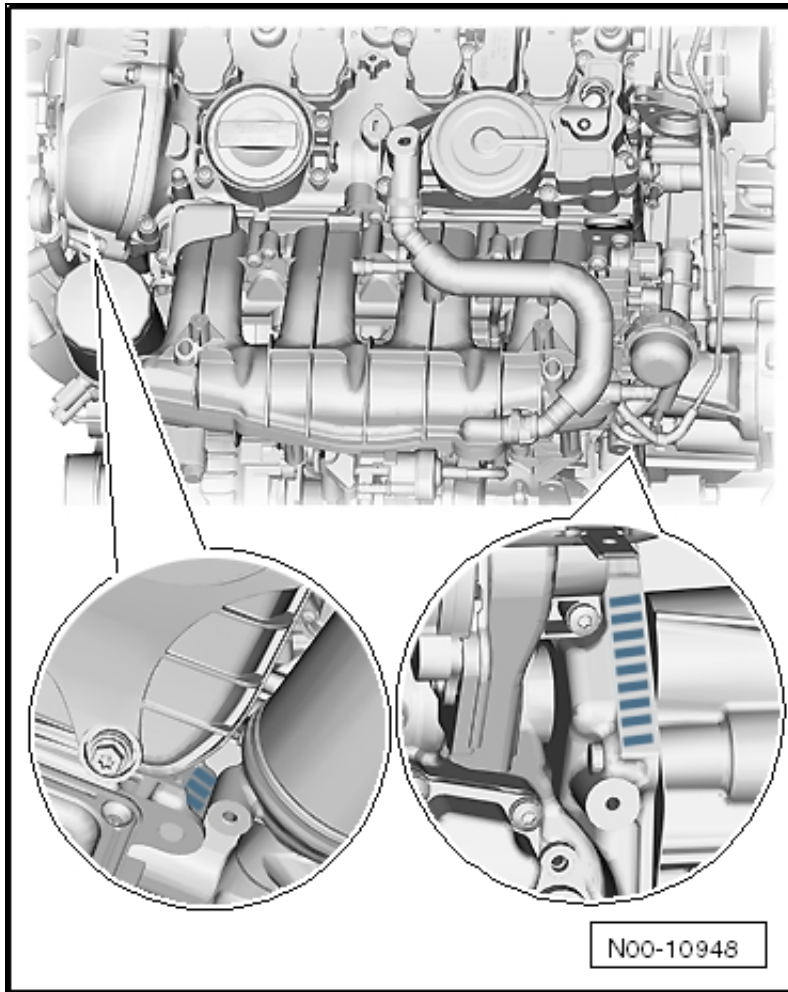


00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > ENGINE NUMBER >

The engine number ("engine code" and "serial number") are located at the engine to transmission joint.

Fig 1: Locating Engine Number ("Engine Code" And "Serial Number")



Courtesy of VOLKSWAGEN UNITED STATES, INC.

The engine code is also stamped on the cylinder block behind the oil filter.

Vehicles with Four Digit Engine Codes

Four digit engine codes beginning with the letter "C" are used. The first three digits describe the mechanical structure of the engine and are still stamped on the engine, as before. The fourth digit describes the engine output and torque and depends on the Engine Control Module (ECM). Four digit engine codes are found on the type plate and vehicle data label. It can also be read via the ECM.

NOTE:

For the vehicle data label location, refer to relevant Maintenance Procedures.

00 GENERAL, TECHNICAL DATA > SPECIFICATIONS > ENGINE DATA >

Code Letters		CBFA	CCTA
Manufactured from			
GTI (2008 through 2009)		from 03.08	from 03.08
Eos		from 05.08	from 05.08
Tiguan		---	from 01.08
Passat		from 03.08	from 03.08
CC		from 10.09	from 06.08
GTI (from MY 2010)		from 07.09	from 07.09
Emissions values		SULEV ⁽¹⁾	ULEV 2 ⁽²⁾
Displacement	Liter	2.0	2.0
Output	kW at RPM	147 at 5100	147 at 5100
Torque	Nm at RPM	280 at 1700	280 at 1700
Bore	diameter mm	82.5	82.5
Stroke	mm	92.8	92.8
Compression ratio		9.6:1	9.6:1
Research Octane Number (RON)		95	95
Injection system/ignition system		FSI	FSI
Ignition sequence		1-3-4-2	1-3-4-2
Turbocharger, Supercharger		Turbocharger	Turbocharger
Variable valve timing		yes	yes
Secondary Air Injection (AIR)		yes	no
Valves per cylinder		4	4
Oil pressure control		no	no
⁽¹⁾ SULEV = Super Ultra Low Emissions Vehicle			
⁽²⁾ ULEV = Ultra Low Emissions Vehicle			

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > A/C SYSTEM AND REFRIGERANT R134A, SAFETY PRECAUTIONS >



WARNING:

- *It is recommended to have an eye-flushing bottle available.*
- *If liquid refrigerant has come in contact with your skin and eyes, immediately flush with cool water for 15 minutes. Afterwards instill eye drops and consult a doctor immediately, even when the eyes are not hurting.*
- *The doctor must be informed that the injury was caused by refrigerant R134a. Should refrigerant come into contact with other parts of the body despite compliance with safety regulations, these must likewise be rinsed immediately for at least 15 minutes with cold water.*
- *Work on refrigerant system should only be performed in ventilated areas (workshops). Turn on the exhaust gas ventilation system*
- *Refrigerant must not be stored in low-lying areas such as cellars or in their entry ways or windowsills.*

- Do not attempt repair on filled air conditioning systems by soldering, brazing or welding. This applies also for welding and soldering work on the vehicle, in the event that parts of the A/C system may heat up. When performing paint work repairs, the temperature in the drying booth or preheating zone must not exceed 80°C (176°F).

Reason

Exposure to heat increases the pressure in the system, which could cause the pressure relief valve to open.

Corrective action

-- Discharge refrigerant circuit using service station.



NOTE:

Always replace damaged or leaking A/C system components. Do not attempt to repair them by

soldering, brazing or welding.

Refrigerant vessels (such as, charging cylinders of A/C service station) must never be subjected to excessive heat or exposed to direct sunlight.

Corrective action

-- Vessels must never be completely filled with liquid refrigerant. Without sufficient room for expansion (gas cushion), vessels will rupture with devastating effect in the event of an increase in temperature. Refer to REFRIGERANT R134A CHARACTERISTICS .

Refrigerant is never to be transferred to systems or vessels in which air is present.

Corrective action

-- Evacuate systems and vessels before charging with refrigerant.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > A/C SYSTEM, REPAIR INFORMATION >

WARNING:

When performing work on refrigerant circuit, observe all generally applicable safety precautions and pressure vessel regulations.

CAUTION:

Non-approved tools or materials such as leak sealing additives can cause damage or malfunctions in the system.

Only use tools and materials approved by the manufacturer.

The warranty is voided if non-approved tools or materials are used.

- An A/C system made for refrigerant R12 must not be filled with refrigerant R134a without making modifications to the refrigerant circuit. Refer to REFRIGERANT CIRCUIT, CONVERTING R12 TO R134A AND SERVICING .
- The refrigerant oils specifically developed for R134a and R12 refrigerant circuits are never to be mixed.
- Service stations which come in contact with the refrigerant are only to be used for the intended refrigerant.
- Components of R134a refrigerant circuits can be identified by their markings, green labels or design (such as different threads) to prevent interchanging with components designed for

refrigerant R12.

- A label indicating the refrigerant used is provided in the engine compartment on the lock carrier or in the plenum chamber.
- Different refrigerants are never to be mixed.



NOTE:

When working on the refrigerant circuit, always heed the information given in, see A/C SYSTEM AND REFRIGERANT R134A, SAFETY PRECAUTIONS and REFRIGERANT CIRCUIT, GENERAL PRECAUTIONS .

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 in, see SPECIAL TOOLS .
- Requires compliance with the basic instructions for use of leak detectors. Refer to REFRIGERANT CIRCUIT, FINDING LEAKS WITH ELECTRONIC LEAK DETECTOR VAG 1796 .
- Requires expert knowledge.



NOTE:

Releasing refrigerant into the environment is not permitted (punishable by law). Refer to LAWS AND REGULATIONS .

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > A/C SERVICE AND RECYCLING UNITS >

At this time, A/C service units for extracting, cleaning and filling refrigerant for motor vehicle A/C systems are available from various manufacturers.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > COMPONENT REPLACEMENT >



CAUTION:

- ***For instructions on how to handle refrigerant oil, refer to Volkswagen-Service Net, Handbook, Handbook Service Germany; 15. Environment Protection; further with Environmental Protection; 7 emission protection; refrigerant oil.***

- All components of the refrigerant circuit submitted for quality observation are always to be sealed (use original sealing caps of original part).
- To date, the original parts (compressor, reservoir, receiver, evaporator and condenser) have been filled with nitrogen gas. This charging stops gradually or the charging pressure is so low that gas does not escape noticeably when opening.
- On vehicles installed with a compressor with no A/C clutch, the engine is only to be started following complete assembly of the refrigerant circuit (compressor always in operation as well). Refer to REFRIGERANT CIRCUIT, GENERAL PRECAUTIONS .
- So that the compressor with A/C Compressor Regulator Valve -N280- (without A/C clutch) is not damaged when the refrigerant circuit is empty, it is equipped with a secured oil supply. This means that approximately 40 to 50 cm³ of refrigerant oil remains in the A/C compressor. Refer to REFRIGERANT CIRCUIT, GENERAL PRECAUTIONS .



NOTE:

As original parts are sometimes stored for lengthy periods and at different locations within the spare parts organization, it is entirely possible that gas will escape from some parts and not from others on initial opening (even in the case of identical original part numbers). Sealing caps at original part connections are therefore to be removed carefully and the nitrogen gas allowed to escape slowly.

The refrigerant circuit is equipped either with a restrictor and accumulator or with an expansion valve and receiver.

Seal open connections and pipes (to prevent absorption of moisture).

Always replace restrictor.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > NOT REPLACING RESERVOIR/FLUID RESERVOIR OR DRYER BAG/CARTRIDGE, CONDITIONS >

- After an accident when there is no damage on the reservoir/fluid reservoir.
- The repair was done quickly (not beyond the normal repair time) and no moisture has entered. The vehicle is not older than 5 years.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > REPLACING RESERVOIR/FLUID RESERVOIR OR DRYER CARTRIDGE, CONDITIONS >

- The refrigerant circuit was opened and the vehicle is older than 5 years.
- The refrigerant circuit has been opened for an indefinite period of time (slow leak).

- The repair exceeded the normal repair time and moisture has entered.
- Always replace the reservoir or dryer cartridge after flushing with compressed air, nitrogen or refrigerant R134a. Leave original parts in their packaging as long as possible to minimize the amount of moisture they absorb.
- The A/C compressor has locked up.
- The reservoir/fluid reservoir is damaged (accident).

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > COMPRESSOR REPLACEMENT >

-- After installing a new A/C compressor or fresh refrigerant oil has been filled into compressor (for example, after blowing through the A/C system), turn ribbed belt pulley of A/C compressor 10 rotations by hand before starting the engine. This prevents damage to the A/C compressor.

-- For 5 cylinder and 10 cylinder diesel engines, rotate A/C compressor 10 rotations by hand at overload protection. Then install A/C compressor. This prevents damage to the A/C compressor.

-- Start the engine with the A/C turned off (A/C clutch -N25- and A/C compressor regulator valve -N280- are not actuated).

-- Following engine idling speed stabilization, switch on A/C compressor and run it for at least 10 minutes at idling speed with maximum cooling output.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > EVAPORATOR, SPRAYING WITH PRESSURE CUP GUN AND SPRAY NOZZLE VAG 1538 >

Spray off the evaporator directly with Contra Sept using a spray nozzle (approximately 10 bar) Contra Sept neutralizes microbes and bacteria directly on the evaporator.

To make it possible to access the evaporator, some prework and different spray nozzles are needed, for example -V. A. G 1538/5-; -V. A. G 1538/6- or -V. A. G 1538/7-.

A vehicle-specific instruction booklet is included with the evaporator cleaning solution -D 600 100 A2-

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > EXTRACTION AND CHARGING SYSTEM SAFETY PRECAUTIONS >

- Make sure the shut-off valves are closed before connecting the charging system to the air conditioning system.
- Make sure the process is finished before disconnecting the charging system from the A/C system. This prevents any refrigerant from escaping 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 charging system to moisture or use it in a wet environment.
- Disconnect from power supply before performing service work on the charging system.
- Never use an extension cable on account of the fire hazard. If the use of an extension cable is unavoidable, the minimum cross-section should be 2.5 mm².
- In case of fire, remove external cylinder.

- Entrained oil from the air conditioning system drawn by the suction unit into the measurement vessel supplied is subsequently to be transferred to a sealed container as it contains a small quantity of refrigerant. It must not be released into the environment.
- Following shutdown, service station is to be secured to stop it rolling away.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > 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.

- Do not throw vessels.

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.

Valves may break off if cylinders are not properly transported. To protect the valves, cylinders are only to be transported with protective cap screwed on.

- Never store in the vicinity of radiators.

High temperatures may occur next to radiators. High temperatures are also accompanied by high pressures and the maximum permissible vessel pressure may be exceeded.

Temperature Warning

To avoid possible risk, pressure vessel regulations specify that vessels are not to be heated to in excess of 50°C (122°F).

Heating Warning

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

Empty Containers

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

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > HANDLING REFRIGERANT >



WARNING:

There is a danger of ice-up.

The refrigerant can then escape as a fluid or vapor.

Do not open containers, which store refrigerant.

Follow the instructions for the workplace. They should be displayed in the workplace.

If refrigerant vessels are opened, the contents may escape in liquid or vapor form. This process is intensified the higher the pressure in the vessel.

The pressure level is governed by two factors:

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

Protective Eyewear

Put on protective goggles. They prevent refrigerant getting into the eyes, as this could cause severe injury from exposure to cold.

Protective Gloves and Clothing

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

Fluid Refrigerant and Skin Precaution

The refrigerant draws heat for evaporation from the surrounding area. Even if this is the skin. This may cause extremely low temperatures. Local frost bite may result (boiling point of R134a: -26.5°C (-15.7°F) at ambient pressure).

Do Not Breathe In Refrigerant Vapor



NOTE:

If highly concentrated refrigerant vapor escapes, it mixes with the surrounding air and displaces the oxygen necessary for breathing.

Smoking Hazard

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 or soldering work on vehicles near the air conditioning system components, extract the refrigerant and remove the residue by flushing with compressed air and nitrogen.

The products of refrigerant decomposition due to the effect of heat are not only toxic, but may also have a highly corrosive effect on pipes and system components. They mainly take the form of hydrogen fluoride.

Pungent Odor

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

First Aid

- Following contact with eyes or mucous membranes, immediately rinse with copious amounts of

running water and consult an eye specialist.

- Following contact with the skin, immediately remove affected clothing and rinse skin with copious amounts of water.
- Following inhalation of highly concentrated refrigerant vapors, immediately take the affected person into the open air. Call a doctor. Administer oxygen in the event of breathing difficulties. If the affected person has difficulty breathing or cannot breathe, tip head back and perform mouth to mouth respiration.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > REFRIGERANT R134A >

Vehicle air conditioning systems make use of the vaporization and condensation process. In this case, one works with a substance which boils easily, designated as refrigerant.

The refrigerant employed is tetrafluoroethane R134a, which boils at -26.5°C (-15.7°F) at a vapor pressure of 1 bar.

Refrigerant R134a Environmental Information

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

Vehicles manufactured after 1992 have air conditioning systems that use refrigerant R134a. This refrigerant does not contain chlorine and does not deplete the ozone layer.

Refrigerant R12 was used through 1992. Due to its chlorine atoms, this CFC has a high potential for depleting the ozone layer as well as a tendency to increase the greenhouse effect.

Conversions are offered for existing systems filled with the ozone-depleting substance R12.

Refer to Repair Information for A/C systems with refrigerant R12. This repair information is only available in hard copy.

For environmental protection reasons, refrigerants must not be released into the atmosphere. For laws and regulations, refer to LAWS AND REGULATIONS .

Refrigerant R134a Physical Data

Chemical formula	$\text{CH}_2\text{F}-\text{CF}_3$ or $\text{CF}_3-\text{CH}_2\text{F}$
Chemical designation	Tetrafluoroethane
Boiling point at 1 bar	-26.5°C (-15.7°F)
Solidification point	-101.6°C (-150.88°F)
Critical temperature	100.6°C (213°F)
Critical pressure	40.56 bar (absolute)

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, for example, there is a layer of gas above the liquid.

As long as there is still gas present in the container next to the fluid, pressure is dependent on ambient temperature. Refer to REFRIGERANT R134A VAPOR PRESSURE TABLE .



NOTE:

*Different types of refrigerant are never to be mixed.
Only the refrigerant designated for the corresponding
A/C system may be used.*

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > REFRIGERANT R134A CHARACTERISTICS >

The vapor pressure curves of R134a and other refrigerants are sometimes very similar, therefore it is not possible to make a certain distinction solely by pressure.

With R134a, the A/C compressor is lubricated with special synthetic refrigerant oils, for example, PAG oils (polyalkylene glycol oils).

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > TRADE NAMES AND DESIGNATIONS >

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 may not be used in
automotive vehicles.*

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > PRODUCT CHARACTERISTICS >

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).

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 use is only to be made of approved and appropriately marked containers.

Compliance with specific conditions is required to ensure safe and proper use.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > COLOR >

Like water, refrigerants are colorless in both vapor and liquid form. Gas is invisible. Only the boundary layer between gas and liquid is visible. (Liquid level in tube of charging cylinder or bubbles in sight glass). Refrigerant R134a fluid may appear colored (milky) in a sight glass. This cloudiness is caused by partially dissolved refrigerant oil and does not indicate a malfunction.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > VAPOR PRESSURE >

In a partially filled, closed vessel, the quantity of refrigerant evaporating from the surface equals the quantity returning to the liquid state as vapor particles condense. This state of equilibrium occurs under the influence of pressure and is often called vapor pressure. Vapor pressure is dependent on temperature. Refer to REFRIGERANT R134A VAPOR PRESSURE TABLE .

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > AFFECT ON METAL >

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

Refrigerant impurities such as chlorine compounds however cause corrosion of certain metals and plastics. This can lead to blockage, leaks or deposits on the A/C compressor piston.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > CRITICAL TEMPERATURE/PRESSURE >

The refrigerant R134a remains chemically stable up to a gas pressure of 39.5 bar (corresponding to a temperature of 101°C (213°F). Above this temperature, the refrigerant decomposes (refer to Combustibility).

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > WATER CONTENT >

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

Only a small drop of water may get into the refrigerant circuit. The dryer, dryer bag or dryer cartridge contained in the reservoir can absorb approximately 7 grams (0.25 oz.) of water. They are then saturated and cannot absorb any more water. If water is still present in the refrigerant circuit, it flows up to the expansion valve nozzle or restrictor and becomes ice.

The air conditioning system stops cooling.

Water destroys the air conditioner as it combines with other impurities at high pressures and temperatures to form acids.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM >

COMBUSTIBILITY >

Refrigerant is non-flammable. It actually has a fire resistant or fire extinguishing effect. Refrigerant decomposes when exposed to flames or red-hot surfaces. UV light (occurring for example during electric welding) also causes refrigerant decomposition. The resultant decomposition products are toxic and are not to be inhaled. However, irritation of the mucous membranes provides an adequate and timely warning.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > CHARGE FACTOR >

A vessel must have space for vapor as well as liquid. As the temperature rises, the liquid expands. The vapor-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 forces that result are strong enough to rupture the vessel. To prevent a vessel from being overfilled, the regulations regarding compressed gases specify how many kilograms of refrigerant that may be added to a vessel per liter of interior volume. Multiplying this filling factor with the interior volume gives the permitted filling capacity. The figure for refrigerant used in vehicles is 1.15 kg/liter.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > EVIDENCE OF 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. Use leak detectors designed for the type of refrigerant. For example, a leak detector for R12 refrigerant will not work with R134a because R134a refrigerant has no chlorine atoms so the leak detector will not respond to it.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > REFRIGERANT R134A VAPOR PRESSURE TABLE >

The vapor pressure table for every refrigerant is published in literature for refrigeration system engineers. This table makes it possible to determine the vapor pressure acting on the column of liquid in a vessel if the temperature of the vessel is known.

Because each refrigerant has its own characteristic vapor pressure table, refrigerant can be identified by measuring the pressure and temperature.



NOTE:

At absolute pressure, 0 bar corresponds to absolute vacuum. Normal ambient pressure (positive pressure) corresponds to 1 bar absolute pressure. 0 pressure corresponds to an absolute pressure of one bar on most pressure gauges (indicated by -1 bar below 0).

Temperature in °C	Pressure in Bar (Positive Pressure) of 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

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > 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, for example 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 compressor. Using non-approved oils can cause the HVAC system to malfunction. Only use approved oils.

 **NOTE:**

Do not store open containers of refrigerant oil because it attracts moisture.

Always keep oil containers sealed.

Do not use old refrigerant oil over again. Dispose of old oil. Ester-based oils are only intended for use in large systems, not in passenger vehicle systems.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > REFRIGERANT OIL CHARACTERISTICS >

The most important properties are a high degree of solubility with refrigerant, good lubricity, absence of acid and minimal water content. Only certain oils are permitted. For a list of approved refrigerant oils and capacities, refer to Maintenance, Diagnosis .

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 aging of refrigerant oil, causing it to become dark and viscous as well as corrosive towards metals.

 **NOTE:**

Only use oils approved for the A/C compressor in refrigerant circuits with refrigerant R134a. For capacities, refer to CAPACITIES .

Dispose of old oil.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > SERVICING A/C SYSTEM >

 **CAUTION:**

Non-approved tools or materials such as leak sealing additives can cause damage or malfunctions in the system.

Only use tools and materials approved by the manufacturer.

The warranty is voided if non-approved tools or materials are used.

The purpose of this Repair Information is to provide foremen and mechanics with the basic knowledge needed to ensure expert working.



NOTE:

Expert knowledge is achieved by one who has taken part successfully in instructional training for example, AB160 or ST160, including trained experts.

This Repair Information also serves as instructional material.

It should also be available for presentation to the responsible supervisory agency on request.

Additional Information Sources

- Technical Service Handbook outlining action to be taken to rectify current problems.
- Repair Information for type-specific servicing work, refer to Air Conditioning .
- Sections of Self Study Program number 208 are no longer up-to-date. An example of this is the statement "The fluid reservoir is replaced each time the refrigerant circuit is opened". The following prerequisites apply. Refer to NOT REPLACING RESERVOIR/FLUID RESERVOIR OR DRYER BAG/CARTRIDGE, CONDITIONS .
- Video programs for in-dealership training.
- Special Tools and Workshop Equipment Information.
- Service Organization Volume 1 Additional Equipment.
- Repair information Air Conditioning with Refrigerant R12. Only hardcopies of this information are available for vehicles through MY 1993.
- The procedure for flushing the refrigerant circuit is selected in Volkswagen Service Net; Volkswagen TV; API Online; or Volkswagen TV Net; API/PKW under the book title Body and then the program from June 8, 2005 Refrigerant Circuit, Flushing, Golf Plus.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM > ULTRASOUND A/C CLEANER -VAS 6189A- >

-- The Ultrasound A/C Cleaner -VAS 6189A- is placed in the front passenger footwell and sprays Aero-Clean. Aero-Clean neutralizes microbes and bacteria inside the heater and A/C unit.

The unit comes with Operating Instructions.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > LAWS AND REGULATIONS > CHARGING SYSTEMS NOT REQUIRING 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 A/C service units are charging systems not requiring a permit. When working with such equipment, the

refrigerant 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 pressure relief valve for surplus refrigerant for internal use.

Attention must be paid to TRG 402 (technical regulations for compressed gases) when transferring compressed gases to other compressed-gas vessels.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > LAWS AND REGULATIONS > EXTRACTION SYSTEM GROUP CLASSIFICATIONS >

Group 3

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 accordance with 3 Paragraph 5 No. 3 of pressure vessel regulations, compressed-gas vessels are classified as pressure vessels in this case.

The charging systems require:

- No permit
- No expert testing as the gas is transferred to compressed-gas vessels which are classed as being pressure vessels. (Systems used for transfer from these pressure vessels to compressed-gas vessels for supplying to third parties do require a permit and are subject to mandatory testing).

NOTE:

The A/C service and recycling units used in motor vehicle workshops are extraction and charging systems not requiring a permit (Group "3") but which are only to be operated by qualified personnel. Instructions for unit operation and maintenance can be found in the relevant manufacturer's documentation.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > LAWS AND REGULATIONS > 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.

Addresses in other countries can be obtained from the relevant authorities.

The effects of climate change can be seen worldwide. Protecting the climate is one of the most important responsibilities. However, this responsibility presents enormous challenges to all involved.

The Kyoto Protocol outlines worldwide goals regarding climate protection, among other things. In addition to target reductions of carbon dioxide, this protocol also outlines target reductions for fluorinated greenhouse gases such as refrigerant R134a due to their high potential of contributing to the greenhouse effect.

Numerous laws have been created for the automotive industry, for example at the European level. For example, chemical-climate protection regulations were put into effect on August 1, 2008 in Germany in order to define the European legislation in more detail.

- Provision (EU) no. 1005/2009
- Provision (EU) no. 842/2006
- Provision (EU) no. 706/2007
- Provision (EU) no. 307/2008
- Guideline 2006/40/EU
- Chemical-climate protection provision, recycling management and disposal regulations (for Germany)

Maintenance and repair work on the A/C system refrigerant circuit

All individuals performing maintenance and repair work on vehicle A/C systems must have completed a training program and be competent in the work required. Other regulations may apply in addition to those of the European Union.

The following general points apply

Operation, repair, decommissioning, take-back obligation

- When operating, repairing and decommissioning items that contain refrigerant, allowing the refrigerant to vent into the air is prohibited.
- Keep records about the quantities used during operation and maintenance so they can be presented to the authorities upon request. Other provisions may apply in countries that are not members of the EU.
- Distributors of the substances and preparations discussed above are obligated to accept these items back after use or to ensure they are accepted by a third party of their choosing.
- Maintenance and decommissioning of items containing refrigerant that are named in the legislation Substances and preparations named in this legislation may only be accepted by those with the necessary expertise and technical equipment.

Criminal offenses and infringements of the law

- Willfully or negligently venting refrigerant into the air when operating, repairing or decommissioning items that contain refrigerant constitutes a violation of the laws and legislation described above.

Technical Regulations For Compressed Gases (TRG) 400, 401, 402

Only excerpts concerning vehicle manufacturers and workshops are listed below.

TRG 400 (General Regulations For Charging Systems)

2. Definition of terms and explanations

2. 1 Charging systems

2.1.1 Charging systems are systems for filling mobile compressed-gas vessels. The charging system includes the premises and facilities concerned.

2. 4 Charging systems requiring a permit

Charging systems requiring a permit are ones used to transfer compressed gases to mobile compressed-gas vessels for supplying to third parties.

5 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)

2. Employees and employee instruction

2. 1 Charging systems are only to be operated and maintained by personnel

- Who are 18 years of age and older
- Who possess the necessary technical knowledge
- Who can be relied upon to work diligently.

2. 2 Supervised work may also be performed by personnel that do not meet the requirements stipulated in item 2. 1, points 1 and 2.

2. 3 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 according to the operating instructions.

Charging (a separate TRG applies to vessels from other countries and their charging)

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.

2. 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 t_k greater than or equal to -10°C (14°F) (t_k = critical temperature) - the maximum permissible charging weight in line with TRG 104 No. 3. 3 must be marked on the vessel prior to connection for filling.

3. Compressed-gas vessels marked with the maximum permissible charge pressure in bar at 15°C (59°F) must be filled manometrically. If, at the time of filling, the temperature is not 15°C (59°F), the pressure corresponding to the prevailing temperature must be established; it must be ensured that the permissible

charge pressure at 15°C (59°F) is not exceeded in the compressed- gas vessel. The charged vessels are to be checked by way of random pressure measurements to determine possible overfilling.

4. 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 are to be weighed during filling and subsequently subjected to a weight check on special scales to establish possible overfilling. Scales used for this purpose must be calibrated.

5. Under certain conditions, gases with a tk greater than or equal to 70°C (158°F) may be transferred volumetrically from compressed-gas vessels with a maximum volume of 150 l to compressed-gas vessels with a volume of maximum 1000 ccm. The stipulations of the TRG apply to the transfer of liquefied gas to cylinders used by workmen.

6. Vessels in vehicles for

(1) Gases with tk greater than or equal to +70°C (158°F)

(2) Industrial gas mixtures with tk greater than or equal to +70°C (158°F) or

Liquefied extremely low-temperature compressed gases may, contrary to item 4, be filled volumetrically if the charging system and/or the vessels is/are equipped with devices for measuring or limiting the volume of the charge and - with the exception of motor vehicle vessels as per item 3 - 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 filled containers are to be checked gravimetrically on a calibrated scale or - provided that the pressurized gases are not highly toxic - volumetrically. Volumetric checking requires the use of appropriate equipment with completely separate charging and checking devices.

7. Charging and check measurements are to be performed by different people. Check measurements must be performed immediately upon completion of the filling process.

8. Overfilled vessels must be drained immediately and in a safe manner until the permissible fill is attained. The compressed-gas fill is then to be determined again.

9. 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.

10. When filling compressed gas vessels with liquefied gases at charging temperatures less than or equal to -20°C (-4°F), the compressed gas vessel (if the vessel material has not been tested for temperatures less than or equal to -20°C (-4°F)) is not to be released from the charging system for transportation until the vessel wall temperature is greater than or equal to +20°C (68°F).

Recycling and Disposal Regulations

Specifications and rules for handling and disposing of refrigerants and refrigerant oils can be found in the chemical-climate protection provision and recycling and disposal regulations. These are valid in Germany. Different specifications and rules may apply in other countries.

Refrigerant, Keeping Records

The environmental statistics law requires records to be kept on the use of refrigerants.

Consequently, motor vehicle workshops may well have to provide the relevant local authorities with information on their use of refrigerant. It is therefore recommended to keep records of the quantities used during operation and maintenance (refrigerant log) and present them to the relevant authorities upon request.

 **NOTE:**

Other provisions may apply in countries that are not members of the EU.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > LAWS AND REGULATIONS > RECYCLING AND DISPOSAL REGULATIONS >

 **NOTE:**

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

Addresses in other countries can be obtained from the relevant authorities.

Specifications and rules for handling and disposing of refrigerants and refrigerant oils can be found in the chemical-climate protection provision and recycling and disposal regulations. These are valid in Germany. Different specifications and rules may apply in other countries.

Refrigerant Disposal

Refrigerants intended for disposal are to be transferred to marked recycling containers, observing the permissible filling quantity. Refer to the chemical-climate protection provision and the recycling and disposal regulations in Germany. Different specifications and rules may apply in other countries.

Refrigerant Oil Disposal

Used refrigerant oils from systems employing halogenated hydrocarbons are to be disposed of as waste subject to special supervision. They are not to be mixed with other oils or substances. Proper storage and disposal must be ensured in line with local regulations. Refer to the chemical-climate protection provision and the recycling and disposal regulations in Germany. Different specifications and rules may apply in other countries.

Addresses in other countries can be obtained from the relevant authorities.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > LAWS AND REGULATIONS > REFRIGERANT CIRCUIT, CONVERTING R12 TO R134A AND SERVICING >

 **NOTE:**

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

Addresses in other countries can be obtained from the relevant authorities.

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 replaced.

A precise description of the conversion procedure and information on the servicing of converted refrigerant circuits can be found in Repair Information: Air conditioner with refrigerant R12 Parts 2 and 3. This repair information is only available in hard copy.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > LAWS AND REGULATIONS > REFRIGERANT, KEEPING RECORDS >



NOTE:

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

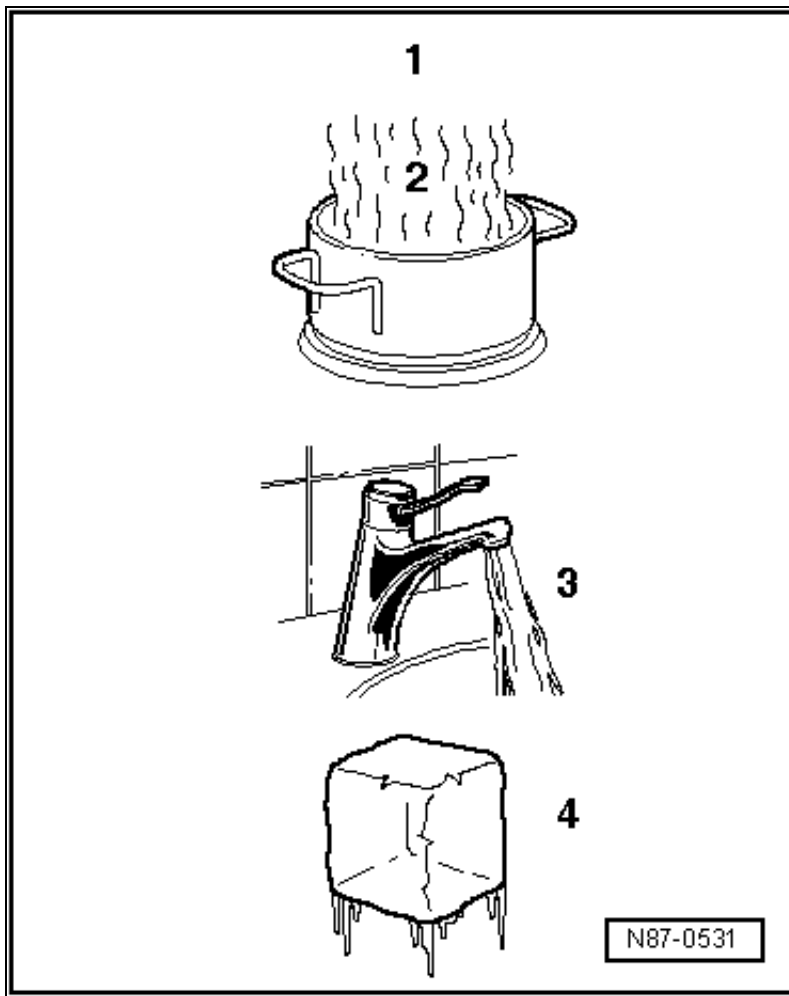
Addresses in other countries can be obtained from the relevant authorities.

Keep records about the quantities used during operation and maintenance so they can be presented to the authorities upon request. Other provisions may apply in countries that are not members of the EU.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM PRINCIPLES > PHYSICAL PRINCIPLES >

The four known states of water also apply to air conditioning system refrigerants.

Fig 1: Identifying Four States Of Water

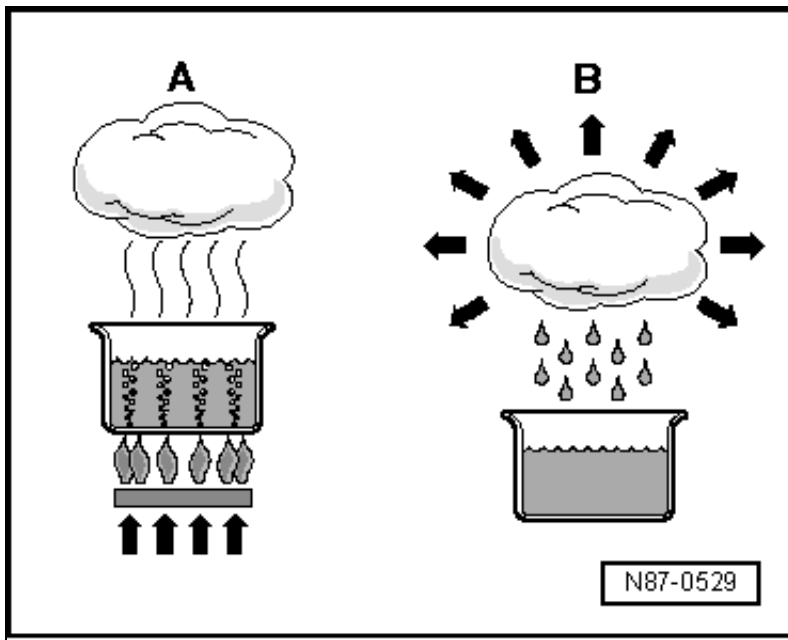


Courtesy of VOLKSWAGEN UNITED STATES, INC.

1. **Gaseous (invisible)**
2. **Vapor**
3. **Fluid**
4. **Solid**

When water is heated in a vessel (heat absorption), water vapor can be seen to rise. If the vapor is further heated through heat absorption, the visible vapor turns into invisible gas. The process is reversible. The warmth is extracted from gaseous water, vapor forms first, then water and then ice.

Fig 2: Identifying Diagram Of Heat Absorption & Heat Emission



Courtesy of VOLKSWAGEN UNITED STATES, INC.

A - Heat absorption

B - Heat emission

Heat Transfer

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.

00 GENERAL, TECHNICAL DATA > GENERAL INFORMATION > A/C SYSTEM PRINCIPLES > PRESSURE AND BOILING POINT >

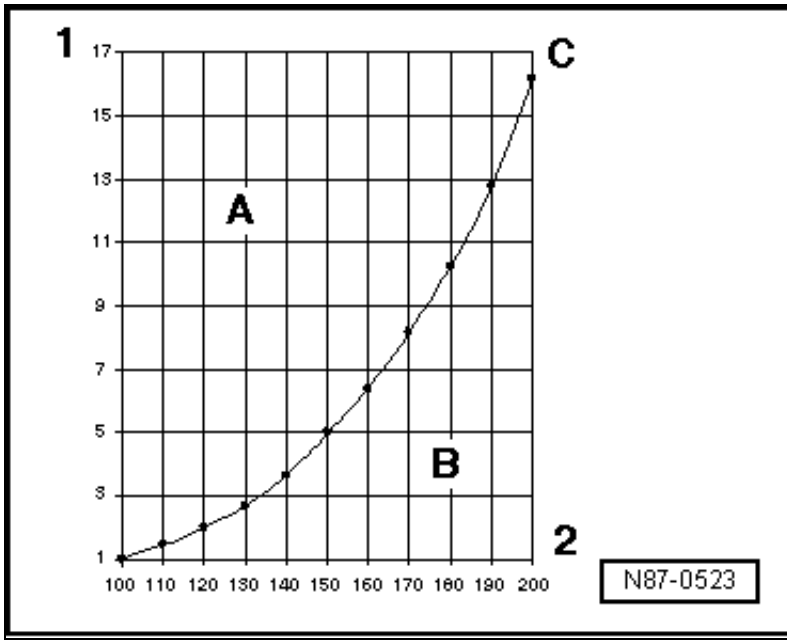
The boiling point given in tables for a liquid is always referenced to an atmospheric pressure of 1 bar. If the pressure acting on a fluid changes, its boiling point also changes.

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

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

Vapor pressure curve of water

Fig 1: Identifying Vapor Pressure Curve Of Water Graph



Courtesy of VOLKSWAGEN UNITED STATES, INC.

A - Fluid

B - Gaseous

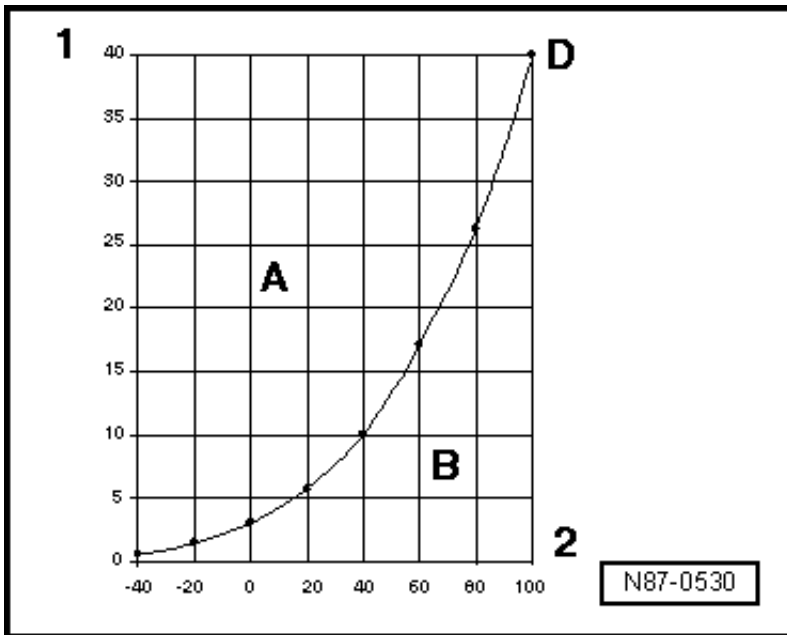
C - Vapor pressure curve of water

1 - Pressure acting on liquid in bar (absolute)

2 - Temperature in °C

Vapor pressure curve of refrigerant R134a

Fig 2: Identifying Vapor Pressure Curve Of Refrigerant R134a Graph



Courtesy of VOLKSWAGEN UNITED STATES, INC.