refrigerant circuit are only supplied with a small quantity of refrigerant oil in the course of air conditioner operation (e.g. top-mounted cap of receiver attached to condenser on Audi A8 2010 >). 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. In such areas it may therefore be appropriate to use an electronic leak detector for leak localisation*
  ⇒ „4.6.1 Tracing refrigerant circuit leaks with electronic leak detector (e.g. V.A.G 1796)“, page 88 .

– Move vehicle to a less brightly lit area of the workshop (daylight or bright artificial lighting diminishes the effect of the UV light).
– Check the accessibility of the various parts of the refrigerant circuit and remove any components in the surrounding area which prevent a clear view of the refrigerant circuit components (e.g. noise insulation and bumper).
– Wear safety goggles to protect the eyes.
– Connect the UV lamp to a 12 V battery (vehicle battery). Take care to ensure correct polarity of connections.
– Switch on UV lamp and illuminate components of refrigerant circuit. Locations at which leakage has resulted in the emergence of refrigerant, refrigerant oil and thus also leak detection additive show up under UV light (fluorescent).



5 Problems with refrigerant circuit

- Possible complaints about refrigerant circuit ⇒ page 97

5.1 Possible complaints about refrigerant circuit

- Test requirements ⇒ page 97
- Possible complaints ⇒ page 97

5.1.1 Test requirements:

- Electrical system, vacuum system and air duct fault-finding has not revealed any faults ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner), ⇒ Current flow diagrams, Electrical fault finding and Fitting locations and ⇒ Heating, air conditioning or ⇒ Air conditioning .
- Air conditioner self-diagnosis/guided fault-finding with the ⇒ Vehicle diagnostic tester has not revealed any faults, no compressor shut-off criteria displayed in measured value block (vehicles with „air conditioner“ self-diagnosis only) ⇒ Heating, air conditioning or ⇒ Air conditioning or „Guided fault-finding“ function ⇒ Vehicle diagnostic tester .

5.1.2 Possible complaints

Note

- *For all complaints marked *, refer to ⇒ page 103 „Checking pressures“.*
- *If problems are only encountered at one evaporator on vehicles fitted with two evaporators, also check the pressures in the refrigerant circuit.*
- *Heed the test conditions ⇒ page 97 .*

- Total cooling system failure *
- Insufficient cooling output at all vehicle or engine speeds.*
- No cooling or insufficient cooling after driving a few miles *
- No or insufficient cooling at one or via both evaporators (on vehicles with two air conditioner units). *
- Air conditioner compressor, air conditioning system magnetic clutch -N25- or air conditioner compressor regulating valve -N280- shut off by a pressure switch (e.g. -F73-, -F118-, -F129--F129- or by the operating and display unit for Climatronic air conditioning system -E87- or the Climatronic control unit -J255-) on account of excessive or inadequate pressure *
- No or sharp decrease in fresh-air supply after driving several miles (evaporator iced up) *

Other possible problems:

Air conditioner compressor noise

– Re-tighten the bolts for the air conditioner compressor and the compressor holder using a torque wrench.

– Check routing of refrigerant pipes; they must not touch other components and must not be subject to strain (align if necessary).

Noise (refrigerant hammer) occurring immediately after switching on the air conditioner and/or when cornering or braking

– Discharge, evacuate and re-charge refrigerant circuit (too much refrigerant in circuit).

Note

Too much refrigerant oil in the circuit may also result in this problem (no adjustment of refrigerant oil quantity, for example, on replacing compressor).

Water sprays out of the vents (in the dash panel or footwell) although the air conditioning system is otherwise functioning properly

– Check proper routing of condensate drain; it must not be crushed or kinked.

– Check the condensate drain valve; it must not be gummed up with wax or underseal and must close properly.

– Check the plenum chamber cover; it must not be damaged and must be properly installed (to stop water running into the evaporator).

– Check the plenum chamber water drains; they must not be blocked (e.g. by leaves).

6 Connecting air conditioner service station

- Air conditioner service station connection on vehicles with a connection on the low and high-pressure end of the refrigerant circuit ⇒ page 99 .
- Air conditioner service station connection on vehicles with no connection on the low-pressure end of the refrigerant circuit ⇒ page 99 .

6.1 Connecting air conditioner service station on vehicles with a connection on the low and high-pressure end of the refrigerant circuit

Connecting air conditioner service station for measuring and testing

– Switch off ignition.

– Connect air conditioner service station to power supply.

– Connect quick-release coupling adapters to the charging hoses of the air conditioner service station (handwheels not screwed in/hand shut-off valve not open).

– Switch on the air conditioner service station and evacuate the charging hoses (only necessary if there is air in the charging hoses).

– Switch off air conditioner service station.

– Unscrew the sealing caps from the service connections (with valve).

– Connect up the air conditioner service station via the service connections with quick-release coupling adapters to the vehicle refrigerant circuit.

– Only screw in the handwheel of the quick-release coupling adapters to the extent required to reliably open the valves at the refrigerant circuit connection (observe pressure gauge, do not open valves further than necessary).

– Perform the intended tests and measurements.

6.2 Connecting air conditioner service station on vehicles with no connection on the low-pressure end of the refrigerant circuit

On the following vehicles, no service connection is provided for the air conditioner service station on the low-pressure side of the refrigerant circuit. Adapters are required for connecting the air conditioner service station to the refrigerant circuit of these vehicles.

- Audi 80, Audi Cabriolet, Audi Coupé
- Audi A4 up to 07/96
- Audi 100 / Audi A6 up to 03/97
- Audi A8 up to 11/97

Note

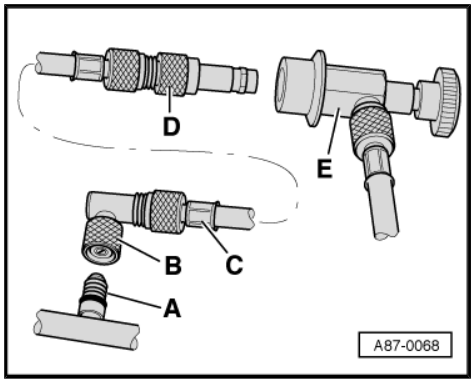
On vehicles with no or an inaccessible connection at the air conditioner compressor, remove the low-pressure switch for air conditioning system -F73- (jumper the contacts in the connector for the low-pressure switch for air conditioning system -F73-) and screw an adapter to this connection ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

Note

- *The tools listed below are commercially available or can be obtained from the regional sales centre or importer.*
- *Should it be necessary to measure pressures at switch connections on high-pressure side, use adapter from adapter set for refrigerant circuit -V.A.G 1785/9- and proceed in the same manner.*

- Connecting air conditioner service station to refrigerant circuit with adapter set for refrigerant circuit -V.A.G 1786- ⇒ page 100
- Connecting air conditioner service station to refrigerant circuit with adapter V.A.G 1785/10 ⇒ page 101
- Connecting air conditioner service station for measuring and testing ⇒ page 101

6.2.1 Connecting air conditioner service station to refrigerant circuit with adapter set for refrigerant circuit -V.A.G 1786-



A - Connection with valve (small valve core) at low-pressure side of refrigerant circuit

B - Adapter with union nut -V.A.G 1786/1-

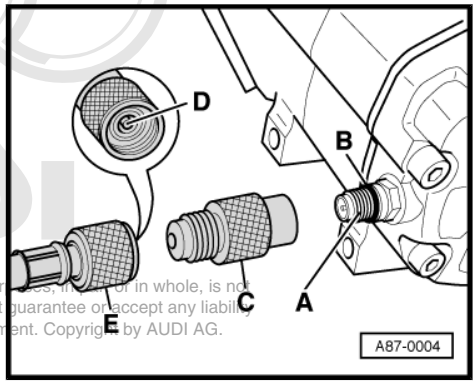
C - Commercially available filler hose (short version with 5/8" thread on each end)

D - Adapter with service connection -V.A.G 1786/2- (for connection of quick-release coupling of air conditioner service station -E-)

Note

- *Assemble adapter and filler hose as shown and start by connecting to connection with valve -A-.*
- *The adapter with union nut -V.A.G 1786/1- is only to be used at connections with a „small“ valve insert (standard for connection with valve for low-pressure switch for air conditioning system -F73- and also gradually introduced as of 10.94 at the air conditioner compressor).*
- *Instead of adapter with union nut -V.A.G 1786/1- , you can also use adapter -V.A.G 1785/10- (remove valve from adapter -V.A.G 1785/10- or install valve opener in filler hose).*

6.2.2 Connecting air conditioner service station to refrigerant circuit with adapter V.A.G 1785/10



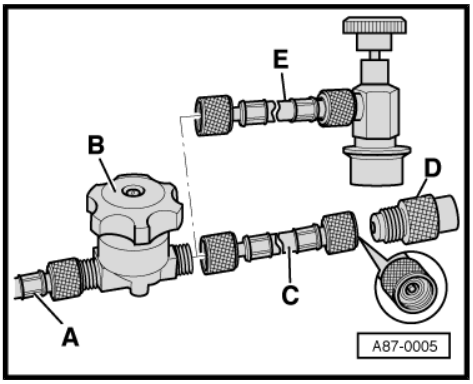
– Unscrew the sealing cap from the connection with valve -A- (at the air conditioner compressor).
– Attach an O-ring -B- to the connection (8.9 mm; 1.8 mm).
– Screw adapter V.A.G 1785/10 -C- onto connection -B-.
– Install valve opener -D- with appropriate seal in filler hose connection.

Note

- *The type of valve opener -D- and seals required depends on the filler hose used (specific to manufacturer).*
- *The quick-release coupling adapter is not required for connection on the low-pressure side of Audi vehicles.*
- *Screw filler hose -E- (to air conditioner service station) onto adapter - V.A.G 1785/10- .*

Note

To minimise the amount of air and moisture ingressing into the charging hoses and thus into the refrigerant circuit, the charging hoses should be connected together as illustrated.



A - Filler hose to air conditioner service station

B - Hand shut-off valve

C - Filler hose (short version) with valve opener for connection to adapter -D-

D - Adapter - V.A.G 1785/10-

E - Filler hose (short version) with quick-release coupling adapter (for vehicles with quick-release coupling adapter on low-pressure side)

– Perform planned tests and measurements.

6.2.3 Connecting air conditioner service station for measuring and testing

– Switch off ignition.
– Connect air conditioner service station to power supply.
– Assemble adapter set and screw onto connection on low-pressure side.
– Connect quick-release coupling adapters to the charging hoses of the air conditioner service station (handwheels not screwed in/hand shut-off valve not open).
– Switch on the air conditioner service station and evacuate the charging hoses (only necessary if there is air in the charging hoses).
– Switch off air conditioner service station.

– Unscrew the sealing cap from the service connection or the connection with valve (or remove the low-pressure switch and jumper the corresponding electrical connections).
– Connect up the air conditioner service station via the service connections with quick-release coupling adapters to the vehicle refrigerant circuit.
– Only screw in the handwheel of the quick-release coupling adapters to the extent required to reliably open the valve at the refrigerant circuit connection (observe pressure gauge, do not open valve too far).
– Perform the intended tests and measurements.

7 Checking pressures

- Checking the pressures in the refrigerant circuit (with the air conditioner service station) with the ignition switched off ⇒ page 103
- Checking pressures on vehicles with a restrictor and reservoir (with internally regulated air conditioner compressor) ⇒ page 108
- Checking pressures on vehicles with an expansion valve and receiver (with internally regulated air conditioner compressor) ⇒ page 113
- Checking pressures on vehicles with restrictor, reservoir and air conditioner compressor regulating valve -N280- (externally regulated air conditioner compressor) ⇒ page 118
- Checking pressures on vehicles with expansion valve, receiver and air conditioner compressor regulating valve -N280- (externally regulated air conditioner compressor) ⇒ page 126

7.1 Checking pressures in refrigerant circuit with air conditioner service station (with ignition switched off)

Note

- *All test requirements marked with an * are vehicle-specific and are described in the Workshop Manual for the relevant vehicle.*
- *Check cooling output.*
- *Connections with valve and service connections for measurement and testing ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *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.*

Under certain operating conditions, residual moisture in the coolant circuit may lead to the formation of ice at the air conditioner compressor regulating valve. Such ice formation impedes air conditioner compressor control. The evaporator is excessively cooled and ices up. An iced-up evaporator may cause the following problems:

- Repeated or sporadic failure of the air conditioner (no cooling/heating output) after a lengthy journey; operation of the air conditioner soon returns to normal after switching off the engine
- Misting up of the windows on the inside after a long journey; the windows are initially not cleared even by pressing the De-

frost button; the air conditioner functions properly again after a short delay following engine shut-off.

Remedy:

– In the case of vehicles as of Model Year 2001 and an air conditioner compressor with air conditioner compressor regulating valve -N280- , check the measured value of the evaporator output temperature sender -G263- (by way of the „Reading measured value block“ function). If the sender measured value is too low under the usage conditions outlined by the customer (at ambient temperature above 0 °C, colder than 0 °C for a lengthy period although -N280- is currently not being actuated) or too high (greater than approx. 10 °C although the air conditioner is functioning properly), the evaporator may ice up due to the incorrect measured value ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

– On vehicles with no evaporator output temperature sender -G263- use the footwell vent temperature sender -G192- for example to check the output temperature in the settings: "Lo temperature" for driver and front passenger side, 4 or 5 bars for the fresh air blower speed, air outlet to the footwell and fresh-air mode under the usage conditions described by the customer. If the measured value of the sender is too low (at ambient temperature above 0 °C, colder than 0 °C for lengthy period).

– Check refrigerant pipe between evaporator and reservoir (thick pipe, low-pressure side) with engine running. If this pipe is severely iced up when the problem occurs (a thin ice layer is permissible), this is a further indication that the temperature in the evaporator is too low.

– Discharge refrigerant circuit, renew reservoir or receiver with dryer and then evacuate refrigerant circuit for at least 3 hours.

♦ Test requirements ⇒ page 104 .

♦ Checking pressures ⇒ page 106 .

♦ Continuation of testing depending on design of refrigerant circuit ⇒ page 108

7.1.1 Test requirements

• Radiator and condenser 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.*

• All air ducts, covers and seals OK and properly installed.

• Electrical system and vacuum system fault-finding has not revealed any faults* ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

• Air conditioner self-diagnosis has not revealed any faults (with engine running and air conditioner switched on), no compressor shut-off criteria displayed in measured value block (vehicles with „air conditioner“ self-diagnosis only) * ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

• Air flow through dust and pollen filter not impeded by dirt*

- Air conditioning unit not drawing in secondary air at maximum fresh-air blower speed; evaporator and heater not drawing in secondary air at maximum fresh-air blower speed*
- Air flaps in air conditioning unit, heater and evaporator reach end position*
- Fresh-air intake ducts beneath bonnet and in passenger compartment as well as corresponding water drain valves OK* ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- Engine at operating temperature
- Vehicle not exposed to sunlight ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- Ambient temperature above 15 ° C.
- All dash panel vents open

– Start engine.

Setting at the operating and display unit for Climatronic air conditioning system -E87- or the Climatronic control unit -J255- (and the rear Climatronic operating and display unit -E265- on vehicles with two air conditioner units):

– Preselect „Auto“ mode (air conditioner compressor on).
– Set „LO“ temperature for driver's and front passenger's side (and rear left and right on vehicles with two air conditioner units).

Settings on heater controls:

– Press A/C button and "Rec" or recirculated air button.
– Turn the rotary temperature control towards the „cold“ stop.
– Set rotary fresh-air blower control to „4“.

Subsequently, the following system test requirements should be met:

- Operation of radiator fan(s) -V7- (at least speed 1).*

Note

With some versions, the fan is not switched on until the pressure in the refrigerant circuit has exceeded a specified value.

- Fresh air blower -V2- (and rear fresh air blower -V80- on vehicles with two air conditioning units) run(s) at maximum speed.
- Recirculated/fresh-air flap set to „Recirculated air mode“ (within 1 min. after starting vehicle, air-flow flap is closed and recirculated-air flap opened)*
- Coolant shut-off valve closed.*
- Valves of pump valve unit closed and no coolant circulation pump delivery*
- Air conditioner compressor is actually driven (air conditioning system magnetic clutch -N25- energised, overload safeguard (if fitted) not tripped).*

Note

Depending on the engine, the air conditioner compressor is driven by different components (belt or drive shaft). To protect these components and the engine, the pulley or the air conditioner compressor drive unit is fitted with an overload safeguard which is tripped if the air conditioner compressor is not operating smoothly ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

7.1.2 Checking pressures

- Heed the test conditions ⇒ page 104 .

– Switch off ignition.

– Connect air conditioner service station ⇒ page 99 .

– Read pressures off pressure gauges; there are two possible results:

- The pressure in the refrigerant circuit is lower than indicated in the table.
- The pressure in the refrigerant circuit corresponds to that indicated in the table or is higher.

Ambient temperature (in degrees centigrade)	Pressure in refrigerant circuit in bar
+15 °C	3,9
+20 °C	4,7
+25 °C	5,6
+30 °C	6,7
+35 °C	7,8
+40 °C	9,1
+45 °C	10,5

Note

- *The temperature of the refrigerant circuit components should be equal to ambient temperature (the pressure will deviate from the values in the table if individual components of the refrigerant circuit are warmer or colder).*
- *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 corresponds to an absolute pressure of 1 bar (can be seen from -1 bar mark below 0).*
- *On vehicles with a high-pressure sender -G65- or refrigerant pressure and temperature sender -G395- for which the measured pressure is displayed in the measured value block, the pressure measured should coincide with the values in the table ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *Pressure may be given in various units: 1 MPa (megapascal) corresponds to 10 bar gauge pressure or 145 psi; 1 bar absolute pressure corresponds to 0 bar gauge pressure, which is roughly equivalent to atmospheric pressure.*

The pressure in the refrigerant circuit is lower than indicated in the table.

Not enough refrigerant in circuit

– Determine refrigerant circuit leaks ⇒ page 87 .

– Check the pressure relief valve.

If the pressure relief valve has responded:

– Check actuation of the radiator fans.

– Check for constricted refrigerant pipe and hose cross-sections caused by inadequate bending radii.

– Check refrigerant pipes and hoses for external damage.

– If no fault is found, clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).

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

– Start engine.

– Set air conditioning system to maximum cooling output.

Note

On vehicles with an air conditioner compressor regulating valve -N280- , the control current can be read out in the measured value block ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

If the air conditioner compressor is not driven when the engine is running or the regulating valve is not actuated:

– Establish and eliminate the cause e.g. by interrogating the air conditioner event recorder.

– Observe test requirements.

– Check the power supply for the air conditioning system magnetic clutch -N25- . If this is OK, service the magnetic clutch.

– Check actuation of the air conditioner compressor regulating valve -N280- ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

Note

- *If low-pressure switch has been removed to connect air conditioner service station, jumper electrical connections in relevant connector for pressure measurement.*
- *The air conditioner compressor is driven by the engine via the air conditioning system magnetic clutch -N25- .*
- *The air conditioner compressor regulating valve -N280- is actuated by the operating and display unit for Climatronic air conditioning system -E87- or the Climatronic control unit -J255- ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*

- Continuation of testing depending on design of refrigerant circuit ⇒ page 108

7.1.3 Continuation of testing depending on design of refrigerant circuit

- Checking pressures on vehicles with a restrictor and reservoir (with internally regulated air conditioner compressor) ⇒ page 108
- Checking pressures on vehicles with an expansion valve and receiver (with internally regulated air conditioner compressor) ⇒ page 113
- Checking pressures on vehicles with restrictor, reservoir and air conditioner compressor regulating valve -N280- (with externally regulated air conditioner compressor) ⇒ page 118
- Checking pressures on vehicles with expansion valve, receiver and air conditioner compressor regulating valve -N280- (with externally regulated air conditioner compressor) ⇒ page 126

7.2 Checking pressures on vehicles with a restrictor and reservoir (with internally regulated air conditioner compressor)

Note

- *Connect air conditioner service station ⇒ page 99 .*
- *Observe test requirements ⇒ page 103 .*

– Check the pressures in the refrigerant circuit (with the air conditioner service station) with the ignition switched off ⇒ page 103 .

The pressures with the ignition switched off correspond to the specifications.

– Start the engine.

– Set engine speed to 2000 rpm.

– Observe the pressure reading (e.g. pressure gauge) of the air conditioner service station.

Note

- *Switching pressures for refrigerant circuit switches are vehicle-specific.*
- *The connection with valve for the low-pressure switch or at the evaporator is only to be used for vehicles with no service connection on the low-pressure end and an inaccessible connection at the air conditioner compressor or reservoir (measurement accuracy). Only applies to certain vehicles ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*

- Specifications for pressures in refrigerant circuit ⇒ page 109

7.2.1 Specifications for pressures in refrigerant circuit

High-pressure side:

Increasing from initial pressure (on connecting pressure gauges) up to max. 20 bar

Low-pressure side:

Decreasing from initial pressure (on connecting pressure gauges) to value in graph

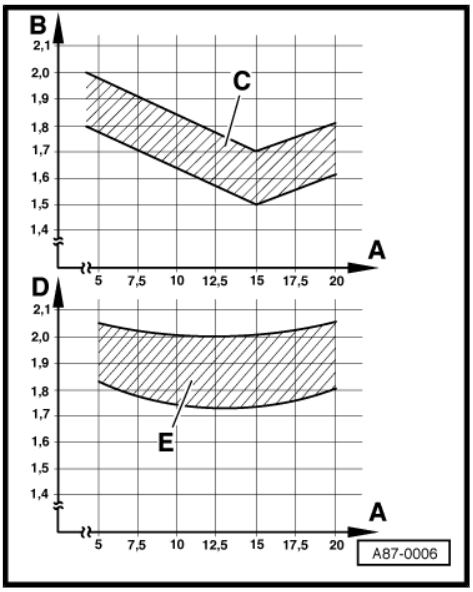
A - High pressure (measured at service connection) in bar

B - Low pressure (measured at connection with valve at air conditioner compressor or reservoir) in bar

C - Permissible tolerance range

D - Low pressure (measured at connection with valve for low-pressure switch or at service connection) in bar

E - Permissible tolerance range



Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure remains constant or only increases slightly (above pressure with engine stopped) • Low pressure quickly drops to value in graph or below • Required cooling output is not attained	Not enough refrigerant in circuit	– Localise leak with leak detector and eliminate – Re-charge refrigerant circuit.
• High pressure normal • Low pressure in line with value in graph • Required cooling output is not attained		
• High pressure normal • Low pressure too low (see graph) • Required cooling output is not attained		

Note

If no fault is found for this problem, clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure does not increase or only to slightly above the pressure with the engine stopped, • low pressure does not decrease or only slightly. • Required cooling output is not attained	♦ No actuation of the air conditioner compressor (magnetic clutch). ♦ The air conditioner compressor is not driven.	– Check actuation and drive of the air conditioner compressor and perform repair ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 .
	♦ Constriction or blockage in the refrigerant circuit (e.g. in the refrigerant pipe between the „low-pressure end“ service connection and the air conditioner compressor).	– Clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). – Renew hose or pipe if kinked or constricted.
	♦ Air conditioner compressor defective.	– Replace the air conditioner compressor.

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure increases above specification • Low pressure quickly drops to value in graph or below • Required cooling output is not attained	Constriction or obstruction in refrigerant circuit	– Run hand over refrigerant circuit to check for differences in temperature • If difference in temperature is found at one component: – Renew hose or pipe if kinked or constricted. – In the event of clogging, clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). • If no fault is found: – Clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).
• High and low pressure normal at first • After some time, high pressure increases above specification and • Low pressure drops to value in graph or below • Required cooling output is no longer attained	Moisture in refrigerant circuit	– Check and if necessary replace reservoir (with dryer) and restrictor, then evacuate refrigerant circuit for min. 3 hours (see note) – Clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).
• High and low pressure normal at first • After lengthy operating period, low pressure drops excessively (evaporator ices up)		

Note

- *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 (adjust the quantity of refrigerant oil). Subsequently, evacuate refrigerant circuit for at least 3 hours.*
- *It is not initially necessary to clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55) when this problem occurs. Normally, there is only a small quantity of moisture in the system which can be removed by lengthy evacuation.*

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure normal • Low pressure too low (see graph) • Required cooling output is attained	Air conditioner compressor defective.	– Clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). – Replace the air conditioner compressor.

Note

- *Heed the following in the event of the fault „High pressure normal, low pressure too low“: This fault may result in the evaporator icing up or the low-pressure switch for air conditioning system -F73- switching off the air conditioner compressor although the quantity of refrigerant in the circuit is OK.*
- *On the Audi 100, Audi A6 (up to and including Model Year 1997) and the Audi V8, this fault may result in the air conditioner compressor being shut off by the operating and display unit (if the temperature at the fresh-air blower drops below -3 °C) ⇒ Heating, air conditioning; Rep. gr. 87 .*

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure normal or too high • Low pressure too high (see graph) • Air conditioner compressor noise (particularly after switch-on) • Required cooling output is not attained	Too much refrigerant in the circuit.	– Extract refrigerant from refrigerant circuit. • If quantity of refrigerant extracted roughly corresponds to specified capacity: – Replace the air conditioner compressor. • The quantity of refrigerant extracted is substantially greater than the specified capacity. – Re-charge refrigerant circuit. – Repeat test.

Possible deviation from specification	Possible causes of fault	Fault elimination
• High and low pressure normal • Required cooling output is not attained	Too much refrigerant oil in the circuit.	– Discharge refrigerant circuit. – Clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).
• High and low pressure normal • Air conditioner compressor noise (particularly after switch-on) • Required cooling output is attained		

Note

- *Overfilling with refrigerant oil may occur if, for example, the air conditioner compressor has been replaced without adjusting the quantity of refrigerant oil.*
- *If there is too much refrigerant oil in the circuit, drain the air conditioner compressor and replace the reservoir. After cleaning the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55), add the correct amount of refrigerant oil to the circuit ⇒ page 164 .*

7.3 Checking pressures on vehicles with an expansion valve and receiver (with internally regulated air conditioner compressor)

Note

- *Connecting air conditioner service station* ⇒ page 99
- *Heed the test conditions* ⇒ page 103 .

– Check the pressures in the refrigerant circuit (with the air conditioner service station) with the ignition switched off ⇒ page 103 .

The pressures with the ignition switched off correspond to the specifications.

– Start the engine.

– Set the engine speed to 2000 rpm.

– Observe the pressure reading (e.g. pressure gauge) of the air conditioner service station.

Note

- *Switching pressures and design of refrigerant circuit switches are vehicle-specific.*
- *The pressures must be measured at the service connections; the fitting locations of these connections are vehicle-specific ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- Specifications for pressures in refrigerant circuit ⇒ page 113

7.3.1 Specifications for pressures in refrigerant circuit

High-pressure side:

Increasing from initial pressure (on connecting pressure gauges) up to max. 20 bar

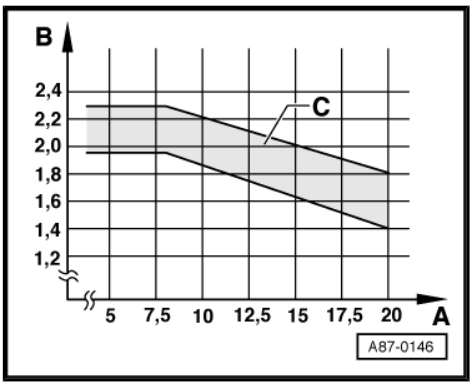
Low-pressure end:

Decreasing from initial pressure (on connecting pressure gauges) to value in graph

A - High pressure in bar

B - Low pressure in bar

C - Permissible tolerance range



Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure remains constant or only increases slightly (above pressure with engine stopped) • Low pressure quickly drops to value in graph or below • Required cooling output is not attained	Not enough refrigerant in circuit or expansion valve defective	– Extract refrigerant from refrigerant circuit. • If quantity of refrigerant extracted roughly corresponds to specified capacity: – Renew expansion valve. – Re-charge refrigerant circuit. – Repeat test.
• High pressure normal • Low pressure in line with value in graph • Required cooling output is not attained		• The quantity of refrigerant extracted is substantially less than the specified capacity. – Localise leak with leak detector and eliminate – Re-charge refrigerant circuit. – Repeat test.

Note

If no fault can be found and air conditioner operation is not OK when the test is repeated, clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure does not increase or only to slightly above the pressure with the engine stopped, • low pressure does not decrease or only slightly. • Required cooling output is not attained	♦ No actuation of the air conditioner compressor (magnetic clutch) ♦ The air conditioner compressor is not driven.	– Check actuation and drive of the air conditioner compressor and perform repair ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87

Possible deviation from specification	Possible causes of fault	Fault elimination
	♦ Constriction or blockage in the refrigerant circuit (e.g. in the refrigerant pipe between the „low-pressure end“ service connection and the air conditioner compressor).	– Clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). – Replace hose or pipe if kinked or constricted.
	♦ Air conditioner compressor defective.	– Replace the air conditioner compressor.

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure increases above specification • Low pressure quickly drops to value in graph or below • Required cooling output is not attained	♦ Constriction or obstruction in refrigerant circuit ♦ Expansion valve defective	– Run hand over refrigerant circuit to check for differences in temperature • If difference in temperature is found at one component: – Renew hose or pipe if kinked or constricted. – In the event of clogging, clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55 and replace the expansion valve if applicable). • If no fault is found: – Clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55 and replace the expansion valve if applicable). – Repeat test.

Note

If operation is not OK after cleaning the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55), the expansion valve must be replaced.

Possible deviation from specification	Possible causes of fault	Fault elimination
• High and low pressure normal at first • After some time, high pressure increases above specification and low pressure drops to value in graph or below • Required cooling output is no longer attained	♦ Expansion valve defective ♦ Moisture in refrigerant circuit	– Replace receiver (with dryer) and evacuate refrigerant circuit for at least 3 hours (see notes) – Check expansion valve for dirt or corrosion and renew if necessary – Clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).
• High and low pressure normal at first • After lengthy operating period, low pressure drops excessively (evaporator ices up)		

Note

- ♦ *It is not initially necessary to clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55) when this problem occurs. Normally, there is only a small quantity of moisture in the system which can be removed by lengthy 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 (adjust the quantity of refrigerant oil). Subsequently, evacuate refrigerant circuit for at least 3 hours.*

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure normal or too high • Low pressure too high (see graph) • Required cooling output is not attained • Air conditioner compressor noise (particularly after switch-on).	♦ Too much refrigerant in the circuit. ♦ Expansion valve or air conditioner compressor defective.	– Extract refrigerant from refrigerant circuit. • If quantity of refrigerant extracted roughly corresponds to specified capacity: – Renew expansion valve. – Re-charge refrigerant circuit. – Repeat test. • The quantity of refrigerant extracted is substantially greater than the specified capacity. – Re-charge refrigerant circuit. – Repeat test.

Note

If operation of the air conditioning system is not OK when the test is repeated, re-fit the old expansion valve and clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). Then replace the air conditioner compressor and receiver.

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure only increases slightly above pressure with engine stopped • Low pressure only drops slightly • Required cooling output is not attained	Air conditioner compressor defective.	– Clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). – Replace the air conditioner compressor and receiver.

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure normal • Low pressure too low (see graph) • Required cooling output is attained	Expansion valve or air conditioner compressor defective.	– Renew expansion valve. – Re-charge refrigerant circuit. – Repeat test.

Note

- *If operation of the air conditioning system is not OK when the test is repeated, re-fit the old expansion valve and clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). Then replace the air conditioner compressor and receiver.*
- *With this fault, the evaporator may ice up although the quantity of refrigerant in the circuit is OK.*

Possible deviation from specification	Possible causes of fault	Fault elimination
• High and low pressure normal • Required cooling output is not attained	Too much refrigerant oil in the circuit.	– Discharge refrigerant circuit. – Clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).

Possible deviation from specification	Possible causes of fault	Fault elimination
• High and low pressure normal • Air conditioner compressor noise (particularly after switch-on) • Required cooling output is attained		

Note

- *Overfilling with refrigerant oil may occur if, for example, the air conditioner compressor has been replaced without adjusting the quantity of refrigerant oil.*
- *If there is too much refrigerant oil in the circuit, drain the air conditioner compressor and replace the receiver. After cleaning the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55), add the correct amount of refrigerant oil to the circuit ⇒ page 164 .*

7.4 Checking pressures on vehicles with restrictor, reservoir and air conditioner compressor regulating valve -N280- (with externally regulated air conditioner compressor)

Note

- *Connecting air conditioner service station ⇒ page 99*
- *Heed the test conditions ⇒ page 103 .*

– Check the pressures in the refrigerant circuit (with the air conditioner service station) with the ignition switched off ⇒ page 103 .

The pressures with the ignition switched off correspond to the specifications.

– Start the engine.

– Set the engine speed to 2000 rpm.

– Observe the pressure reading (e.g. pressure gauge) of the air conditioner service station.

Note

- *The switching pressures for actuation of -N280- and the radiator fans -V7- are vehicle-specific.*
- *The pressures must be measured at the service connections; the fitting locations of these connections are vehicle-specific ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*

♦ Specifications for pressures in refrigerant circuit ⇒ page 119

7.4.1 Specifications for pressures in refrigerant circuit

High-pressure side:

Increasing from initial pressure (on connection of pressure gauges) up to 20 bar

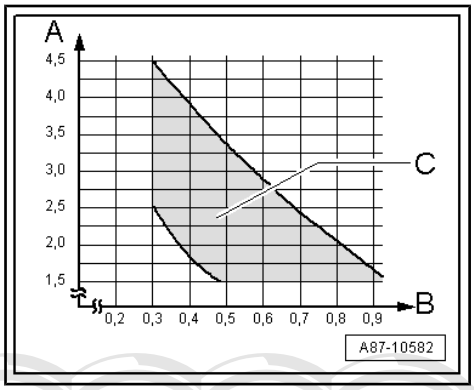
Low-pressure end:

Decreasing from initial pressure (on connecting pressure gauges) to value in graph

A - Low pressure (measured at service connection) in bar absolute

B - Control current for air conditioner compressor regulating valve -N280- in amps

C - Permissible tolerance range



Note

- *In the event of a very high cooling output requirement (e.g. high ambient temperature and high fresh-air blower speed at low engine speed), the air conditioner compressor cannot initially set the pressure on the low-pressure end to the value -C- given in the graph (e.g. for a certain time after switching on the air conditioner). The air conditioner compressor is actuated with the maximum specified control current, however the delivery volume of the air conditioner compressor is no longer sufficient under these ambient conditions and at this engine speed to reduce the pressure on the low-pressure end to the value in the graph. One way of checking the control action of the air conditioner compressor under these conditions is to actuate the fresh-air blower with only approx. 40 % of the maximum voltage and to check the pressures at reduced fresh-air blower speed ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *Under unfavourable conditions (very high ambient temperatures, high humidity), the pressure on the high-pressure end may increase up to max. 29 bar.*
- *The control current -B- is displayed in the measured value block of the operating and display unit for Climatronic air conditioning system -E87- or the operating and display unit, Climatronic control unit -J255- .*
- *The pressure in the refrigerant circuit measured by the high-pressure sender -G65- or the refrigerant pressure and temperature sender -G395- is displayed in the measured value block of the operating and display unit for Climatronic air conditioning system -E87- or the operating and display unit, Climatronic control unit -J255- ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *The low pressure settles as a function of the control current for the air conditioner compressor regulating valve -N280- within the air conditioner compressor output range in the tolerance band.*
- *Under unfavourable conditions (very high ambient temperatures, high humidity), the air conditioner compressor output may not always be sufficient to attain the specified value.*
- *If the compressor capacity utilisation is greater than 90 %, the pressure on the low-pressure end may be in excess of the tolerance range „C“ shown in the graph (the compressor output no longer suffices).*
- *The specified operating current for the regulating valve must be greater than 0.3 A to ensure reliable actuation of the regulating valve.*
- *At absolute pressure, „0 bar“ corresponds to an absolute vacuum. Normal ambient pressure corresponds to 1 bar absolute. On the scales of most pressure gauges, 0 bar corresponds to an absolute pressure of one bar (can be seen from „-1 bar“ mark below „0“).*

- *In the "maximum cooling output" setting, the control current is regulated to approx. 0.65 (vehicle-specific up to 0.85 A) (displayed in measured value block) ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure remains constant or only increases slightly (above pressure with engine stopped) • Low pressure quickly drops to value in graph or below • Required cooling output is not attained	♦ Actuation of air conditioner compressor regulating valve -N280- not OK ♦ Not enough refrigerant in circuit	– Check actuation of -N280- . – Localise leak with leak detector and eliminate – Re-charge refrigerant circuit.
• High pressure normal • Low pressure too low (see graph) • Required cooling output is not attained		
• High pressure normal • Low pressure too low (see graph) • Required cooling output is not attained		

Note

If no fault is found for this problem, clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure does not increase or only to slightly above the pressure with the engine stopped, • low pressure does not decrease or only slightly. • Required cooling output is not attained	♦ No actuation of the air conditioner compressor (air conditioner compressor regulating valve -N280-) ♦ The air conditioner compressor is not driven.	– Check actuation and drive of the air conditioner compressor and perform repair ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87
	♦ Constriction or blockage in the refrigerant circuit (e.g. in the refrigerant pipe between the „low-pressure end“ service connection and the air conditioner compressor). ♦ Air conditioner compressor defective.	– Clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). – Replace hose or pipe if kinked or constricted. – Replace the air conditioner compressor.

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure increases above specification • Low pressure quickly drops to value in graph or below • Required cooling output is not attained	♦ Actuation of air conditioner compressor regulating valve -N280- not OK ♦ Constriction or obstruction in refrigerant circuit	– Check actuation of -N280- . – Run hand over refrigerant circuit to check for differences in temperature • If difference in temperature is found at one component: – Replace hose or pipe if kinked or constricted. – Flush the refrigerant circuit with compressed air and nitrogen if clogged. • If no fault is found: – Clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).

Possible deviation from specification	Possible causes of fault	Fault elimination
• High and low pressure normal at first, after some time high pressure increases above specification and • Low pressure drops to value in graph or below • Required cooling output is no longer attained	♦ Actuation of air conditioner compressor regulating valve -N280- not OK ♦ Moisture in refrigerant circuit	– Check actuation of -N280- . – Replace reservoir (with dryer) and evacuate refrigerant circuit for at least 3 hours (see note) – Clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).
• High and low pressure normal at first • After lengthy operating period, low pressure drops excessively (evaporator ices up)		

Note

- *It is not initially necessary to clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55) when this problem occurs. Normally, there is only a small quantity of moisture in the system which can be removed by lengthy 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 (adjust the quantity of refrigerant oil). Subsequently, evacuate refrigerant circuit for at least 3 hours.*
- *A problem with evaporator output temperature sender -G263- can also cause icing-up of refrigerant circuit. If this problem is encountered, also pay attention to the measured value of the evaporator output temperature sender -G263- ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure normal • Low pressure too low (see graph) • Required cooling output is attained	♦ Actuation of air conditioner compressor regulating valve -N280- not OK ♦ Air conditioner compressor defective.	– Check actuation of -N280- . – Clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). – Replace the air conditioner compressor.

Note

Heed the following in the event of the fault „High pressure normal, low pressure too low“: With this fault, the evaporator may ice up although the quantity of refrigerant in the circuit is OK. Check the measured values of the evaporator output temperature sender -G263- and actuation of the air conditioner compressor regulating valve -N280- . If the measured value of the evaporator output temperature sender -G263- is incorrect, the evaporator may ice up or the cooling output is not attained ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure normal or too high • Low pressure too high (see graph) • Air conditioner compressor noise (particularly after switch-on) • Required cooling output is not attained	♦ Actuation of air conditioner compressor regulating valve -N280- not OK ♦ Too much refrigerant in the circuit.	– Check actuation of -N280- . – Extract refrigerant from refrigerant circuit. • If quantity of refrigerant extracted roughly corresponds to specified capacity: – Replace the air conditioner compressor. • The quantity of refrigerant extracted is substantially greater than the specified capacity. – Re-charge refrigerant circuit. – Repeat test.
• High and low pressure normal • Required cooling output is not attained	♦ Actuation of air conditioner compressor regulating valve -N280- not OK ♦ Too much refrigerant oil in the circuit.	– Check actuation of -N280- . – Discharge refrigerant circuit.
• High and low pressure normal. • Air conditioner compressor noise (particularly after switch-on). • The required cooling output is attained.		– Clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).

Note

♦ *Overfilling with refrigerant oil may occur if, for example, the air conditioner compressor has been replaced without adjusting the quantity of refrigerant oil.*

♦ *If there is too much refrigerant oil in the circuit, drain the air conditioner compressor and replace the reservoir. After cleaning the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55), add the correct amount of refrigerant oil to the circuit ⇒ page 164 .*

7.5 Checking pressures on vehicles with expansion valve, receiver and air conditioner compressor regulating valve - N280- (with externally regulated air conditioner compressor)

Note

- *Connect air conditioner service station ⇒ page 99 .*
- *Observe test requirements ⇒ page 103 .*
- *If problems are only encountered at one evaporator on vehicles fitted with two evaporators, check whether the pressures in the refrigerant circuit are OK. Check for cross-sectional restriction or blockage of the pipe connection between the problematic evaporator and the outgoing pipe connection at the refrigerant pipe distribution point. If no fault is found, discharge the refrigerant circuit and re-fill it with the specified quantity of refrigerant. Then check the pressures and the cooling output of the air conditioner again. If the problem persists, replace the expansion valve upstream of the problematic evaporator ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*

– Check the pressures in the refrigerant circuit (with the air conditioner service station) with the ignition switched off ⇒ page 103 .

The pressures with the ignition switched off correspond to the specifications.

– Start the engine.
– Set the engine speed to 2000 rpm.
– Observe the pressure reading (e.g. pressure gauge) of the air conditioner service station.

Note

- *The switching pressures for actuation of the air conditioner compressor regulating valve -N280- and the radiator fans -V7- are vehicle-specific.*
- *The pressures must be measured at the service connections; the fitting locations of these connections are vehicle-specific ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- Specifications for pressures in refrigerant circuit ⇒ page 126

7.5.1 Specifications for pressures in refrigerant circuit

High-pressure side:

Increasing from initial pressure (on connecting pressure gauges) up to max. 20 bar

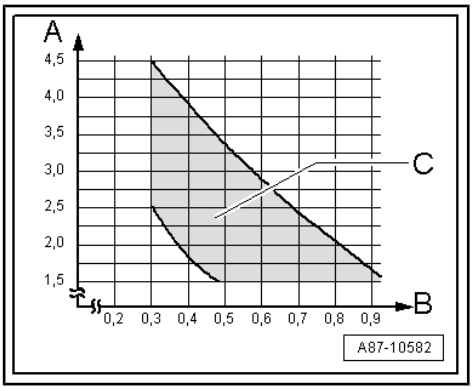
Low-pressure side:

Decreasing from initial pressure (on connecting pressure gauges) to value in graph

A - Low pressure (measured at service connection) in bar absolute

B - Control current for air conditioner compressor regulating valve -N280- in amps

C - Permissible tolerance range (applicable to compressor capacity utilisation of 10...90 %).



Note

- *In the event of a very high cooling output requirement (e.g. high ambient temperature and high fresh-air blower speed at low engine speed), the air conditioner compressor cannot initially set the pressure on the low-pressure end to the value -C- given in the graph (e.g. for a certain time after switching on the air conditioner). The air conditioner compressor is actuated with the maximum specified control current, however the delivery volume of the air conditioner compressor is no longer sufficient under these ambient conditions and at this engine speed to reduce the pressure on the low-pressure end to the value in the graph. One way of checking the control action of the air conditioner compressor under these conditions is to actuate the fresh-air blower with only approx. 40 % of the maximum voltage and to check the pressures at reduced fresh-air blower speed ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *Under unfavourable conditions (very high ambient temperatures, high humidity), the pressure on the high-pressure end may increase up to max. 29 bar.*
- *The control current -B- is displayed in the measured value block of the operating and display unit for Climatronic air conditioning system -E87- or the Climatronic control unit -J255- .*
- *The high pressure measured by the high-pressure sender -G65- or the refrigerant pressure and temperature sender -G395- is displayed in the measured value block of the operating and display unit for Climatronic air conditioning system -E87- or the operating and display unit, Climatronic control unit -J255- .*
- *The low pressure settles as a function of the control current for the air conditioner compressor regulating valve -N280- and the control characteristic of the expansion valve within the air conditioner compressor output range in the tolerance band.*
- *Under unfavourable conditions (very high ambient temperatures, high humidity), the air conditioner compressor output may not always be sufficient to attain the specified value.*
- *If the compressor capacity utilisation is greater than 90 %, the pressure on the low-pressure end may be in excess of the tolerance range „C“ shown in the graph (the compressor output no longer suffices).*
- *The specified operating current for the air conditioner compressor regulating valve -N280- must be greater than 0.3 A to ensure reliable valve actuation.*
- *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 displayed in the measured value block.*
- *At absolute pressure, 0 bar corresponds to an absolute vacuum. Normal ambient pressure corresponds to 1 bar absolute. On the scales of most pressure gauges, 0 bar corresponds to an absolute pressure of 1 bar (can be seen from -1 bar mark below 0) ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure remains constant or only increases slightly (above pressure with engine stopped) • Low pressure quickly drops to value in graph or below • Required cooling output is not attained	♦ Actuation of air conditioner compressor regulating valve -N280- not OK ♦ Not enough refrigerant in circuit ♦ Expansion valve defective	– Check actuation of -N280- – Extract refrigerant from refrigerant circuit. • If quantity of refrigerant extracted is substantially less than specified capacity:
• High pressure normal • Low pressure in line with value in graph • Required cooling output is not attained		– Localise leak with leak detector and eliminate – Re-charge refrigerant circuit. – Repeat test.
• High pressure normal • Low pressure too low (see graph) • Required cooling output is not attained		• If quantity of refrigerant extracted roughly corresponds to specified capacity: – Renew expansion valve. – Re-charge refrigerant circuit. – Repeat test.

Note

- *If no fault is found for this problem, clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).*
- *Check the measured values of the evaporator output temperature sender -G263- and actuation of -N280- . If the measured value of the evaporator output temperature sender -G263- is not OK, the evaporator may ice up or the cooling output is not attained.*
- *If, after replacing the expansion valve, operation of the air conditioning system is not OK when the test is repeated (re-fit old expansion valve), clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). Then replace the air conditioner compressor and receiver.*
- *With this fault, the evaporator may ice up although the quantity of refrigerant in the circuit is OK.*
- *If the expansion valve is defective (permanently closed or does not open sufficiently), -N280- is actuated to maximum output and the low pressure drops to the value in the graph or below (the air conditioner compressor draws off refrigerant from the low-pressure end). As however refrigerant cannot flow via the expansion valve, the cooling output is not attained and the high pressure may also not increase or only increase slightly due to the absence of energy conversion ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure does not increase or only to slightly above the pressure with the engine stopped, • low pressure does not decrease or only slightly. • Required cooling output is not attained	♦ No actuation of the air conditioner compressor (air conditioner compressor regulating valve - N280-)	– Check actuation and drive of the air conditioner compressor and perform repair ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87
	♦ The air conditioner compressor is not driven.	
	♦ Constriction or blockage in the refrigerant circuit (e.g. in the refrigerant pipe between the „low-pressure end“ service connection and the air conditioner compressor).	– Clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). – Replace hose or pipe if kinked or constricted.
	♦ Air conditioner compressor defective.	– Replace the air conditioner compressor.

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure increases above specification • Low pressure quickly drops to value in graph • Required cooling output is not attained	♦ Actuation of air conditioner compressor regulating valve -N280- not OK ♦ Constriction or obstruction in refrigerant circuit ♦ Expansion valve defective	– Check actuation of -N280- . – Run hand over refrigerant circuit to check for differences in temperature • If a difference in temperature is found at one component: – Replace hose or pipe if kinked or constricted. – In the event of clogging, clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). – Re-charge refrigerant circuit. – Repeat test. • If no fault is found: – Clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). – Re-charge refrigerant circuit. – Repeat the test, if the function is not OK: – Renew expansion valve and receiver.

Note

- *If the function of the air conditioning system is not OK when the test is repeated, renew expansion valve and receiver.*
- *With this fault, the evaporator may ice up although the quantity of refrigerant in the circuit is OK.*
- *If the expansion valve is defective (permanently closed or does not open sufficiently), the air conditioner compressor regulating valve -N280- is actuated to maximum output and the low pressure drops to the value in the graph or below (the air conditioner compressor draws off refrigerant from the low-pressure end). As however refrigerant cannot flow via the expansion valve, the cooling output is not attained and the high pressure may also not increase or only increase slightly due to the absence of energy conversion ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *If there is too much refrigerant oil in the circuit, drain the air conditioner compressor and replace the receiver. After cleaning the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55), add the correct amount of refrigerant oil to the circuit ⇒ page 164 .*

Possible deviation from specification	Possible causes of fault	Fault elimination
• High and low pressure normal at first • After some time, high pressure increases above specification and • low pressure drops to value in graph or below • Required cooling output is no longer attained	♦ Actuation of air conditioner compressor regulating valve -N280- not OK ♦ Moisture in refrigerant circuit	– Check actuation of -N280- . – Clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).
• High and low pressure normal at first • After lengthy driving time, low pressure drops below specification (evaporator ices up)		– Renew receiver with dryer. – Evacuate refrigerant circuit for at least 3 hours. – Re-charge refrigerant circuit. – Repeat test.

Note

- *It is not initially necessary to clean the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55) when this problem occurs. Normally, there is only a small quantity of moisture in the system which can be removed by lengthy 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 problem with evaporator output temperature sender -G263- can also cause icing-up of refrigerant circuit. If this problem is encountered, also pay attention to the measured value of the evaporator output temperature sender -G263- ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure normal • Low pressure too low (see graph) • Required cooling output is attained	♦ Actuation of air conditioner compressor regulating valve -N280- not OK ♦ Expansion valve or air conditioner compressor defective. ♦ Air conditioner compressor defective.	– Check actuation of -N280- . – Clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55) (not always necessary, refer to notes). – Renew expansion valve and receiver. – Re-charge refrigerant circuit. – Repeat the test, if the function is not OK: – Replace the air conditioner compressor. – Re-charge refrigerant circuit. – Repeat test.

Note

- *Heed the following in the event of the fault „High pressure normal, low pressure too low“: With this fault, the evaporator may ice up although the quantity of refrigerant in the circuit is OK.*
- *If the problem is with -N280- (the regulating valve is not actuated but the air conditioner compressor operates nevertheless), the refrigerant circuit does not have to be cleaned (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55). 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 defective (permanently closed or does not open sufficiently), -N280- is actuated to maximum output and the low pressure drops to the value in the graph or below (the air conditioner compressor draws off refrigerant from the low-pressure end). As refrigerant cannot however flow via expansion valve, cooling output is not attained and high pressure may either not increase or only slightly due to the absence of energy conversion.*
- *Check the measured values of the evaporator output temperature sender -G263- and actuation of -N280- . If the measured value of the evaporator output temperature sender -G263- is incorrect, the evaporator may ice up or the cooling output is not attained ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*

Possible deviation from specification	Possible causes of fault	Fault elimination
• High pressure normal or too high • Low pressure too high (see graph) • Air conditioner compressor noise (particularly after switch-on) • Required cooling output is attained	♦ Actuation of air conditioner compressor regulating valve -N280- not OK ♦ Too much refrigerant in the circuit. ♦ Expansion valve defective ♦ Air conditioner compressor defective.	– Check actuation of -N280- . – Extract refrigerant from refrigerant circuit. • The quantity of refrigerant extracted roughly corresponds to the actual capacity. – Renew expansion valve and receiver. – Re-charge refrigerant circuit. – Repeat the test, if the function is not OK: – Replace the air conditioner compressor. • If quantity of refrigerant extracted is substantially greater than specified capacity: – Re-charge refrigerant circuit. – Repeat test.

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.*

♦ *If the expansion valve is defective (permanently closed or does not open sufficiently), -N280- is actuated to maximum output and the low pressure drops to the value in the graph or below (the air conditioner compressor draws off refrigerant from the low-pressure end). As however refrigerant cannot flow via the expansion valve, the cooling output is not attained and the high pressure may also not increase or only increase slightly due to the absence of energy conversion ⇒ Vehicle diagnostic tester („self-diagnosis“ or „guided fault-finding“ function for air conditioner) and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*

Possible deviation from specification	Possible causes of fault	Fault elimination
• High and low pressure normal • Required cooling output is attained	♦ Actuation of air conditioner compressor regulating valve -N280- not OK ♦ Too much refrigerant in the circuit. ♦ Expansion valve defective	– Check actuation of -N280- . – Discharge refrigerant circuit. – Clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55).

Possible deviation from specification	Possible causes of fault	Fault elimination
• High and low pressure normal • Air conditioner compressor noise (particularly after switch-on) • Required cooling output is attained		– Add the correct quantity of refrigerant oil to the circuit (refer to note). – Re-charge refrigerant circuit. – Repeat the test, if the function is not OK: – Renew expansion valve. – Re-charge refrigerant circuit. – Repeat test.

Note

- *Overfilling with refrigerant oil may occur if, for example, the air conditioner compressor has been replaced without adjusting the quantity of refrigerant oil.*
- *If the expansion valve is defective (permanently open), the evaporator temperature is no longer regulated such that only refrigerant in gas form exits from the evaporator. Under certain usage conditions, liquid droplets may then be drawn in by the air conditioner compressor and cause noise (liquid cannot be compressed).*
- *If there is too much refrigerant oil in the circuit, drain the air conditioner compressor and replace the receiver. After cleaning the refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55), add the correct amount of refrigerant oil to the circuit ⇒ page 164 .*

8 Renewing components of refrigerant circuit

- Replacing components ⇒ page 136 .

8.1 Renewing components

- All components of the refrigerant circuit submitted for quality observation are always to be sealed (use the original sealing caps of the replacement part).
- Replacement air conditioner compressors, reservoirs, receivers, evaporators and condensers have so far been 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 preceptible 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- (no magnetic clutch) is switched to internal lubrication with the result that only a minimal amount of oil is pumped from the air conditioner compressor into the circuit.

Note

- *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.*
- *Refrigerant circuits are fitted either with a restrictor and reservoir or with an expansion valve and receiver.*
- *The dryer cartridge or components with desiccant bag (reservoir, receiver) are always to be replaced after cleaning the refrigerant circuit (flushing with refrigerant R134a ⇒ page 59 or blowing out with compressed air and nitrogen ⇒ page 55); in doing so, leave sealed as long as possible to minimise the absorption of moisture.*
- *The dryer cartridge or components with desiccant bag (reservoir, receiver) are to be replaced if required for certain repair operations or if the refrigerant circuit has been open for a lengthy period and moisture has ingressed (e.g. following an accident) ⇒ page 138 .*
- *The period of time for which a refrigerant circuit may be left open without having to replace a component with desiccant bag (reservoir, receiver) is largely governed by ambient influences. 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 ingress into the circuit also influences the period for which a refrigerant circuit can be left open without having to replace components with desiccant bag ⇒ page 138 .*
- *Seal open connections and pipes (to prevent absorption of moisture).*
- *Always renew restrictor.*

Caution

- ***Contaminated refrigerant oils must be disposed of as used oils of unknown origin ⇒ Audi-ServiceNet, HSO Environmental Protection .***

- Leaking or damaged components (except air conditioner compressor, reservoir or receiver) ⇒ page 138
- Leaking or damaged components (except air conditioner compressor, reservoir or receiver) ⇒ page 139
- Replacing air conditioner compressor without the need for refrigerant circuit cleaning ⇒ page 140 .
- Replacing air conditioner compressor on account of leakage or internal damage ⇒ page 141
- Renewing receiver or reservoir and restrictor after cleaning refrigerant circuit ⇒ page 141
- Replacing receiver or reservoir without the need for refrigerant circuit cleaning ⇒ page 143 .

- Replacing dryer cartridge/desiccant bag without the need for refrigerant circuit cleaning ⇒ page 143

8.1.1 Leaking or damaged components (except air conditioner compressor, reservoir or receiver)

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

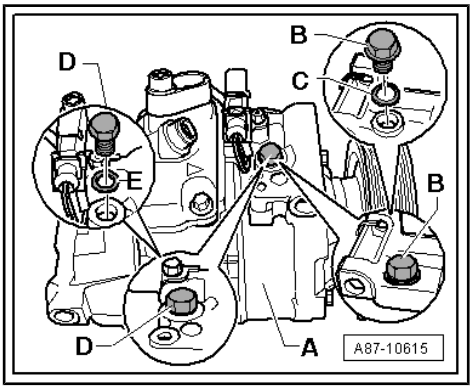
Note

- *In the event of only a minor leak with slow escape of refrigerant (e.g. at a small leakage point), the amount of refrigerant oil lost and the amount of moisture ingressing is not sufficient to influence operation of the air conditioner.*
- *The operations marked * are only to be implemented in the case of a major leak (e.g. following an accident).*

– Remove defective component.

– Remove the air conditioner compressor.*

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



Note

- *The design of the oil drain plug -B- / -D- and the seal -C- / -E- varies (depending on the air conditioner compressor manufacturer).*
- *Pay attention to the tightening torque when fitting the oil drain plug -B- / -D- (depends on the air conditioner compressor manufacturer and the design of the oil drain plug) ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *On the „Denso“ or „Nippondenso“ air conditioner compressor, the oil drain plug -D- is fitted with a sealing ring -E- for example; always replace ⇒ Electronic parts catalogue .*
- *On the „Sanden“ or „Zexel“ air conditioner compressor, the oil drain plug -B- is fitted with an O-ring -C- for example; always replace ⇒ Electronic parts catalogue .*
- *To accelerate drainage of the refrigerant oil, crank the air conditioner compressor by way of the magnetic clutch plate for example.*
- *Pour the old refrigerant oil out of the air conditioner compressor* (disposal ⇒ Audi-ServiceNet, HSO Environmental Protection).*
- *Then fill the air conditioner compressor with the quantity of fresh refrigerant oil corresponding to the quantity of refrigerant oil in the replacement compressor ⇒ page 164 .**
- *Use different refrigerant oils and quantities for the various air conditioner compressors ⇒ page 164 .*
- *To ensure air conditioner compressor lubrication on start-up, at least 80 cm^3 of refrigerant oil must be poured into the air conditioner compressor. The remainder can be added for example to the new reservoir or receiver ⇒ page 164 .*
- *If dirt has ingressed into the air conditioner compressor with the refrigerant circuit open (e.g. after an accident), the air conditioner compressor is to be replaced.*
- *Clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air or nitrogen ⇒ page 55).**

– Renew dryer cartridge, receiver* or reservoir* and restrictor.

– Assemble, evacuate and re-charge refrigerant circuit.

8.1.2 Leaking or damaged components (except air conditioner compressor, reservoir or receiver)

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

– Discharge refrigerant circuit.

– Remove the defective component, blow out with compressed air and collect the refrigerant oil escaping.

– The new component is to be filled with the amount of refrigerant oil blown out (plus 20 cm^3 for the evaporator, plus 10 cm^3 for the condenser, refrigerant pipes and refrigerant hoses) as fresh refrigerant oil fill.

Note

Disposal of old refrigerant ⇒ Audi-ServiceNet, HSO Environmental Protection .

– Renew restrictor.
– Assemble, evacuate and charge refrigerant circuit.

8.1.3 Replacing air conditioner compressor without the need for refrigerant circuit cleaning

Note

Cleaning refrigerant circuit means flushing with refrigerant R134a ⇒ page 59 or blowing out with compressed air or nitrogen ⇒ page 55 .

For example in the case of external damage following an accident

– Drain the refrigerant circuit.
– Remove the air conditioner compressor.
– Remove the oil drain plug from the air conditioner compressor.

Note

There are different versions of the oil drain plug and the corresponding seal (an O-ring or a sealing ring may be fitted, always replace) ⇒ page 138 and ⇒ Electronic parts catalogue .

– To accelerate drainage of the refrigerant oil, crank the air conditioner compressor by way of the magnetic clutch plate for example.
– Pour the old refrigerant oil out of the air conditioner compressor (for disposal, refer to ⇒ Audi-ServiceNet, HSO Environmental Protection).
– Remove the oil drain plug from the replacement compressor, pour out the refrigerant oil and only add a quantity of fresh refrigerant oil equal to the amount poured out of the defective air conditioner compressor.

Note

- *If, for example, 70 cm^3 of refrigerant oil has been poured out of the defective air conditioner compressor and 220 cm^3 out of the replacement compressor (a small quantity of refrigerant oil remains in the air conditioner compressor), fill the air conditioner compressor to be installed with 70 cm^3 of refrigerant oil (use can be made of the oil poured out of the replacement compressor).*
- *Use different refrigerant oils and quantities for the various air conditioner compressors ⇒ page 144 .*
- *If a greater quantity of refrigerant oil (more than approx. 80 cm^3) has been poured out of the defective air conditioner compressor, the remaining refrigerant oil can also be added to the evaporator or reservoir/receiver ⇒ page 144 .*

– Renew restrictor.

– Assemble, evacuate and charge refrigerant circuit.

8.1.4 Replacing air conditioner compressor on account of leakage or internal damage

For example due to noise from the air conditioner compressor or no air conditioner compressor output

– Drain the refrigerant circuit.

– Remove the air conditioner compressor.

Note

- *In the event of internal (air conditioner compressor) damage, check the refrigerant hoses and condenser. If, e.g. swarf has ingressed, clean the refrigerant hoses and condenser (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air or nitrogen ⇒ page 55) and replace the refrigerant hoses if necessary.*
- *On vehicles with two evaporators, the quantity of refrigerant oil in the refrigerant circuit may be greater than the quantity in the replacement compressor. On such vehicles, add the extra quantity of refrigerant oil to the refrigerant circuit as necessary ⇒ page 55 .*

– Renew dryer cartridge, receiver or reservoir and restrictor.

– Check expansion valve for dirt or corrosion and renew if necessary

– Assemble, evacuate and charge refrigerant circuit.

8.1.5 Renewing receiver or reservoir and restrictor after cleaning refrigerant circuit

Note

Cleaning refrigerant circuit means flushing with refrigerant R134a ⇒ page 59 or blowing out with compressed air or nitrogen ⇒ page 55 .

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

– Discharge refrigerant circuit.

– Remove the air conditioner compressor.

– Eliminate cause of fault.

– Clean refrigerant circuit (flush with refrigerant R134a ⇒ page 59 or blow out with compressed air or nitrogen ⇒ page 55).

– Check expansion valve for dirt or corrosion and renew if necessary

– Remove the oil drain plug from the air conditioner compressor.

Note

There are different versions of the oil drain plug and the corresponding seal (an O-ring or a sealing ring may be fitted, always replace) ⇒ page 138 and ⇒ Electronic parts catalogue .

– To accelerate drainage of the refrigerant oil, crank the air conditioner compressor by way of the magnetic clutch plate for example.

– Pour the old refrigerant oil out of the air conditioner compressor.

Note

Disposal of old refrigerant ⇒ Audi-ServiceNet, HSO Environmental Protection .

– Then add the quantity of fresh refrigerant oil to the air conditioner compressor corresponding to the quantity of refrigerant oil in the replacement compressor (or the specified quantity of refrigerant oil on vehicles with two evaporators if applicable) ⇒ page 164 .

Note

- *Use different refrigerant oils and quantities for the various air conditioner compressors ⇒ page 164 .*
- *To ensure air conditioner compressor lubrication on start-up, at least 80 cm^3 of refrigerant oil must be poured into the air conditioner compressor. The remainder can be added for example to the new reservoir or receiver ⇒ page 144 .*
- *If dirt has ingressed into the air conditioner compressor with the refrigerant circuit open (e.g. after an accident), the air conditioner compressor is to be replaced.*
- *On vehicles with two evaporators, the quantity of refrigerant oil in the refrigerant circuit may be greater than the quantity in the replacement compressor. On such vehicles, add the extra quantity of refrigerant oil to the refrigerant circuit as necessary ⇒ page 55 .*

– Renew receiver or reservoir and restrictor.

– Assemble, evacuate and charge refrigerant circuit.

8.1.6 Replacing receiver or reservoir without the need for refrigerant circuit cleaning

Note

Cleaning refrigerant circuit means flushing with refrigerant R134a ⇒ page 59 or blowing out with compressed air or nitrogen ⇒ page 55 .

For example in the event of accident damage; no refrigerant escaped and no ingress of moisture and dirt into the circuit

- Discharge refrigerant circuit.
- Renew restrictor.
- Remove receiver or reservoir.
- Remove dirt from receiver or reservoir.
- Weigh receiver or reservoir removed.
- Fill the new receiver or reservoir with refrigerant oil until it attains the weight of the vessel removed.
- Install new receiver or reservoir.
- Assemble, evacuate and charge refrigerant circuit.

8.1.7 Replacing dryer cartridge/desiccant bag without the need for refrigerant circuit cleaning

Note

Cleaning the refrigerant circuit means flushing with refrigerant R134a ⇒ page 59 or blowing out with compressed air or nitrogen ⇒ page 55 .

For example in the event of a leak; refrigerant has escaped but no dirt has ingressed into the circuit

- Discharge the refrigerant circuit.
- Replace the dryer cartridge ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).
- Assemble, evacuate and charge the refrigerant circuit.

9 Capacities for refrigerant R134a, refrigerant oil and approved refrigerant oils

- Capacities for refrigerant R134a ⇒ page 144
- Approved refrigerant oils and refrigerant oil capacities ⇒ page 164

9.1 Capacities for refrigerant R134a

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, the air conditioner service station must be on the same level as the vehicle in which the refrigerant circuit is to be charged (maximum difference 50 cm). Depending on the design of the air conditioner service station , an excessive difference in height could lead to differences between the quantity of refrigerant displayed and that actually poured in. The filling accuracy of the air conditioner service station may vary.*
- *For air conditioner compressor assignment („Zexel / Valeo“, „Sanden“ or „Denso / Nippondenso“), refer to the ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*

Note

- *Refrigerant circuits converted from R12 to R134a are to be filled with the quantity indicated in the Workshop Manual „Air conditioner with refrigerant R12“. ⇒ Air conditioner with refrigerant R12 (this Workshop Manual is only available in hard-copy form).*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

- ⇒ „9.1.1 Capacities for Audi A1 (8X_) 2011 ►“, page 145
- ⇒ „9.1.2 Capacities for Audi A2 (8Z_) 2001 ►“, page 145
- ⇒ „9.1.3 Capacities for Audi A3 (8L_) 1997 ► and Audi TT (8N_) 1999 ►“, page 146
- ⇒ „9.1.4 Capacities for Audi A3 (8P_) 2004 ►“, page 149
- ⇒ „9.1.5 Capacities for Audi TT (8J_) 2007 ►“, page 150
- ⇒ „9.1.6 Capacities for Audi 80 (8A_ / 8C_), Audi Coupé (8B_), Audi Cabriolet (8G_) ► 2002“, page 150
- ⇒ „9.1.7 Capacities for Audi A4 (8D_) 1995 ► “, page 151
- ⇒ „9.1.8 Capacities for Audi A4 (8E_) 2001 ►, Audi A4 Cabriolet (8H_) 2003 ►“, page 153
- ⇒ „9.1.9 Capacities for Audi A4 (8K_) 2008 ►, Audi A5 Coupé and Sportback (8T_) 2008 ►, Audi Q5 (8R_) 2008 ►, Audi A5 Cabriolet (8F_) 2009 ►“, page 154

9.1.1 Capacities for Audi A1 (8X_) 2011 ►

Characteristics of refrigerant circuit:

- Expansion valve
- Receiver
- „Denso“, „Sanden“ (or „Delphi“) air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A1	08.10 onwards	500 + / - 15	• None

Note

- *Various air conditioner compressors have been fitted depending on the production period and engine (these air conditioner compressors have no magnetic clutch).*
- *At the start of production, „Denso“ type „6 SEU 14C“ or „Sanden“ type „7 PXE 16“ air conditioner compressors were fitted ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .*
- *Depending on the engine, „Delphi“ type „6 CVC 140“ air conditioner compressors may also be fitted at a later date (introduction not yet finalised) ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .*

9.1.2 Capacities for Audi A2 (8Z_) 2001 ►

Characteristics of refrigerant circuit:

- Restrictor (coloured).
- Reservoir.
- „Denso“ air conditioner compressor with no magnetic clutch and with air conditioner compressor regulating valve -N280- .

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A2	From 06.00 to 07.01	525 + / - 25	• Yellow-coloured restrictor • Condenser, no. 8Z0 260 401 (403) with index „B“ or „C“.
	From 07.01 onwards	500 + / - 25	• Red-coloured restrictor • Condenser, no. 8Z0 260 401 (403) with index „D“.

Note

- *Replacement restrictors with different holes are available (yellow-coloured 1.54 mm, red-coloured 1.42 mm).*
- *Depending on manufacturer, colour of red restrictor may tend more towards orange.*
- *To avoid altering the cooling output of the air conditioner, restrictors with the same hole diameter must always be used.*
- *A restrictor with a smaller hole (red-coloured) and a condenser with a smaller internal volume are installed from model year 2002 onwards. The capacity has therefore been slightly modified (condenser -70 g, smaller restrictor +50 g) ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*

9.1.3 Capacities for Audi A3 (8L_) 1997 ► and Audi TT (8N_) 1999 ►

Characteristics of refrigerant circuit:

- Expansion valve
- Receiver
- „Sanden“ or „Zexel / Valeo“ air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue

Capacity for Audi A3 (8L_) 1997 to 2004

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A3	From 08.96 onwards	750 + 50	• None

Note

- *Exclusive use was made at the start of production of „Sanden“ air conditioner compressors. With effect from Model Year 1999, use has also been made of „Zexel / Valeo“ air conditioner compressors ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*
- *If no replacement condenser with a flat tube width = 20 mm is available for an Audi A3 and a condenser with a flat tube width = 16 mm is fitted, only 650 + / - 20 g of refrigerant are to be added instead of 750 + 50 g. In addition the capacity given on the label must be altered accordingly (heed notes on Audi TT ⇒ page 148).*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

Capacity for Audi TT (8N_) 1999 ►

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi TT	From 10.98 to 10.03 (and from 06.04 to 08.04 ⇒ page 148)	750 + 50	• Condenser with a flat tube width of 20 mm ⇒ page 148
	From 10.03 onwards (except 06.04 to 08.04 ⇒ page 148)	650 $^{+}$ / $_{-}$ 20	• Condenser with a flat tube width of 16 mm ⇒ page 148

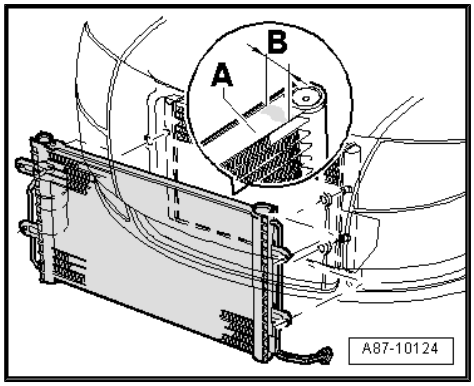
Note

- *Exclusive use was made at the start of production of „Sanden“ air conditioner compressors. With effect from Model Year 1999, use has also been made of „Zexel / Valeo“ air conditioner compressors ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*
- *The air conditioner compressor designation „Zexel / Valeo“ was changed as of 2006 to „Valeo“.*
- *With effect from 10.03 (as of vehicle identification number 8N41015239), production of the Audi TT was switched from the condenser with part no. „1J0 820 411 J“ (with a flat tube width of 20 mm) to the condenser with part no. „ 8N0 820 411 A“ (with a flat tube width of 16 mm) ⇒ page 148 . In the period between 06.04 and 08.04, a certain number of vehicles was again fitted with condensers with a flat tube width of 20 mm.*
- *Condensers with a flat tube width = 16 mm must be filled with approx. 120 g less refrigerant than condensers with a flat tube width = 20 mm ⇒ Electronic parts catalogue .*
- *In the period between 10.03 (vehicles as of vehicle identification number 8N41015239) and 06.04, the Audi TT was fitted at the factory with a condenser with a flat tube width of 16 mm (with part no. „ 8N0 820 411 A“) and the refrigerant circuit was filled with 750 + 50 g of refrigerant. These vehicles were also provided with a label indicating the wrong capacity, namely 750 g (or 700 g in 06.04) instead of 650 g ⇒ page 148 . Under certain ambient conditions (e.g. high ambient temperatures), over-filling of the systems may result in the air conditioner compressor being shut off on account of excess pressure in the refrigerant circuit. Complaints may also be received about engine performance (e.g. humming and drumming; the engine is subjected to greater load as the air conditioner compressor constantly has to cope with excessively high pressure). Remedy: Discharge the refrigerant circuit, then re-charge with the correct capacity and replace the label with a label indicating the correct capacity or delete the old capacity indicated on the label and enter the new capacity in waterproof ink for example.*
- *Pay attention to flat tube dimensions if condenser is renewed. If a condenser with different flat tube dimensions is to be fitted, also replace the label indicating the refrigerant R134a capacity or delete the old capacity and enter the new capacity in waterproof ink for example ⇒ Electronic parts catalogue .*

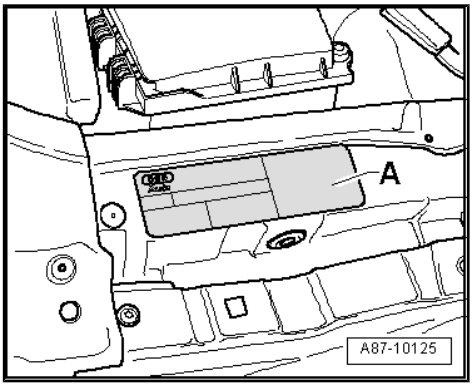
Reading flat tube dimensions of condenser

- Flat tubes of condenser -A-
- Width of flat tubes -B-

Label indicating refrigerant R134a capacity



Pay attention to flat tube dimensions if condenser is renewed. If a condenser with different dimensions is to be fitted, also replace the label -A- indicating the refrigerant R134a capacity or delete the old capacity and enter the new capacity in waterproof ink for example ⇒ Electronic parts catalogue .



9.1.4 Capacities for Audi A3 (8P_) 2004 ►

Note

Applies to the Audi A3, Audi A3 Sportback and Audi A3 Cabriolet.

Characteristics of refrigerant circuit:

- Expansion valve
- Receiver
- „Denso“, „Delphi“, „Sanden“ or „Zexel / Valeo“ air conditioner compressor with air conditioner compressor regulating valve - N280- ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A3	From 05.03 on-wards	525 + / - 25	• None

Note

- *Various air conditioner compressors have been fitted depending on the production period and engine (these air conditioner compressors have no magnetic clutch).*
- *At the start of production exclusive use was made of type „7 SEU 16“ air conditioner compressors from „Denso“. From model year 2004 onwards, a different „Denso“ compressor (type „7 SEU 17“) has gradually been replacing the old one.*
- *With effect from Model Year 2004, „Zexel / Valeo“ (type „DSC17E“) and „Sanden“ (type „PXE16“) air condtioner compressors were gradually introduced depending on the engine ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .*
- *With effect from Model Year 2008, „Denso“ (type „6 SEU 14“) and „Delphi“ air condtioner compressors were gradually introduced depending on the engine ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

9.1.5 Capacities for Audi TT (8J_) 2007 ►

Characteristics of refrigerant circuit:

- Expansion valve
- Receiver
- „Denso“ or „Sanden“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi TT • With 4 or 6-cyl. engine	From 08.06 onwards	525 + / - 25	• None
Audi TT • With 5-cyl. engine	03.09 onwards	500 + / - 25	• Different type of condenser fitted ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .

Note

- *At the start of production, exclusive use was made of air conditioner compressors of type „6 SEU 14“ manufactured by „Denso“. This air conditioner compressor has no magnetic clutch (it is constantly driven by the engine). Different makes of air conditioner compressor may also be fitted at a later date depending on the engine ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .*
- *As of Model Year 2008, air conditioner compressors manufactured by „Sanden“ (type „PXE16“) were also gradually introduced for certain engines. This air conditioner compressor has no magnetic clutch (it is constantly driven by the engine) ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .*

9.1.6 Capacities for Audi 80 (8A_ / 8C_), Audi Coupé (8B_), Audi Cabriolet (8G_) ► 2002

Characteristics of refrigerant circuit:

- Restrictor (not coloured).
- Reservoir
- „Zexel / Valeo“ air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi 80 Audi Coupé Audi Cabriolet	From 10.92 onwards	750 + 50 • Vehicles with 5-cyl. engine	• None
		650 + 50 • Vehicles with 4 or 6-cyl. engine	

Note

- *Replacement restrictors with different holes are available. If these vehicles are fitted with a yellow-coloured restrictor, add 50 g more refrigerant than specified in the table. After charging, amend capacity stated on label or affix label indicating new capacity.*
- *In order to distinguish between the two restrictor versions, the one with the smaller hole (1.54 mm) is yellow-coloured. The restrictor with the larger hole (1.83 mm) is not coloured.*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

9.1.7 Capacities for Audi A4 (8D_) 1995 ►

Characteristics of refrigerant circuit:

- Restrictor
- Reservoir
- „Denso“ or „Zexel / Valeo“ air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A4	From 11.94 to 11.97	650 + 50	• Restrictor not coloured
	From 11.97 onwards	700 + 50	• Restrictor coloured (yellow) • „Showa“ condenser (distinguishing feature ⇒ page 152)
	From 11.98 onwards	550 + 50	• Restrictor coloured (yellow) • „AWG“ condenser (distinguishing feature ⇒ page 152)
Audi RS4	From 05.00 onwards	650 + 50	• Restrictor coloured (yellow)

Note

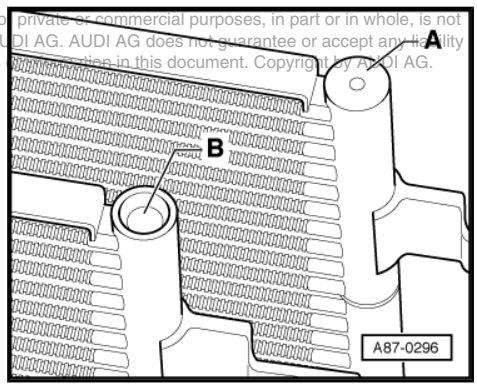
- *Restrictors with a modified hole have been installed at the factory since November 1997 (yellow-coloured). The capacity was increased by 50 g for vehicles with a yellow-coloured restrictor.*
- *In order to distinguish between the two restrictor versions, the one with the smaller hole (1.54 mm) is yellow-coloured. The restrictor with the larger hole (1.83 mm) is not coloured.*
- *The Audi A4 was fitted with different air conditioner compressors depending on the engine and production period. Exclusive use was made at the start of production of „Zexel / Valeo“ air conditioner compressors. As of Model Year 1996, „Denso“ air conditioner compressors were gradually introduced for vehicles with 6-cylinder engines.*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*
- *Replacement restrictors with different holes (not coloured, yellow-coloured, red-coloured) are available. If a vehicle is fitted with a different restrictor, add more or less refrigerant depending on type (⇒ Table). After charging, amend capacity stated on label or affix label indicating new capacity.*
- *Depending on manufacturer, colour of red restrictor may tend more towards orange.*
- *From November 1998 onwards, Audi A4 models have also been fitted with „AWG“ condensers (initially approx. 10000 vehicles with chassis numbers between 8DXA 065 253 and 8DXA 077 026). The specified capacity for vehicles with these condensers differs from those with „Showa“ condensers. The condensers can be identified on the basis of certain characteristic features ⇒ page 152 .*
- *If the condenser installed is replaced by one with a different part number, check the capacity indicated on the label in the vehicle and amend if necessary or affix a label with the correct capacity over the existing one ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*

Distinguishing features of „Showa“ and „AWG“ condensers

Different manifolds:

A - Manifold on „Showa“ condenser

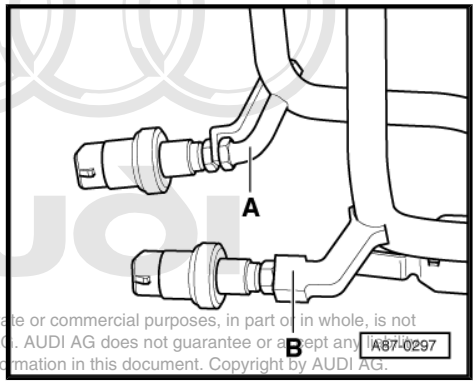
B - Manifold on „AWG“ condenser



Different connections to the pressure switch.

A - Connection area on „Showa“ condenser

B - Connection area on „AWG“ condenser



9.1.8 Capacities for Audi A4 (8E_) 2001 ►, Audi A4 Cabriolet (8H_) 2003 ►

Characteristics of refrigerant circuit:

- Restrictor (yellow or red-coloured).
- Reservoir
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- (no magnetic clutch)

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A4	From 11.00 onwards	500 + / - 20	• Yellow or red-coloured restrictor
Audi RS4	From 07.05 onwards	440 + / - 20	• Red-coloured restrictor.

Note

- *Replacement restrictors with different holes are available (yellow-coloured 1.54 mm, red-coloured 1.42 mm).*
- *Depending on manufacturer, colour of red restrictor may tend more towards orange.*
- *To avoid altering the cooling output of the air conditioner, only red or yellow-coloured restrictors are to be fitted. Yellow-coloured restrictors were fitted in model year 2001. Red-coloured restrictors were introduced in model year 2002. The change to the restrictor (on vehicles produced in model year 2001, a red-coloured restrictor may also be fitted instead of a yellow-coloured one) does not alter the capacity for these vehicles.*
- *Various air conditioner compressors have been fitted depending on the production period and engine (these air conditioner compressors have no magnetic clutch).*
- *At the start of production exclusive use was made of type „6 SEU 12“ and „7 SEU 16“ air conditioner compressors from „Denso“. From model year 2004 onwards, different „Denso“ compressors (types „6 SEU 14“ and „7 SEU 17“) have gradually replaced the old ones. ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue*
- *The Audi RS 4 is fitted with a condenser with a smaller internal volume. The capacity for this vehicle is therefore lower than for the other vehicles ⇒ Electronic parts catalogue .*

9.1.9 Capacities for Audi A4 (8K_) 2008 ►, Audi A5 Coupé and Sportback (8T_) 2008 ►, Audi Q5 (8R_) 2008 ►, Audi A5 Cabriolet (8F_) 2009 ►

Characteristics of refrigerant circuit:

- Expansion valve
- Receiver
- Refrigerant pipe with internal heat exchanger
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A4	From 10.07 onwards	600 + / - 20	• None
Audi A5 Coupé and Sportback	From 05.07 onwards	600 + / - 20	• None
Audi Q5	From 09.08 onwards	600 + / - 20	• None
Audi A5 Cabriolet	From 03.09 onwards	600 + / - 20	• None
Audi RS 5	03.10 onwards	570 + / - 20	• None

Note

- *The air conditioner compressors fitted at the start of production are manufactured by „Denso“ (type „6 SEU 14“) for vehicles with 4 and 6-cyl. engine and type „7 SEU 17“ for vehicles with 8-cyl. engine). Different makes of air conditioner compressor may also be fitted at a later date ⇒ Electronic parts catalogue and ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *The Audi RS 5 is fitted with a condenser with a smaller internal volume. The capacity for this vehicle is therefore lower than for the other vehicles of this series ⇒ Electronic parts catalogue .*

9.1.10 Capacities for Audi 100 / Audi A6 (4A_) ► 1998

Characteristics of refrigerant circuit:

- Restrictor not coloured
- Reservoir
- „Denso“ or „Zexel / Valeo“ air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi 100 / Audi A6	From 10.92 to 03.97	750 + 50	• None

Note

- *If a vehicle is fitted with a yellow-coloured restrictor as replacement for a non-coloured restrictor, add 50 g more refrigerant than specified in the table. In addition, the capacity specified on the label in the vehicle is to be checked and amended if necessary or the existing label is to be replaced with one indicating the correct capacity (affix over old label).*
- *Restrictors with modified hole (coloured) have been installed at the factory since November 1997. In order to distinguish between the two restrictor versions, the one with the smaller hole (1.54 mm) is yellow-coloured. The restrictor with the larger hole (1.83 mm) is not coloured.*
- *The Audi 100 / Audi A6 features different air conditioner compressors depending on the engine and production period. Exclusive use was made at the start of production of „Zexel / Valeo“ air conditioner compressors. As of Model Year 1996, „Denso“ air conditioner compressors were gradually introduced for vehicles with 6-cylinder engines.*
- *The air conditioner compressor designation „Zexel / Valeo“ was changed as of 2006 to „Valeo“.*
- *From September 1994, production was gradually switched from condenser 4A0 260 403 AB to condenser 4A0 260 403 AC.*
- *The refrigerant capacity of 750+50 g applies to all Audi 100 models (regardless of condenser).*
- *Only condensers with part number 4A0 260 403 AC are now available as replacement parts (if necessary use label, part no. 8A0 010 126 P).*
- *After charging the refrigerant circuit of vehicles manufactured up to October 1994, check the capacity stated on the label in the vehicle and amend if necessary or affix the label, part no. 8A0 010 126 P over the existing label (modified capacity) ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*

9.1.11 Capacities for Audi A6 (4B_) 1998 ► and Audi allroad (4B_) ► 2005

Characteristics of refrigerant circuit:

- Restrictor
- Reservoir
- „Denso“ or „Zexel Valeo“ air conditioner compressor ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A6	From 04.97 to 11.97	800 + 50	• Restrictor not coloured • Air conditioner unit version „1“ ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual). • Condenser with flat tube dimensions 20 mm x 3 mm ⇒ page 159 .

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
	From 11.97 to 08.98	850 + 50	• Restrictor coloured (yellow) • Air conditioner unit version „1“ ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual). • Condenser with flat tube dimensions 20 mm x 3 mm ⇒ page 159 .

Note

- *Restrictors with a modified hole have been installed at the factory since November 1997 (yellow-coloured). The capacity was increased by 50 g for vehicles in which a yellow-coloured restrictor was installed.*
- *In order to distinguish between the two restrictor versions, the one with the smaller hole (1.54 mm) is yellow-coloured. The restrictor with the larger hole (1.83 mm) is not coloured.*
- *If a vehicle is fitted with a coloured restrictor as replacement for a non-coloured restrictor, add 50 g more refrigerant (see table). In addition, the capacity specified on the label in the vehicle is to be checked and amended if necessary or the existing label is to be replaced with one indicating the correct capacity (affix over old label).*
- *The Audi A6 is fitted with different air conditioner compressors depending on the engine and production period.*
- *In August/September 1998, production was gradually switched from air conditioning unit version „1“ to air conditioning unit version „2“. A reduction in capacity was achieved as the evaporator was also modified together with the air conditioning unit.*
- *The two air conditioner unit versions can be identified on the basis of certain characteristics described in the vehicle-specific workshop manual ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A6 • With 4-cyl. engine • With 6-cyl. petrol engine	From 08.98 to 04.99	750 + 50	• Restrictor coloured (yellow) • Air conditioner unit version „2“ ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual). • Condenser with part no. 4B0 260 401 (403) and index „D“, „E“ or „F“ (flat tube dimensions 20 mm x 3 mm ⇒ page 159) ⇒ Electronic parts catalogue .

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A6 • With 6-cyl. diesel engine	♦ From 08.98 to 10.98 ♦ From 12.98 to 10.99 (see notes)	750 + 50	• Restrictor coloured (yellow). • Air conditioner unit version „2“ ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual). • Condenser with part no. 4B0 260 401 (403) and index „D“, „E“ or „F“ (flat tube dimensions 20 mm x 3 mm ⇒ page 159) ⇒ Electronic parts catalogue .

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A6/Audi allroad • With 6-cyl. diesel engine	♦ From 10.98 to 12.98 ♦ From 10.99 onwards (see notes)	550 + 50	• Restrictor coloured (yellow). • Air conditioner unit version „2 or 3“ ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual). • Condenser with part no. 4B0 260 401 (403) and index „G“ or „R“ (flat tube dimensions 16 mm x 1.7 mm ⇒ page 159) and ⇒ Electronic parts catalogue
Audi A6/Audi allroad • With 4-cyl. engine except 2.0 l • With 6-cyl. petrol engine except 3.0 l engine • With 6-cyl. diesel engine (refer to notes)	From 04.99 onwards	650 + 50	• Restrictor coloured (yellow) • Air conditioner unit version „2 or 3“ ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual). • Condenser with part no. 4B0 260 401 (403) and index „H“, „J“, „K“, „S“, „T“ or „N“ (flat tube dimensions 18 mm x 1.7 mm ⇒ page 159) and ⇒ Electronic parts catalogue .
Audi A6 • With 4-cyl. engine 2.0 l • With 6-cyl. engine 3.0 l	From 05.01 onwards	550 + 50	• Restrictor coloured (yellow) • Air conditioner unit version „3“ ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual). • Condenser with part no. 8E0 260 401 (403) and index A (flat tube dimensions 18 mm x 1.7 mm ⇒ page 159) and ⇒ Electronic parts catalogue . • Air conditioner compressor regulating valve -N280-

Note

- *Condensers with air conditioning system pressure switch - F129- or high-pressure sender -G65- are supplied for factory use as part no. XXX XXX 401 X. This condenser is supplied without an air conditioning system pressure switch -F129- or high-pressure sender -G65- for replacement purposes as part no. XXX XXX 403 X.*
- *From 10.98 to 12.98 vehicles with 6-cyl. diesel engine (initially about 10000) were fitted with condensers of a different design. The capacity is different for vehicles with these condensers. The condensers can be identified on the basis of certain characteristics and the part number ⇒ page 159 .*
- *The Audi A6 is fitted with different air conditioner compressors depending on the engine and production period.*
- *On condenser replacement, pay attention to the index of the part number (different flat tube versions, flat tube dimensions 16 mm x 1.7 mm, 18 mm x 1.7 mm or 20 mm x 3 mm) and the different capacities involved. If a condenser with a different part number index is installed, the capacity specified on the label must be checked and amended if necessary or a label indicating the modified capacity must be affixed over the existing label. The part number can be found on a sticker attached to the bottom of the condenser.*
- *As of 04.99, production was gradually switched from condensers with flat tube dimensions 20 mm x 3 mm to condensers with flat tube dimensions 18 mm x 1.7 mm or 16 mm x 1.7 mm. The change in production took place gradually during the course of 1999 depending on the engine and existing supplies of the different versions. Refer to the Electronic parts catalogue for precise assignment of the different condensers ⇒ Electronic parts catalogue .*
- *Vehicles with 6-cyl. diesel engine produced from 04.99 onwards may be equipped with a condenser with index „D“, „G“, „R“ or „K“. Observe the different capacities ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific Workshop Manual) and ⇒ Electronic parts catalogue .*

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A6 • With 8-cyl. engine	• Up to 03.99 and • From 02.00 onwards	550 + 50	• Restrictor coloured (yellow). • Air conditioner unit version „2 or 3“ ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual). • Condenser with part no. 4B3 260 401 (403) B, D, E (flat tube dimensions 18 mm x 1.7 mm ⇒ page 159) ⇒ Electronic parts catalogue .
Audi A6 • With 8-cyl. engine	From 03.99 to 02.00	650 + 50	• Restrictor coloured (yellow) • Air conditioner unit version „2“ ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual). • Condenser with part no. 4B3 260 401 (403) C (flat tube dimensions 18 mm x 1.7 mm ⇒ page 159) ⇒ Electronic parts catalogue .

Note

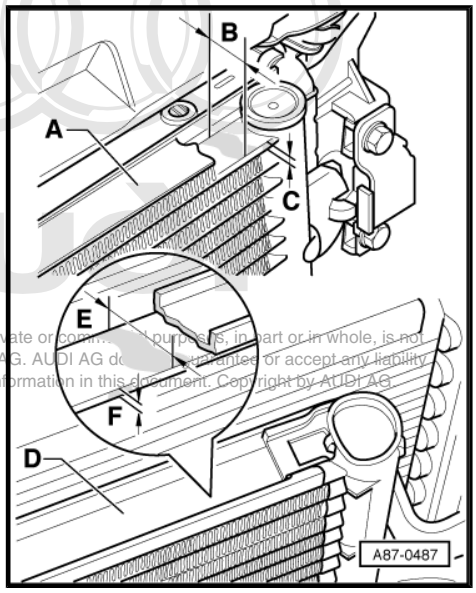
- *The Audi A6 with 8-cyl. engine is fitted with „Denso“ air conditioner compressors.*
- *In August/ September 1998 production was gradually switched from air conditioning unit version „1“ to air conditioning unit version „2“. Vehicles with an 8-cyl. engine are only fitted with air conditioning unit from version „2“ onwards.*
- *The different air conditioner unit versions can be identified on the basis of certain characteristics described in the workshop manual ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *Different condensers were installed in vehicles with 8-cylinder engines. Exclusive use was made for USA vehicles of condensers with part no. 4B3 260 401 (403) C, D, E.*
- *In March 1999, production was gradually switched from condensers with part number 4B3 260 401 (403) B to condensers with part number 4B3 260 401 (403) C.*
- *If the condenser fitted is replaced by one with a different part number, amend the capacity specified on the label or affix a label with the modified capacity over the existing label. The part number can be found on a sticker attached to the bottom of the condenser ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*

Flat tube dimensions of condenser

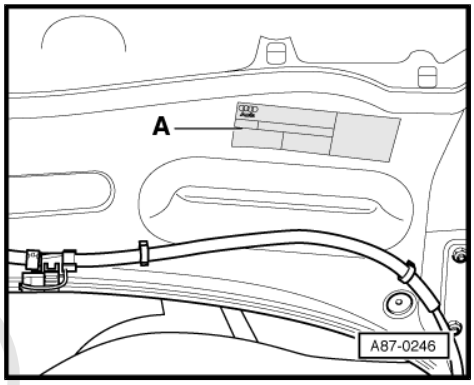
Note

- *Production was gradually switched from calendar week 45, 1998 onwards (initially for Audi A6 with 6-cyl. diesel engine) to a condenser with smaller flat tubes.*
- *Pay attention to the part number on condenser replacement (sometimes the only distinguishing feature) ⇒ Electronic parts catalogue .*

Condensers -A- with flat tube dimensions -B- = 20 mm and -C- = 3.0 mm must be filled with more refrigerant than condensers -D- with flat tube dimensions -E- = 18 mm or 16 mm and -F- = 1.7 mm ⇒ Electronic parts catalogue .



Pay attention to flat tube dimensions if condenser is renewed. If a condenser with different dimensions is to be fitted, also renew label -A- indicating the refrigerant R134a capacity or remove the old capacity and record the new capacity using a waterproof pen ⇒ Electronic parts catalogue .



9.1.12 Capacities for Audi A6 (4F_) 2005 ►

Note

Also applies to the Audi S6 and Audi RS 6.

Characteristics of refrigerant circuit:

- Restrictor (red-coloured).
- Reservoir
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- (no magnetic clutch)

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A6/ S6	From 04.04 onwards	530 + / - 20	• Red-coloured restrictor
Audi RS6	From 05.08 onwards	500 + / - 20	• Red-coloured restrictor • Condenser with smaller internal volume

Note

- *Replacement restrictors with different holes are available (yellow-coloured 1.54 mm, red-coloured 1.42 mm).*
- *Depending on manufacturer, colour of red restrictor may tend more towards orange.*
- *To avoid altering the cooling output of the air conditioner, only red-coloured restrictors are to be fitted.*
- *Different air conditioner compressors are fitted depending on the model ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *The condenser fitted on vehicles with a 10-cyl. TFSI engine (Audi RS 6) has a smaller internal volume than the condenser with other engines. For vehicles with a 10-cyl. TFSI engine the refrigerant capacity is thus also slightly less than for other vehicles ⇒ Electronic parts catalogue .*

9.1.13 Capacities for Audi A7 (4G_) 2011 ►

Characteristics of refrigerant circuit:

- Expansion valve
- Receiver
- Refrigerant line with internal heat exchanger
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A7	10.10 onwards	570^{+} / - 20	• None

Note

The air conditioner compressors fitted at the start of production are manufactured by „Denso“ (type „6 SEU 14“). Different makes of air conditioner compressor or another type of compressor may also be fitted at a later date ⇒ Electronic parts catalogue and ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).

9.1.14 Capacities for Audi V8 (4C_) ► 1994

Characteristics of refrigerant circuit:

- Restrictor (not coloured).
- Reservoir
- „Zexel / Valeo“ air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi V8	From 10.92 to 10.93	850 + 50	• None

Note

- *Replacement restrictors with different holes are available. If these vehicles are fitted with a yellow-coloured restrictor, add 50 g more refrigerant than specified in the table. After charging, amend capacity stated on label or affix label indicating new capacity.*
- *In order to distinguish between the different restrictor versions, the ones with a smaller hole are coloured (yellow or red). The red-coloured restrictor is not to be used for these vehicles.*
- *Depending on manufacturer, colour of red restrictor may tend more towards orange.*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

9.1.15 Capacities for Audi A8 (4D_) 1994 ►

Characteristics of refrigerant circuit:

- Restrictor
- Reservoir
- „Denso“ or „Zexel / Valeo“ air conditioner compressor ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A8	From 05.94 to 11.97	750 + 50	• Restrictor not coloured.
	11.97 onwards	800 + 50	• Restrictor coloured (yellow)

Note

- *Restrictors with a modified hole have been installed at the factory since November 1997 (yellow-coloured). The capacity was increased by 50 g for vehicles with a yellow-coloured restrictor.*
- *In order to distinguish between the different restrictor versions, the one with the smaller hole is coloured yellow (1.54 mm) or red (1.42 mm). The restrictor with the larger hole (1.83 mm) is not coloured.*
- *If a vehicle is fitted with a yellow-coloured restrictor as replacement for a non-coloured restrictor, add 50 g more refrigerant (see table). In addition, the capacity specified on the label in the vehicle is to be checked and amended if necessary or the existing label is to be replaced with one indicating the correct capacity (affix over old label). The red-coloured restrictor is not to be used for these vehicles.*
- *Exclusive use was made at the start of production of „Zexel / Valeo“ air conditioner compressors. As of Model Year 1996, production was gradually switched to „Denso“ air conditioner compressors ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

9.1.16 Capacities for Audi A8 (4E_) 2003 ►

Characteristics of refrigerant circuit:

- Restrictor (red-coloured).
- Reservoir
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- (no magnetic clutch)

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A8	From 10.02 onwards	620 $^{+}$ / $_{-}$ 20	• Red-coloured restrictor.

Note

- *Replacement restrictors with different holes are available (yellow-coloured 1.54 mm, red-coloured 1.42 mm).*
- *Depending on the manufacturer, the colour of the red restrictor may tend more towards orange.*
- *Only red-coloured restrictors are to be fitted, so as not to alter the cooling capacity of the air conditioner.*
- *Different air conditioner compressors are fitted depending on the model ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*

9.1.17 Capacities for Audi A8 (4H_) 2010 ►

Characteristics of refrigerant circuit:

- Expansion valve
- With one or two evaporator(s) depending on equipment
- Refrigerant line with internal heat exchanger
- Dryer cartridge in receiver at condenser
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi A8 ♦ Vehicle with one evaporator	03.10 onwards	780 + / - 20	• One evaporator
♦ Vehicle with two evaporators		930 + / - 20	• Two evaporators

9.1.18 Capacities for Audi Q7 (4L_) 2006 ►

Characteristics of refrigerant circuit:

- Expansion valve
- With one or two evaporator(s) depending on equipment
- Dryer cartridge in receiver at condenser
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi Q7	From 02.06 onwards		

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
♦ Vehicle with one evaporator		700 + 50	• One evaporator
♦ Vehicle with two evaporators		1050 + 50	• Two evaporators

9.1.19 Capacities for Audi R8 (42_) 2008 ►

Characteristics of refrigerant circuit:

- Restrictor (red-coloured).
- Reservoir
- Two series-connected condensers
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Capacity in grammes	Differing characteristics of this refrigerant circuit
Audi R8	From 03.07 onwards	650 $^{+}/_{-}$ 20	• Red-coloured restrictor.

Note

- ♦ *Replacement restrictors with different holes are available (yellow-coloured 1.54 mm, red-coloured 1.42 mm).*
- ♦ *Depending on the manufacturer, the colour of the red restrictor may tend more towards orange.*
- ♦ *To avoid altering the cooling output of the air conditioner, only red-coloured restrictors may be fitted.*

9.2 Approved refrigerant oils and refrigerant oil capacities

Note

- ♦ *As PAG (polyalkylene glycol) oil is highly hygroscopic (attracts water), opened containers are to be immediately re-sealed so as to be air-tight.*
- ♦ *PAG oil from containers which have been open for a lengthy period is no longer usable.*

- ♦ Approved refrigerant oils ⇒ page 165
- ♦ Refrigerant oil capacities ⇒ page 166

9.2.1 Approved refrigerant oils

Note

- *The oils used with refrigerant R12 are not suitable for refrigerant R134a.*
- *The name of the compressor manufacturer „Nippondenso“ has been changed to „Denso“.*
- *The refrigerant oil developed specially and exclusively for R134a refrigerant circuits is not commercially available.*
- *Refrigerant oils specifically designed for each air conditioner compressor can therefore be obtained from the replacement parts range ⇒ Electronic parts catalogue .*
- *The use of other refrigerant oils may lead to system failure, as miscibility and thus also circulation with the refrigerant R134a (for air conditioner compressor lubrication) cannot always be guaranteed.*
- *There are different refrigerant oils for „Zexel / Valeo“, „Denso“, „Delphi“ and „Sanden“ compressors ⇒ Electronic parts catalogue*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*
- *The refrigerant oil (G 052 300 A2) for use in refrigerant circuits with „Denso“ air conditioner compressors (old name „Nippondenso“) is also included in the retrofit kit (part number 4A0 298 107 A) ⇒ Electronic parts catalogue .*
- *Use is to be made for refrigerant circuits with „Zexel / Valeo“ or „Sanden“ compressor of refrigerant oil with part no. G 052 154 A2 ⇒ Electronic parts catalogue .*
- *Use can be made for refrigerant circuits with a „Delphi“ compressor of refrigerant oil with part no. G 052 154 A2 and refrigerant oil with part no. G 052 300 A2 ⇒ Electronic parts catalogue .*
- *For refrigerant circuits with „Zexel / Valeo“ compressors, use can be made of both the refrigerant oil (G 052 154 A2) and the refrigerant oil (G 052 200 A2) contained in the retrofit kit (part no. 4A0 298 107) ⇒ Electronic parts catalogue .*

9.2.2 Refrigerant oil capacities

Note

- *For air conditioner compressor assignment („Zexel / Valeo“, „Sanden“ or „Denso“), refer to the vehicle-specific workshop manual ⇒ Heating, air conditioning; Rep. gr. 87 or ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*
- *With „Zexel / Valeo“, „Denso“ and „Sanden“ compressors, the amount of refrigerant oil in the replacement compressor corresponds to the total quantity of oil to be added. If the air conditioner compressor is replaced, the quantity of refrigerant oil in the air conditioner compressor to be fitted therefore has to be adjusted (an incorrect refrigerant oil quantity would damage the compressor).*
- *When pouring the refrigerant oil out of the replacement compressor (or the defective air conditioner compressor), a small quantity of oil generally remains in the air conditioner compressor (20 to 30 cm^3). This refrigerant oil does not affect the function of the air conditioner and can therefore be ignored (always remains in compressor).*
- *On initial switch-on, the refrigerant oil is distributed throughout the refrigerant circuit.*
- *For refrigerant oil topping-up quantities on replacing defective refrigerant circuit components, refer to ⇒ page 136 . Also ⇒ Heating, air conditioning; Rep. gr. 87 , ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*

9.2.3 Capacities for Audi A1 (8X_) 2011 ►

Characteristics of refrigerant circuit:

- Expansion valve
- Receiver
- Air conditioner compressor from various manufacturers with air conditioner compressor regulating valve -N280- (no magnetic clutch) ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3	Differing characteristics of this refrigerant circuit
Audi A1	08.10 onwards	110 + / - 10	110 + / - 10	• „Sanden“ (or „Delphi“) air conditioner compressor
		90 + / - 10	90 + / - 10	„Denso“ air conditioner compressor

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *Different air conditioner compressors are fitted depending on the production period and engine.*
- *At the start of production, „Denso“ type „6 SEU 14C“ or „Sanden“ type „7 PXE 16“ air conditioner compressors were fitted ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .*
- *Depending on the engine, „Delphi“ type „6 CVC 140“ air conditioner compressors may also be fitted at a later date (introduction not yet finalised) ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .*
- *These air conditioner compressors are available as replacement parts with different oil capacities and attention must therefore be paid to the oil quantity in the air conditioner compressor as well as the exact part number ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*
- *The different oil quantities in the air conditioner compressor may result from the design of the air conditioner compressor (with or without oil separator at high-pressure connection) or, in the case of identical air conditioner compressors, from the design of the refrigerant circuit. Attention is to be paid to these oil quantities. Too much oil in the circuit results in higher pressures and reduced system cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor.*
- *The air conditioner compressor may have been fitted at the factory with a rating plate indicating the part number and the quantity of refrigerant oil in the air conditioner compressor.*

9.2.4 Capacities for Audi A2 (8Z_) 2001 ►

Characteristics of refrigerant circuit:

- Restrictor
- Reservoir
- Air conditioner compressor with air conditioner compressor regulating valve -N280- (no magnetic clutch)
- „Denso“ air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3
Audi A2	From 06.00 onwards	180 $^{+}$/ -15	180^{+}/-15

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *As the air conditioner compressor and engine always operate at the same time and the entire quantity of refrigerant oil is contained in the air conditioner compressor, the circuit must be completely assembled before starting the engine ⇒ Heating, air conditioning; Rep. gr. 87 .*
- *As replacement air conditioner compressors of this type are supplied with different oil capacities, the exact part no. must be heeded ⇒ Electronic parts catalogue .*

9.2.5 Capacities for Audi A3 (8L_) 1997 ► and Audi TT (8N_) 1999 ►

Characteristics of refrigerant circuit:

- Expansion valve
- Receiver
- „Sanden“ or „Zexel / Valeo“ air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3
Audi A3	From 08.96 onwards	135 +/-15	135+/-15
Audi TT	From 10.98 onwards	135 +/-15	135+/-15

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *Exclusive use was made at the start of production of „Sanden“ air conditioner compressors. With effect from Model Year 1999, use has also been made of „Zexel / Valeo“ air conditioner compressors ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

9.2.6 Capacities for Audi A3 (8P_) 2004 ►

Note

Applies to the Audi A3, Audi A3 Sportback and Audi A3 Cabriolet.

Characteristics of refrigerant circuit:

- Expansion valve
- Receiver
- Air conditioner compressor from various manufacturers with air conditioner compressor regulating valve -N280- (no magnetic clutch) ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3	Differing characteristics of this refrigerant circuit
Audi A3	From 05.03 to 10.03	180 + / - 10	180 + / - 10	• „Denso“ air conditioner compressor of „7 SEU 16“ type
	From 10.03 onwards	120 + / - 10	120 + / - 10	• „Zexel / Valeo“ air conditioner compressor
		110 + / - 10	110 + / - 10	• „Sanden“ air conditioner compressor
		140 + / - 10	140 + / - 10	„Denso“ air conditioner compressor of „7 SEU 17“ type
	From 06.07 onwards	90 + / - 10	90 + / - 10	• „Denso“ air conditioner compressor of „6 SEU 14“ type
	From 08.07 onwards	110 + / - 10	110 + / - 10	• „Delphi“ air conditioner compressor

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted* *⇒ page 136* *.*
- *Different air conditioner compressors are fitted depending on the production period and engine.*
- *At the start of production, exclusive use was made of air conditioner compressors of type „7 SEU 16“ from „Denso“ (e.g. air conditioner compressor with part no. 1K0 820 803 up to index „D“). In Model Year 2004 (as of approx. 10.03), a gradual change was made to a different type of „Denso“ compressor („7 SEU 17“ e.g. air conditioner compressor with part no. 1K0 820 803 as of index „E“).*

- *With effect from Model Year 2004 (as of approx. 10.03), „Zexel / Valeo“ (type „DSC17E“) and „Sanden“ (type „PXE16“) air conditioner compressors are also gradually being introduced depending on the engine ⇒ Electronic parts catalogue .*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*
- *With effect from Model Year 2008, „Denso“ (type „6 SEU 14“) and „Delphi“ air condtioner compressors were gradually introduced depending on the engine ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .*
- *This air conditioner compressor is available as a replacement part with different oil capacities and attention must therefore be paid to the oil quantity in the air conditioner compressor as well as the exact part number ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*
- *The different oil quantities in the air conditioner compressor may result from the design of the air conditioner compressor (with or without oil separator at high-pressure connection) or, in the case of identical air conditioner compressors, from the design of the refrigerant circuit. Attention is to be paid to these oil quantities. Too much oil in the circuit results in higher pressures and reduced system cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor.*
- *The air conditioner compressor may have been fitted at the factory with a rating plate indicating the part number and the quantity of refrigerant oil in the air conditioner compressor.*

9.2.7 Capacities for Audi TT (8J_) 2007 ►

Characteristics of refrigerant circuit:

- Expansion valve
- Receiver
- „Denso“ or „Sanden“ air conditioner compressor with air conditioner compressor regulating valve -N280- (no magnetic clutch) ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3	Differing characteristics of this refrigerant circuit
Audi TT	From 08.06 onwards	90 + / - 10	90 + / - 10	• „Denso“ air conditioner compressor of „6 SEU 14“ type
		110 + / - 10	110 + / - 10	• „Sanden“ air conditioner compressor

Note

- *The replacement air conditioner compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *At the start of production, exclusive use was made of air conditioner compressors of type „6 SEU 14“ manufactured by „Denso“. This air conditioner compressor has no magnetic clutch (it is constantly driven by the engine). Different makes of air conditioner compressor may also be fitted at a later date depending on the engine ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .*
- *As of Model Year 2008, air conditioner compressors manufactured by „Sanden“ (type „PXE16“) were also gradually introduced for certain engines. This air conditioner compressor has no magnetic clutch (it is constantly driven by the engine) ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 .*
- *This air conditioner compressor is available as a replacement part with different oil capacities and attention must therefore be paid to the oil quantity in the air conditioner compressor as well as the exact part number ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*
- *The different oil quantities in the air conditioner compressor may result from the design of the air conditioner compressor (with or without oil separator at high-pressure connection) or, in the case of identical air conditioner compressors, from the design of the refrigerant circuit. Attention is to be paid to these oil quantities. Too much oil in the circuit results in higher pressures and reduced system cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor.*
- *The air conditioner compressor may have been fitted at the factory with a rating plate indicating the part number and the quantity of refrigerant oil in the air conditioner compressor.*

9.2.8 Capacities for Audi 80 (8A_ / 8C_), Audi Coupé (8B_), Audi Cabriolet (8G_) ► 2002

Characteristics of refrigerant circuit:

- Restrictor (not coloured).
- Reservoir
- „Zexel / Valeo“ air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3
Audi 80 Audi Coupé Audi Cabriolet	From 10.92 onwards	250 + 50	250 + 50

Note

- *The replacement compressor contains the full quantity of oil intended for the circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

9.2.9 Capacities for Audi A4 (8D_) 1995 ►

Characteristics of refrigerant circuit:

- Restrictor
- Reservoir
- „Denso“ or „Zexel / Valeo“ air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3
Audi A4	From 11.94 onwards	250 + 50	250 + 50

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *The Audi A4 is fitted with different air conditioner compressors depending on the engine and production period ⇒ Heating, air conditioning; Rep. gr. 87 and ⇒ Electronic parts catalogue .*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

9.2.10 Capacities for Audi A4 (8E_) 2001 ►, Audi A4 Cabriolet (8H_) 2003 ►

Characteristics of refrigerant circuit:

- Restrictor
- Reservoir
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- (no magnetic clutch) ⇒ Air

conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3	Differing characteristics of this refrigerant circuit
Audi A4 Audi RS4	From 11.00 to 01.04 • All	180 + / - 10	180 + / - 10	• Air conditioner compressor type „6 SEU 12“ „6 SEU 14“ „7 SEU 16“ or „7 SEU 17“ (refer to notes below)
	From 01.04 onwards • All except 8-cyl. engine	120 + / - 10	120 + / - 10	• Air conditioner compressor type „6 SEU 14“ or „7 SEU 17“ (refer to notes below)
	From 01.04 onwards • 8-cyl. engine only	130 + / - 10	130 + / - 10	• Air conditioner compressor type „7 SEU 17“ (refer to notes below)

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted* *⇒ page 136* *.*
- *The Audi A4 is fitted with different air conditioner compressors depending on the engine and production period. As replacement air conditioner compressors of this type are supplied with different oil capacities, the exact part no. must be heeded ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *At the start of production, the compressor types in the first line of the table were supplied with a refrigerant oil quantity of 180 cm^3. These air conditioner compressors can be recognised from the index of the part number (8E0 260 805 with one index or with double index up to „AH“). In Model Year 2004 (as of approx. 01.04), a gradual change was made to other types of compressor with a refrigerant oil quantity of 120 cm^3 or 130 cm^3. These air conditioner compressors can be recognised from the index of the part number 8E0 260 805 (with double index as of „ AJ“) or 4F0 260 805 (and index „E“ for vehicles with 8-cyl. engine) ⇒ Electronic parts catalogue .*
- *The different oil quantities in the air conditioner compressor may result from the design of the air conditioner compressor (with or without oil separator at high-pressure connection) or, in the case of identical air conditioner compressors, from the design of the refrigerant circuit. Attention is to be paid to these oil quantities. Too much oil in the circuit results in higher pressures and reduced system cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor.*
- *The air conditioner compressor may have been fitted at the factory with a rating plate indicating the part number and the quantity of refrigerant oil in the air conditioner compressor.*

9.2.11 Capacities for Audi A4 (8K_) 2008 ►, Audi A5 Coupé and Sportback (8T_) 2008 ►, Audi Q5 (8R_) 2008 ►, Audi A5 Cabriolet (8F_) 2009 ►

Characteristics of refrigerant circuit:

- Expansion valve
- Receiver
- Refrigerant pipe with internal heat exchanger.
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3	Differing characteristics of this refrigerant circuit
Audi A4	From 05.07 onwards	150 + / - 10	150 + / - 10	• „Denso“ air conditioner compressor of „6 SEU 14“ and „7 SEU 17“ type
Audi A5 Coupé and Sportback	From 05.07 onwards	150 + / - 10	150 + / - 10	• „Denso“ air conditioner compressor of „6 SEU 14“ and „7 SEU 17“ type
Audi Q5	From 09.08 onwards	150 + / - 10	150 + / - 10	• „Denso“ air conditioner compressor of „6 SEU 14“ and „7 SEU 17“ type
Audi A5 Cabriolet	From 03.09 onwards	150 + /- 10	150 + / - 10	• „Denso“ air conditioner compressor of „6 SEU 14“ and „7 SEU 17“ type
Audi RS 5	03.10 onwards	150 + /- 10	150 + / - 10	• „Denso“ air conditioner compressor „7 SEU 17“

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *The air conditioner compressors fitted at the start of production are manufactured by „Denso“ (type „6 SEU 14“) for vehicles with 4 and 6-cyl. engine and type „7 SEU 17“ for vehicles with 8-cyl. engine); this air conditioner compressor has no magnetic clutch (it is constantly driven by the engine). Different makes of air conditioner compressor may also be fitted at a later date depending on the engine ⇒ Electronic parts catalogue and ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *This air conditioner compressor is available as a replacement part with different oil capacities and attention must therefore be paid to the oil quantity in the air conditioner compressor as well as to the exact part number ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *The different oil quantities in the air conditioner compressor may result from the design of the air conditioner compressor (with or without oil separator at high-pressure connection) or, in the case of identical air conditioner compressors, from the design of the refrigerant circuit. Attention is to be paid to these oil quantities. Too much oil in the circuit results in higher pressures and reduced system cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor.*
- *The air conditioner compressor may have been fitted at the factory with a rating plate indicating the part number and the quantity of refrigerant oil in the air conditioner compressor.*

9.2.12 Capacities for Audi 100 / Audi A6 (4A_) ► 1998

Characteristics of refrigerant circuit:

- Restrictor
- Reservoir
- „Denso“ or „Zexel / Valeo“ air conditioner compressor ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3
Audi 100 / Audi A6	From 10.92 to 03.97	250 + 50	250 + 50

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *The Audi 100 / Audi A6 features different air conditioner compressors depending on the engine and production period. Exclusive use was made at the start of production of „Zexel / Valeo“ air conditioner compressors. As of Model Year 1996, „Denso“ air conditioner compressors were gradually introduced for vehicles with 6-cylinder engines ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

9.2.13 Capacities for Audi A6 (4B_) 1998 ► and Audi allroad 2005 ►

Characteristics of refrigerant circuit:

- Restrictor
- Reservoir
- „Denso“ or „Zexel / Valeo“ air conditioner compressor with air conditioning system magnetic clutch -N25- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3	Differing characteristics of this refrigerant circuit
Audi A6/Audi allroad • 4-cyl. petrol engine except 2.0 l • 6-cyl. petrol engine except 3.0 l	From 04.97 onwards All	250 + 50	250 + 50	• Refer to notes below.
Audi A6/Audi allroad • 4-cyl. diesel engine • 6-cyl. diesel engine (see notes for Audi allroad)	From 04.97 to 05.01	250 + 50	250 + 50	• Refer to notes below.
Audi A6 • 8-cyl. engine (with toothed belt camshaft drive)	From 04.97 onwards All	250 + 50	250 + 50	• Refer to notes below.

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *The Audi A6 is fitted with different air conditioner compressors depending on the engine and production period.*
- *As of Model Year 2002, the Audi A6 features air conditioner compressors with a magnetic clutch or regulating valve (different oil quantities) depending on the engine. This change is being introduced gradually for the Audi allroad with 6-cyl. diesel engine in Model Year 2003 ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

Characteristics of refrigerant circuit:

- Restrictor
- Reservoir
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue
-

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3	Differing characteristics of this refrigerant circuit
Audi A6 • 4-cyl. petrol engine 2.0 l • 6-cyl. petrol engine 3.0 l	All	220 + 20	220 + 20	Air conditioner compressor type „6 SEU 12“ or „7 SEU 16“ (refer to notes below)
Audi A6/Audi allroad • 4-cyl. diesel engine • 6-cyl. diesel engine (see notes for Audi allroad)	From 05.01 onwards	245 + 20	245 + 20	Air conditioner compressor type „6 SEU 12“ or „7 SEU 16“ (refer to notes below)
Audi allroad • 8-cyl. engine (with chain-driven camshaft)	All	220 + 20	220 + 20	Air conditioner compressor type „7 SEU 17“ (refer to notes below)

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *The Audi A6 is fitted with different air conditioner compressors depending on the engine and production period.*
- *As of Model Year 2002, the Audi A6 features air conditioner compressors with a magnetic clutch or regulating valve (different oil quantities) depending on the engine. This change is being introduced gradually for the Audi allroad with 6-cyl. diesel engine in Model Year 2003.*
- *As the replacement air conditioner compressor with air conditioner compressor regulating valve -N280- is supplied with different oil capacities, the exact part number must be heeded ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *The different oil quantities in the air conditioner compressor may result from the design of the air conditioner compressor (with or without oil separator at high-pressure connection) or, in the case of identical air conditioner compressors, from the design of the refrigerant circuit. Attention is to be paid to these oil quantities. Too much oil in the circuit results in higher pressures and reduced system cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor.*
- *The air conditioner compressor may have been fitted at the factory with a rating plate indicating the part number and the quantity of refrigerant oil in the air conditioner compressor.*

9.2.14 Capacities for Audi A6 (4F_) 2005 ►

Note

Also applies to the Audi S6 and Audi RS 6.

Characteristics of refrigerant circuit:

- Restrictor
- Reservoir
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3
Audi A6/S6	From 04.04 onwards	130 + / - 10	130 + / - 10
Audi RS6	From 05.08 onwards	130 + / - 10	Depending on the version of the air conditioner compressor (refer to note below) ◆ 130 + / - 10

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted.*
- *The Audi A6 is fitted with different air conditioner compressors depending on the engine and production period.*
- *As there are different versions of this type of replacement air conditioner compressor, the exact part no. must be heeded ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *The air conditioner compressor may have been fitted at the factory with a rating plate indicating the part number and the quantity of refrigerant oil in the air conditioner compressor.*
- *On account of the different test bench procedure for this engine, the 10-cyl. TFSI engine (Audi RS 6) is fitted at the factory with an air conditioner compressor with a smaller quantity of refrigerant oil (70 $^{+}$ / - 10 cm^3) than for the 10-cyl. FSI engine (Audi S6) and the other engines (130 $^{+}$ / - 10 cm^3) (at present, the air conditioner compressors on the 10-cyl. FSI and the 10-cyl. TFSI only differ in terms of the part number and the quantity of refrigerant oil; refer also to the air conditioner compressor rating plate). To adjust the total quantity of oil in the refrigerant circuit at the factory, the missing amount of oil in the air conditioner compressor (60 $^{+}$ / - 10 cm^3) with the 10-cyl. TFSI engine (Audi RS 6) is added at a different point in the refrigerant circuit. This is not necessary when performing service work, as replacement air conditioner compressors are only supplied with the original quantity of oil (130 $^{+}$ / - 10 cm^3) (would only be required as part of service work if a new air conditioner compressor with the smaller quantity of oil were to be installed) ⇒ Electronic parts catalogue .*

9.2.15 Capacities for Audi A7 (4G_) 2011 ➤

Characteristics of refrigerant circuit:

- Expansion valve
- Receiver
- Refrigerant line with internal heat exchanger
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3	Differing characteristics of this refrigerant circuit
Audi A7	10.10 onwards	120 $^{+}$ / - 10	120 $^{+}$ / - 10	• „Denso“ air conditioner compressor of „6 SEU 14“ type with oil separator

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *The air conditioner compressors fitted at the start of production are manufactured by „Denso“ (type „6 SEU 14“). Different makes of air conditioner compressor or another type of compressor may also be fitted at a later date ⇒ Electronic parts catalogue and ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual).*
- *This air conditioner compressor is available as a replacement part with different oil capacities and attention must therefore be paid to the oil quantity in the air conditioner compressor as well as to the exact part number ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *The different oil quantities in the air conditioner compressor may result from the design of the air conditioner compressor (with or without oil separator at high-pressure connection) or, in the case of identical air conditioner compressors, from the design of the refrigerant circuit. Attention is to be paid to these oil quantities. Too much oil in the circuit results in higher pressures and reduced system cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor.*
- *The air conditioner compressor may have been fitted at the factory with a rating plate indicating the part number and the quantity of refrigerant oil in the air conditioner compressor.*

9.2.16 Capacities for Audi V8 (4C_) ➢ 1994

Characteristics of refrigerant circuit:

- Restrictor (not coloured).
- Reservoir
- Air conditioner compressor from „Zexel / Valeo“ ⇒ Heating, air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3
Audi V8	From 10.92 to 10.93	250 + 50	250 + 50

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

9.2.17 Capacities for Audi A8 (4D_) 1994 ►

Characteristics of refrigerant circuit:

- Restrictor
- Reservoir
- „Denso“ or „Zexel / Valeo“ air conditioner compressor ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3
Audi A8	From 05.94 onwards	250 + 50	250 + 50

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *Exclusive use was made at the start of production of „Zexel / Valeo“ air conditioner compressors. As of Model Year 1996, production was gradually switched to „Denso“ air conditioner compressors ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

9.2.18 Capacities for Audi A8 (4E_) 2003 ►

Characteristics of refrigerant circuit:

- Restrictor
- Reservoir
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3	Differing characteristics of this refrigerant circuit
Audi A8 • 8-cyl. petrol engine with 3.7 l or 4.2 l (except FSI)	From 10.02 onwards All	200^{+} / - 10	200^{+} / - 10	Air conditioner compressor type „7 SEU 16“ (refer to notes below)
• 6 and 12-cyl. petrol engine • 6 and 8-cyl. diesel engine	From 10.02 to 01.04	200^{+}/ - 10	200^{+}/ - 10	Air conditioner compressor type „6 SEU 14“, „7 SEU 16“ or „7 SEU 17“ (refer to notes below)

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3	Differing characteristics of this refrigerant circuit
• 6, 10 and 12-cyl. petrol engine • 6 and 8-cyl. diesel engine • 8-cyl. 4.2 l petrol engine (FSI only)	From 01.04 onwards	$150^{+}/_{-}10$	$150^{+}/_{-}10$	Air conditioner compressor type „6 SEU 14“ or „7 SEU 17“ (refer to notes below)

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted ⇒ page 136 .*
- *The Audi A8 is fitted with different air conditioner compressors depending on the engine and production period.*
- *As replacement air conditioner compressors of this type are supplied with different oil capacities, the exact part number must be heeded ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- *At the start of production, the compressor types in the first two lines of the table were supplied with a refrigerant oil quantity of 200 cm^3. These air conditioner compressors can be recognised from the index of the part number (4E0 260 805 with index „C“, „D“, „E“, „F“, „J“, „L“ or „S“). In Model Year 2004 (as of approx. 01.04), a gradual change was made to other types of compressor with a refrigerant oil quantity of 150 cm^3. These air conditioner compressors can be recognised from the index of the part number (4E0 260 805 with index „G“, „H“, „T“, „M“, „N“, „Q“ or double index e.g. „ AB“) ⇒ Electronic parts catalogue .*
- *The different oil quantities in the air conditioner compressor may result from the design of the air conditioner compressor (with or without oil separator at high-pressure connection) or, in the case of identical air conditioner compressors, from the design of the refrigerant circuit. Attention is to be paid to these oil quantities. Too much oil in the circuit results in higher pressures and reduced system cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor.*
- *The air conditioner compressor may have been fitted at the factory with a rating plate indicating the part number and the quantity of refrigerant oil in the air conditioner compressor.*

9.2.19 Capacities for Audi A8 (4H_) 2010 ►

Characteristics of refrigerant circuit:

- Expansion valve
- With one or two evaporator(s) depending on equipment
- Refrigerant line with internal heat exchanger
- Dryer cartridge in receiver at condenser

- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3	Differing characteristics of this refrigerant circuit
Audi A8	03.10 onwards			
♦ Vehicle with one evaporator		$130^{+}/_{-}10$	♦ $130^{+}/_{-}10$	• One evaporator
♦ Vehicle with two evaporators		$130^{+}/_{-}10$		• Two evaporators (refer to notes below)

Note

- *The replacement compressor contains a certain quantity of refrigerant oil (at present 130 + / - 10 cm^3). This quantity of refrigerant oil currently corresponds to the quantity of oil specified for this refrigerant circuit on vehicles with one and two evaporators. At present, vehicles with two evaporators are filled with the same amount of oil as vehicles with one evaporator. On account of the longer refrigerant lines and the second evaporator, no greater quantity of refrigerant oil is currently required in the refrigerant circuit on this vehicle. With this vehicle, the design of the refrigerant circuit means that only a small proportion of the refrigerant oil passes into the refrigerant lines to the second evaporator and into the second evaporator during air conditioner operation. If the air conditioner compressor is replaced after cleaning the refrigerant circuit, it is therefore not necessary on vehicles with two evaporators to pour additional refrigerant oil into the refrigerant circuit. If the air conditioner compressor is replaced without having to clean the refrigerant circuit, the quantity of refrigerant oil in the new air conditioner compressor to be fitted should be adjusted in line with the quantity of oil poured out of the old compressor* *⇒ page 136* *.*
- *The different oil quantities in the air conditioner compressor may result from the design of the air conditioner compressor (with or without oil separator at high-pressure connection) or, in the case of identical air conditioner compressors, from the design of the refrigerant circuit. Attention is to be paid to these oil quantities. Too much oil in the circuit results in higher pressures and reduced system cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor.*
- *As replacement air conditioner compressors are supplied with different oil capacities, the exact part number must be heeded ⇒ Electronic parts catalogue .*
- *Too much oil in the circuit results in higher pressures and reduced air conditioner cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor. The specified refrigerant oil quantities are therefore to be heeded.*
- *The air conditioner compressor may have been fitted at the factory with a rating plate indicating the part number and the quantity of refrigerant oil in the air conditioner compressor.*

9.2.20 Capacities for Audi Q7 (4L_) 2006 ➢

Characteristics of refrigerant circuit:

- Expansion valve
- With one or two evaporator(s) depending on equipment
- Dryer cartridge in receiver at condenser
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3	Differing characteristics of this refrigerant circuit
Audi Q7	From 02.06 onwards			
♦ Vehicle with one evaporator		$145^{+}/_{-}15$	♦ $150^{+}/_{-}10$ (air conditioner compressor for a vehicle with an 8-cyl. engine) ♦ $140^{+}/_{-}10$ (air conditioner compressor for a vehicle with a 6-cyl. engine)	• One evaporator • Air conditioner compressor type „7 SEU 16“ (refer to notes below)
♦ Vehicle with two evaporators		$245^{+}/_{-}15$		• Two evaporators (refer to notes below)

Note

- *The replacement compressor contains a certain quantity of refrigerant oil (at present 140 or 150 + / - 10 cm^3, depending on the air conditioner compressor). This quantity of refrigerant oil corresponds to the quantity of oil specified for this refrigerant circuit on vehicles with one evaporator. On account of the greater refrigerant pipe length and the second evaporator, vehicles with two evaporators require more refrigerant oil in the refrigerant circuit (currently an additional 100 cm^3). If the air conditioner compressor is replaced after cleaning the refrigerant circuit, this quantity of refrigerant oil therefore has to be added to the refrigerant circuit on vehicles with two evaporators (e.g. poured into open pipes or component connections). If the air conditioner compressor is replaced without having to clean the refrigerant circuit, the quantity of refrigerant oil in the new air conditioner compressor to be fitted should be adjusted in line with the quantity of oil poured out of the old compressor* *⇒ page 136* *.*

- *As replacement air conditioner compressors are supplied with different oil capacities, the exact part no. must be heeded ⇒ Electronic parts catalogue .*
- *The different oil quantities in the air conditioner compressor may result from the design of the air conditioner compressor (with or without oil separator at high-pressure connection) or, in the case of identical air conditioner compressors, from the design of the refrigerant circuit. Attention is to be paid to these oil quantities. Too much oil in the circuit results in higher pressures and reduced system cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor.*
- *Too much oil in the circuit results in higher pressures and reduced air conditioner cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor. The specified refrigerant oil quantities are therefore to be heeded.*
- *The air conditioner compressor may have been fitted at the factory with a rating plate indicating the part number and the quantity of refrigerant oil in the air conditioner compressor.*

9.2.21 Capacities for Audi R8 (42_) 2008 ►

Characteristics of refrigerant circuit:

- Restrictor
- Reservoir
- Two series-connected condensers
- „Denso“ air conditioner compressor with air conditioner compressor regulating valve -N280- ⇒ Air conditioning; Rep. gr. 87 (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue

Vehicle model	Production period	Total quantity of oil in refrigerant circuit in cm^3	Quantity of refrigerant oil in replacement compressor in cm^3	Differing characteristics of this refrigerant circuit
Audi R8	From 03.07 onwards	150 + /- 10	150+ / - 10	Air conditioner compressor type „7 SEU 17“

Note

- *The replacement compressor contains the full quantity of oil intended for the refrigerant circuit. On replacement, the quantity of oil in the air conditioner compressor is therefore to be adjusted* *⇒ page 136* *.*
- *As replacement air conditioner compressors are supplied with different oil capacities, the exact part no. must be heeded ⇒ Electronic parts catalogue .*
- *The different oil quantities in the air conditioner compressor may result from the design of the air conditioner compressor (with or without oil separator at high-pressure connection) or, in the case of identical air conditioner compressors, from the design of the refrigerant circuit. Attention is to be paid to these oil quantities. Too much oil in the circuit results in higher pressures and reduced system cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor.*
- *Too much oil in the circuit results in higher pressures and reduced air conditioner cooling output. Too little oil may lead to lubrication problems in the air conditioner compressor. The specified refrigerant oil quantities are therefore to be heeded.*
- *The air conditioner compressor may have been fitted at the factory with a rating plate indicating the part number and the quantity of refrigerant oil in the air conditioner compressor.*

10 Test equipment and tools

- List of testers, tools and materials ⇒ page 189 .
- Tools and materials available from regional sales centre or importer ⇒ page 191 .
- Commercially available tools and materials ⇒ page 194 .
- Improvised tools ⇒ page 195 .

10.1 List of testers, tools and materials

Note

This list outlines the testers, tools and materials required for expert refrigerant circuit repair work.

- Tools and materials available from regional sales centre or importer ⇒ page 189 .
- Commercially available tools and materials ⇒ page 190 .
- Improvised tools ⇒ page 191 .

10.1.1 Tools and materials available from regional sales centre or importer

Designation	Page
Air conditioner service station with flushing kit (for currently available air conditioner service stations, refer to ⇒ V.A.G Workshop equipment catalogue) – With integrated program for flushing refrigerant circuit with refrigerant R134a as well as the corresponding flushing kit	Refer to illustration and ⇒ V.A.G Workshop equipment catalogue
Flushing kit for refrigerant circuits (currently available flushing kits) ⇒ V.A.G Workshop equipment catalogue – For flushing the refrigerant circuit with refrigerant R134a; also for use with older air conditioner service stations with a vessel for at least 10 kg of refrigerant R134a (flushing must be performed manually)	⇒ V.A.G Workshop equipment catalogue
Adapter set for refrigerant circuits -VAS 6338/1- – For connecting air conditioner service station to refrigerant circuit and for bridging certain removed components when flushing	⇒ V.A.G Workshop equipment catalogue
Leak detector V.A.G 1796	Refer to illustration
Puller for magnetic clutch (Zexel / Valeo air conditioner compressor) V.A.G 1719	Refer to illustration
Adapter set for refrigerant circuit R134a V.A.G 1785/1-10 – For connecting air conditioner service station to refrigerant circuit and for bridging certain components on flushing and blowing out	Refer to illustration
Valve adapter V.A.G 1785/9 and V.A.G 1785/10	Refer to illustration
Adapter set with service connection V.A.G 1786	Refer to illustration
Combined fine filter unit for compressed-air system (oil, dirt and water separator as used for painting facilities) ⇒ Workshop equipment catalogue	Refer to illustration
O-rings ⇒ Electronic parts catalogue	Refer to illustration
Refrigerant oil ⇒ Electronic parts catalogue	Refer to illustration

Designation	Page
Leak detection system VAS 6201 comprising: ♦ Hand pump with low-pressure service hose, service coupling and non-return valve VAS 6201/1 ♦ Cartridge VAS 6201/2 ♦ Cleaning solution VAS 6201/3 ♦ UV leak detection lamp VAS 6201/4 ♦ Replacement bulb for leak detection lamp VAS 6201/5 ♦ Eye protection VAS 6201/6 ♦ Sticker VAS 6201/7 ♦ Protective gloves VAS 6201/9 ♦ Filler tube VAS 6201/8 ♦ System case VAS 6201/10	Refer to illustration
Adapter set for service connections	Refer to illustration and ⇒ V.A.G Workshop equipment catalogue
Release tools for air conditioner pipes -T40149/-	⇒ V.A.G Workshop equipment catalogue
Disassembly tool for refrigerant line quick-release couplings -T40232-	⇒ V.A.G Workshop Equipment catalogue

10.1.2 Commercially available tools and materials

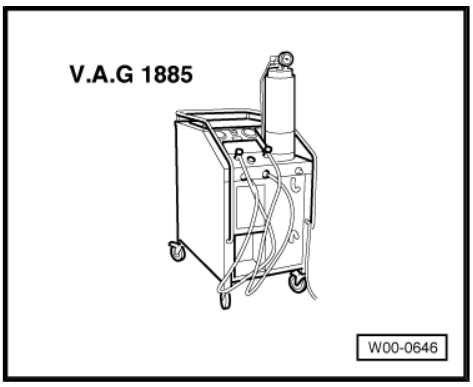
Designation	Page
Fin comb	Refer to illustration
Charging hoses 5/8" - 18 UNF with valve opener	Refer to illustration
Connection piece for refrigerant cylinder and seal with quick-release coupling connection or threaded connection 5/8" - 18 UNF	Refer to illustration
Valve caps 5/8"-18 UNF	Refer to illustration
Pressure gauge set with pressure reducer for nitrogen	Refer to illustration
Quick-release coupling adapter for service connections (2x included in scope of delivery of air conditioner service station)	Refer to illustration
Open-ring spanner, size according to bolted joints at refrigerant pipes	Not illustrated
Valve opener for charging hoses	Not illustrated
Connecting nipple for conical seal 5/8"-18 UNF	Not illustrated
Compressed-air gun with rubber end piece	Not illustrated
Valve opener for Schrader valve	Not illustrated
Hand shut-off valve 5/8"-18 UNF	Not illustrated
Recycling container for refrigerant R134a	Not illustrated
Digital thermometer	Not illustrated
Protective gloves	Not illustrated
Safety goggles	Not illustrated
Refrigerant R134a with cylinder (capacity as required)	Not illustrated

10.1.3 Improvised tools

Designation	Page
Filler hose with connection to compressed-air system for workshop	Not illustrated

10.2 Tools and materials available from regional sales centre or importer

Service station / air conditioner service station (this illustration shows V.A.G 1885 for example; for currently available air conditioner service stations, refer to ⇒ V.A.G workshop equipment catalogue)

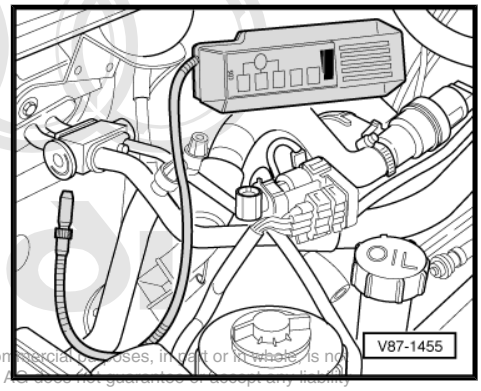


- The operations "testing, extraction (recycling), evacuation, flushing and charging" must be performed according to the relevant operating instructions.
- The filters and dryers fitted must be replaced at the latest at the end of the period of use specified in the operating instructions and each time the station is drained (have replacement filter to hand). Available from equipment manufacturer; refer to the operating instructions for the air conditioner service station.
- Air conditioner service stations not shown here can also be used ⇒ V.A.G Workshop equipment catalogue .
- Currently available air conditioner service stations are provided with a refrigerant circuit flushing program. The scope of delivery of these air conditioner service stations also includes the necessary flushing attachment ⇒ V.A.G workshop equipment catalogue .

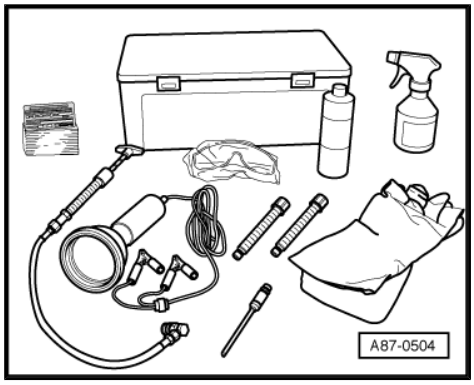
Note

- *This air conditioner service station incorporates the following familiar items: Charging cylinder, pressure gauge set, vacuum pump, shut-off valves and charging hoses.*
- *One quick-release coupling each (for service connections on high and low-pressure side) is included in the scope of delivery of this air conditioner service station.*
- *Depending on the version, a current vacuum display (LED) may appear after pressing the „Evacuation“ button again.*

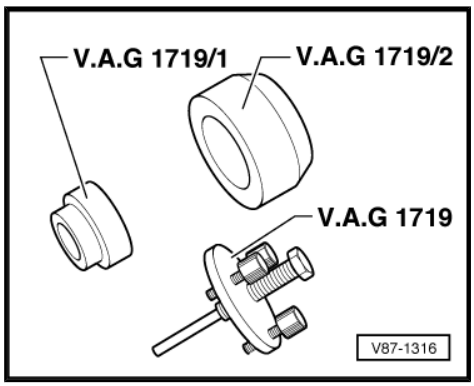
Leak detector V.A.G 1796



Leak detection system VAS 6201



Puller for magnetic clutch V.A.G 1719 (for „Zexel / Valeo“ air conditioner compressor)



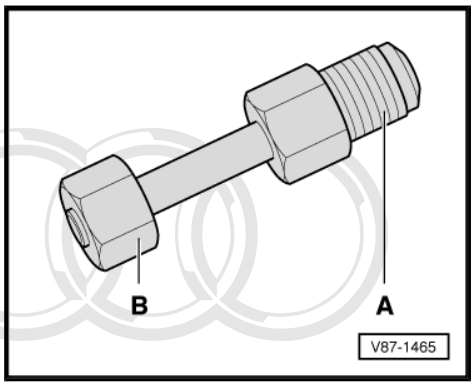
Adapter set for refrigerant circuit R134a V.A.G 1785/1-10

Adapter for cleaning refrigerant circuit (flush with refrigerant R134a) ⇒ page 59 or blow out with compressed air and nitrogen ⇒ page 55 .

A - 5/8"-18 UNF thread for conical seal

B - Union nut (for connection with O-ring) with thread

- M 18x1.5 V.A.G 1785/1
- M 20x1.5 V.A.G 1785/2
- M 24x1.5 V.A.G 1785/3
- M 28x1.5 V.A.G 1785/4

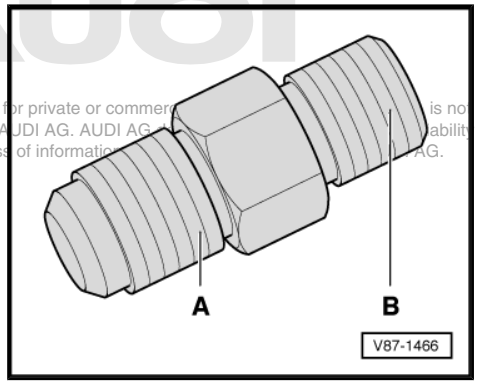


Adapter

A - 5/8"-18 UNF thread for conical seal

B - Threaded connection for O-ring

- M 18 x 1.5 V.A.G 1785/5
- M 20 x 1.5 V.A.G 1785/6
- M 24 x 1.5 V.A.G 1785/7
- M 28 x 1.5 V.A.G 1785/8

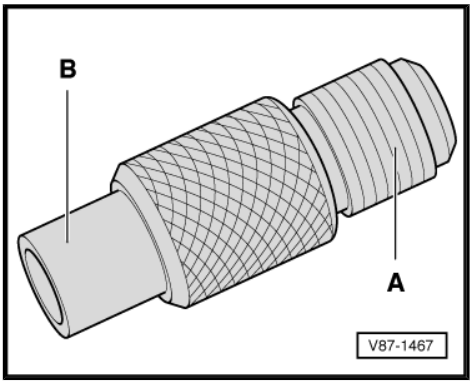


Valve adapter

A - 5/8"-18 UNF thread for conical seal

B - Internal thread with valve opener

- M 10 x 1.25 V.A.G 1785/9 (for connections with valve on high-pressure end)
- M 12 x 1.5 V.A.G 1785/10 (for connections on low-pressure end)



Note

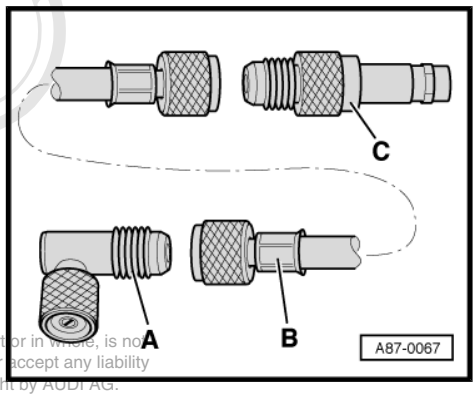
- *A Schrader valve is screwed into connection -A-.*
- *A valve opener must be installed in the charging hose connection.*
- *Various adapters from this adapter set are also included in the adapter set for refrigerant circuits -VAS 6338/1- .*

Adapter set for service connection V.A.G 1786

A - Adapter with union nut -V.A.G 1786/1- (only for connections with small valve core at low-pressure side)

B - Filler hose with union nut 5/8"-18 UNF(short version)

C - Adapter with service connection -V.A.G 1786/2-



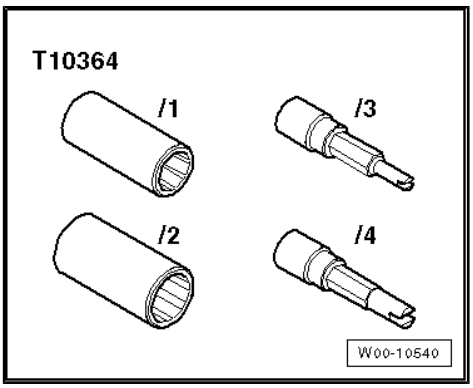
Note

- *For connections with a large valve insert (standard on „Zexel / Valeo“ compressors, gradual change to small valve insert as of 10.94), use is to be made of adapter V.A.G 1785/10 (remove valve from adapter V.A.G 1785/10 or install valve opener in charging hose -B-).*
- *The logo of the compressor manufacturer „Zexel“ affixed to the air conditioner compressor was switched as of year of production 2006 (when the manufacturer's name changed) from „Zexel“ to the new name „Valeo“.*

Socket -T10364-

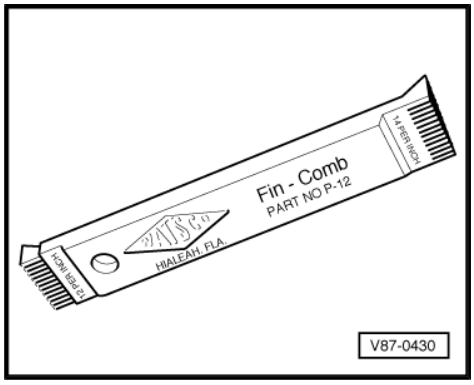
Note

For removing and installing service connections and valve cores with refrigerant circuit discharged.



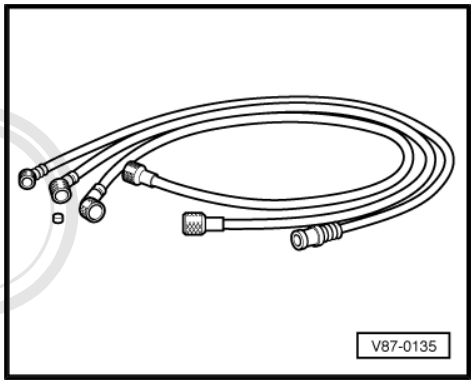
10.3 Commercially available tools and materials

Fin comb



Charging hoses

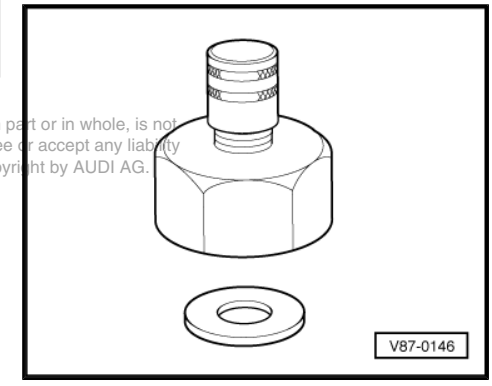
5/8"-18 UNF thread



Note

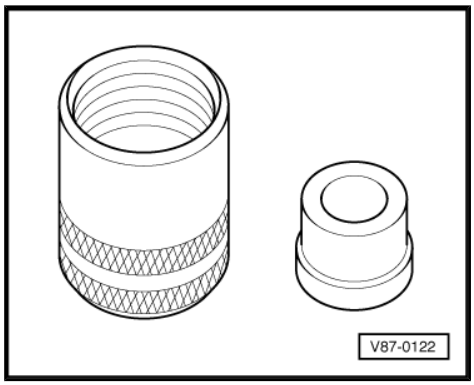
- *Use differently coloured charging hoses (1800 mm long).*
- *Have valve opener and spare seals to hand.*
- *A short filler hose is also included in the adapter set for refrigerant circuits -VAS 6338/1- .*

Connection piece for refrigerant cylinder with seal, quick-release coupling connection or threaded connection 5/8" - 18 UNF



Valve caps with spare seals (for 5/8"-18 UNF thread)

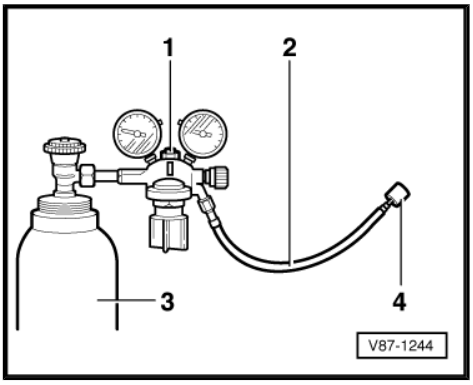
Seals can also be used for charging hoses.



Note

Valve caps with replacement seals are also included in the adapter set for refrigerant circuits -VAS 6338/1- .

Pressure gauge set with pressure reducer for nitrogen (maximum reducing pressure: 15 bar).



1 - Pressure gauge set

2 - Pressure hose (ID 5 mm, length 2 m)

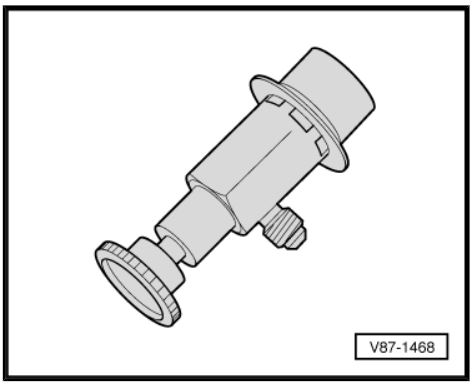
3 - Nitrogen

4 - Hose fitting

Note

For connection to adapter V.A.G 1785 with 5/8"-18 UNF thread

Quick-release coupling adapter for service connections



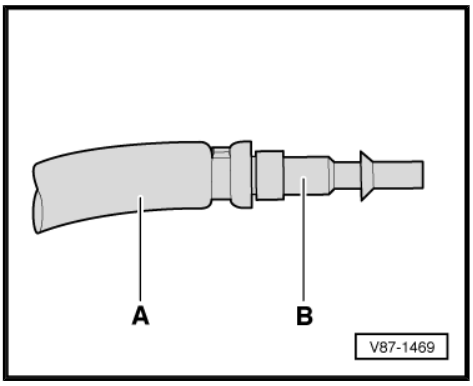
- High-pressure end with nominal size 16 mm
- Low-pressure end with nominal size 13 mm
- 2x release tool (Sharan)

Note

This quick-release coupling is included in the scope of delivery of the air conditioner service station.

10.4 Improvised tools

Filler hose with connection to compressed-air system for workshop



A - Filler hose 5/8" - 18 UNF** (version with large ID)

B - Connection for workshop compressed-air system ** (always use filter)