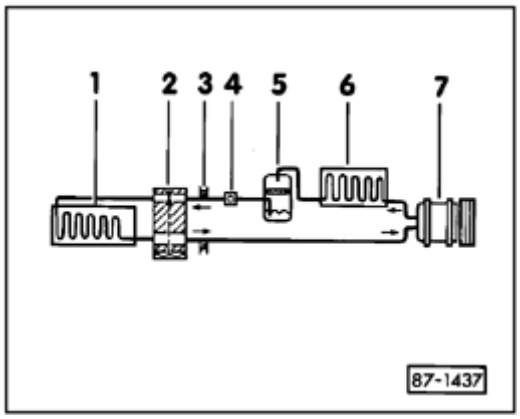
87-18

A/C refrigerant system, overview

A/C refrigerant system, identification



Typical A/C refrigerant system with expansion valve and receiver drier

1 - Evaporator

2 - Expansion valve

3 - High pressure service valve

4 - Sight glass (if equipped)

5 - Receiver drier

6 - Condenser

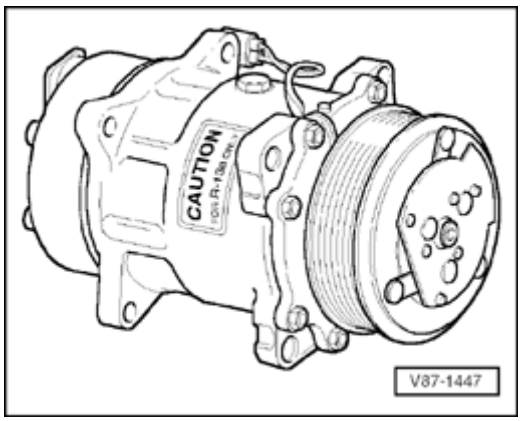
7 - Compressor

Note:

Arrows indicate direction of refrigerant flow.

A/C refrigerant system, components

A/C compressor

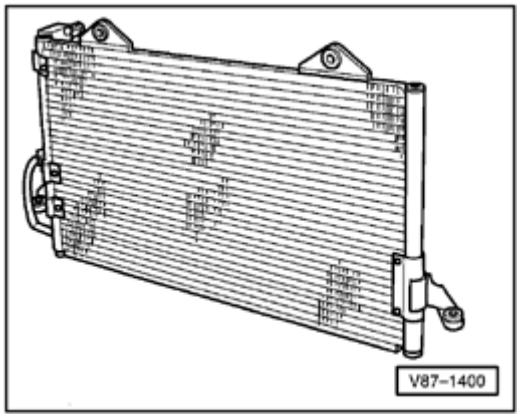


The compressor is driven via a ribbed belt on the engine when the A/C clutch (mounted as part of the compressor) is engaged (A/C ON).

Low pressure refrigerant gas from the evaporator is suctioned and compressed by the compressor. After compression, the refrigerant gas (now high pressure) flows to the condenser.

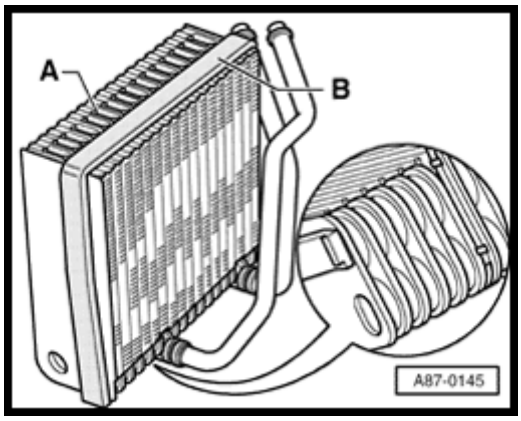
Notes:

- *The compressor contains PAG refrigerant oil that is mixable under all temperatures with refrigerant R-134a.*
- *A label on the compressor indicates that the compressor is for use in R-134a systems only.*



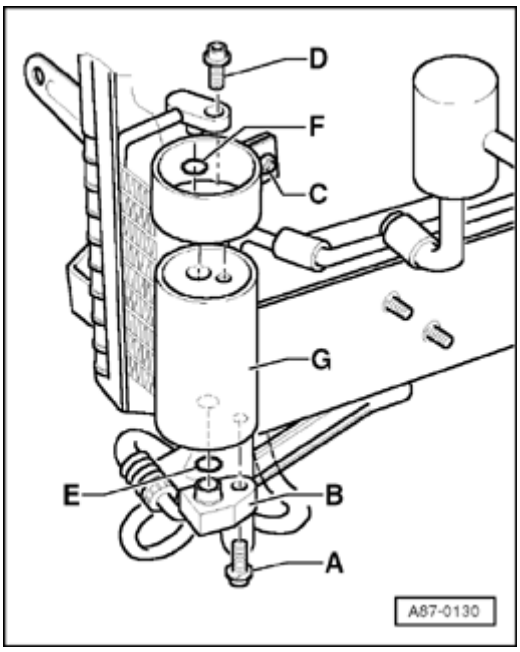
Condenser

- The condenser transfers heat from the compressed refrigerant gas to the outside air which causes the refrigerant to change state from a gas to a liquid.



Evaporator

- Liquid refrigerant entering the evaporator absorbs heat from air passing through the evaporator fins and cools the air. As the refrigerant absorbs heat it turns to vapor and is suctioned by the compressor.



Receiver drier

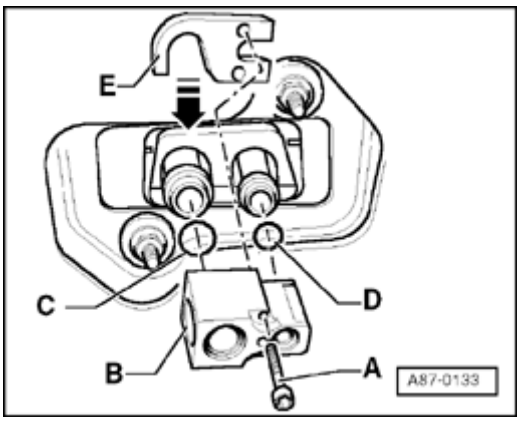
The receiver drier -G- acts as a refrigerant reservoir for the system as the high pressure liquid refrigerant flows to the expansion valve.

Any moisture contaminants in the system is absorbed by the desiccant in the receiver drier.

CAUTION!

- ***Do not remove sealing caps until ready to install new receiver drier.***
- ***If caps are removed too soon, the desiccant becomes saturated with moisture after a very short time. If this occurs, the receiver drier must be replaced.***

87-22



Expansion valve

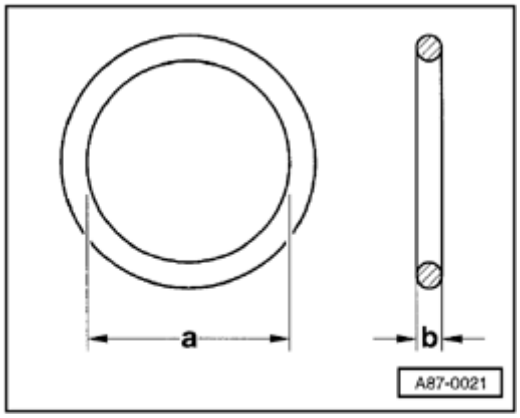
The expansion valve -B- restricts and regulates refrigerant flow, thus lowering refrigerant temperature and pressure as it flows to the evaporator.

The TT uses a thermo-dynamic expansion valve design. It regulates refrigerant flow as follows: As cooling demands increase (high outside temperatures), the temperature of the refrigerant leaving the evaporator and entering the expansion valve also increases. Here, the refrigerant temperature is sensed by a gas filled thermo-pressure chamber inside the expansion valve. The thermo-pressure chamber acts on a membrane attached to a conventional ball/orifice valve positioned in the expansion valve refrigerant circuit from the condensor to the evaporator. As the refrigerant temperature increases, the thermo-pressure membrane opens the ball/orifice valve, allowing an increase in refrigerant flow to the evaporator. Increased cooling capacity is achieved as a result. As the refrigerant temperature exiting the evaporator decreases, the thermo-pressure membrane closes the ball/orifice valve, and restricts refrigerant flow to the evaporator. This cycle ensures consistent cooling efficiency, regardless of outside temperature.

Notes:

- *Always ensure that the expansion valve insulation is in place and is not damaged. Removing and installing ⇒ page 87-63 .*
- *Due to the thermo-dynamic design of the expansion valve,*

the operating parameters of the valve are adversely affected when the insulation is missing or improperly installed. A decrease in cooling efficiency will result.



O-rings

O-rings seal the connections between components of the A/C system.

Use only O-rings which are compatible with R-134a refrigerant and refrigerant (PAG) oil. Refer to the most recent parts information when obtaining new O-rings.

O-rings are recognized by colors (currently red, green or violet). Under certain conditions, black O rings may also be installed in production.

Notes:

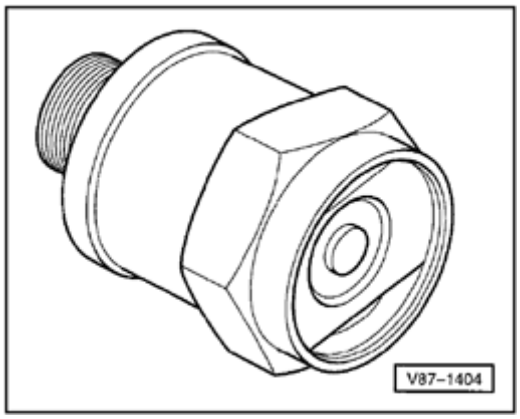
- *Use O-rings only once and always replace.*
- *Handle the O-rings only in a clean working environment.*
- *Always use correct size O-rings (dimensions -a- and -b-).*
- *Lubricate the O-rings with refrigerant (PAG) oil before installing.*
- *Always make sure to properly install the O-rings on line/component mounting flanges/grooves.*
- *O-ring and torque specifications also apply to the threaded connections in the A/C lines.*

Hoses and lines

The mixture of refrigerant oil (PAG oil) and refrigerant R-134a attacks some metals and alloys (for example, copper) and breaks down certain hose material. Use only hoses and lines which are identified with the lettering "R-134a."

Hoses and lines are secured with threaded connections. Always properly torque hose and line connections.

Pressure relief valve



The pressure relief valve is mounted on the compressor. At approx. 38 bar (551 psi), the valve opens to vent excessive pressure. When system pressure is reduced to approx. 30-35 bar (435-508 psi), the valve closes to prevent total refrigerant loss.

87-25

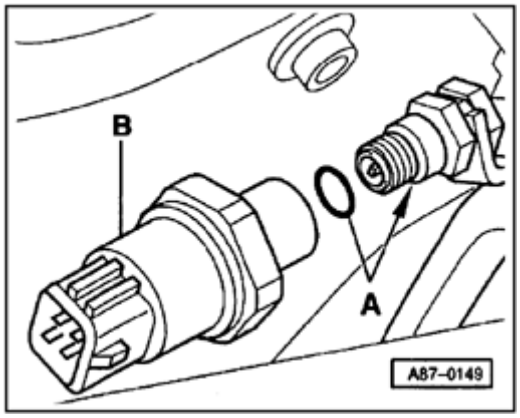
A/C refrigerant system, switches, sensors and valve connections

Notes:

- *As a running change in production, pres switch -F129 is replaced by high pressu sensor -G65-.*
- *The function of Coolant Fan Control (FC Module -J293 and vehicle wiring layout depending on whether vehicle is equipp A/C pressure switch -F129- or high pres sensor -G65-.*

⇒ *Parts catalog.*

⇒ *Electrical Wiring Diagrams, Troubleshoo Component Locations.*



A/C pressure switch -F129-

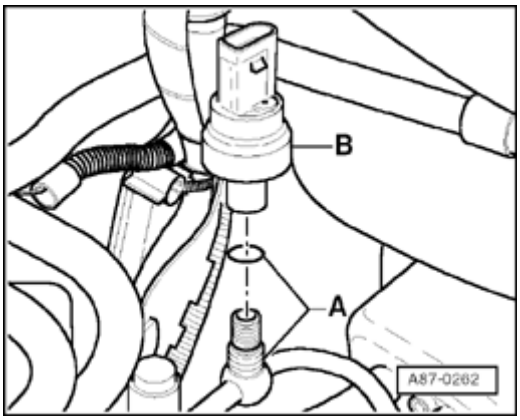
A/C clutch -N25- is disengaged when -F12 detects insufficient or excessive refrigerant pressures (A/C compressor protection).

The coolant fan(s) -V7- are also switched to 2 when -F129- detects an increase in refrig system pressure.

Switching pressures ⇒ page 87-39 .

Removing and installing ⇒ page 87-40 .

87-26



High pressure sensor -G65-

High pressure sensor -G65- -B-, transmits a square wave signal (to Coolant Fan Control (FC) Module -J293-) at a rate which varies according to the refrigerant system pressure.

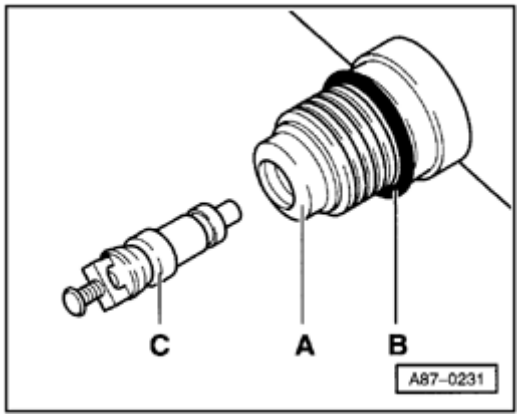
-J293 reacts to the pulse rate of the signal from -G65 as follows: 1) It informs the A/C control head -E87- that the pressure in the refrigerant system is OK and that A/C clutch -N25- can be switched on (compressor is switched on via -J293-). 2) If the refrigerant system pressure rises, the control unit switches the radiator fan(s) to speed 2.

Various versions of Coolant Fan Control (FC) Module -J293-, used in conjunction with high pressure sensor -G65- may be installed. At the time of publishing however, All TT equipped with -J293- / -G65- combination have version where coolant fan(s) -V7- speed 1 is always switched on automatically whenever the A/C clutch -N25- is energized (regardless of refrigerant system pressure).

The signal generated by high pressure sensor -G65- is also provided as an input to the Motronic Engine Control Module (ECM). As the amount of torque needed to drive the A/C compressor varies according to the refrigerant system pressure, the ECM processes this signal in order to enhance engine performance. Depending on the type of ECM, this signal may or may not appear as a duty cycle on the read measuring value block display (function 08) ⇒ Repair Manual *, 1.8 Liter 4-Cyl. 5V Turbo Fuel Injection & Ignition,* Repair Group 01.

Checking signal ⇒ page 01-132 .

87-27



Valve connections for pressure switch/sensor

The A/C system pressure switch/sensor use a different size thread than the service connection.

Use only the proper O-rings for pressure switch/sensor connections ⇒ page 87-23 .

A - Connection (lubricated)

B - O-ring seal

C - Valve

87-28

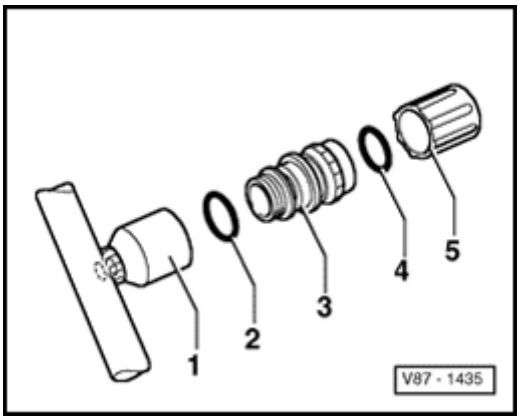
A/C refrigerant system, quick coupling service connections

Notes:

- *Use only the specified quick coupling connectors resistant to R-134a and respective refrigerant oils.*
- *Connections for the high and low pressure sides have different outside diameters.*
- *Before removing the valve or valve stems, discharge refrigerant system* ⇒ *page 87-155* .
- *Always reinstall sealing cap over service valve.*
- *Location in A/C system* ⇒ *page 87-33* .

CAUTION!

Service connections must only be removed after the refrigerant has been discharged. Connections do not have check valves underneath.



Quick coupling service connection, high pressure side

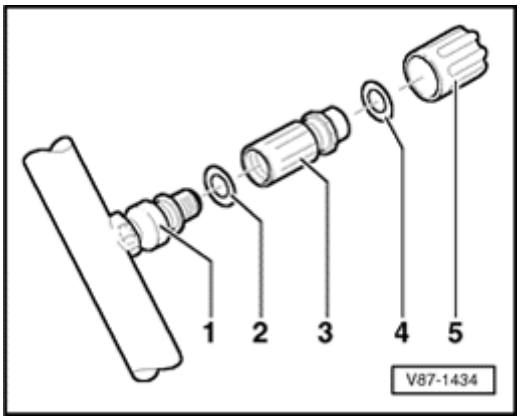
1 - Fitting with inside thread

2 - O ring, 10.8 mm x 1.8mm

3 - Quick coupling service connection with inside thread for sealing cap M8 x 1 and provision for O-ring

4 - O ring for sealing cap

5 - Sealing cap



Quick coupling service connection, low pressure side

1 - Fitting with outside thread and provision for O ring

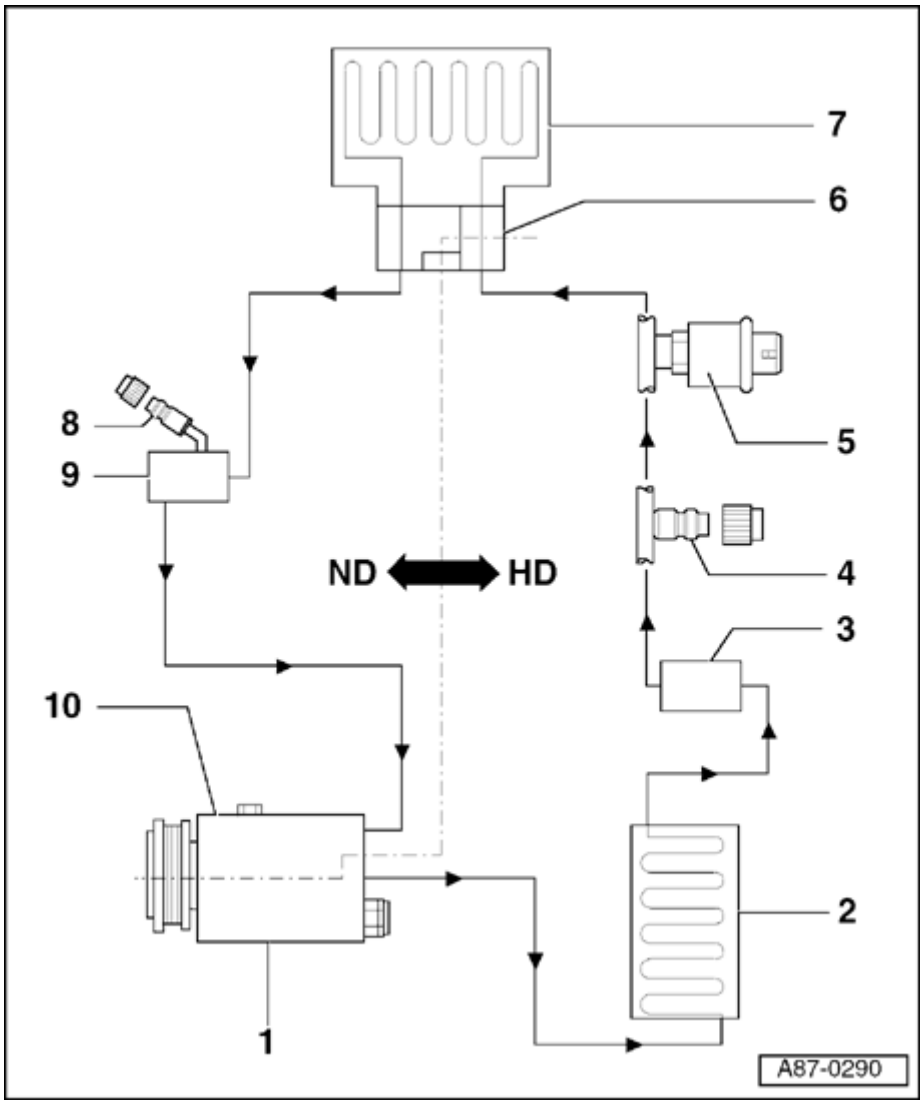
2 - O ring, 7.6 mm x 1.8mm

3 - Quick coupling service connection with inside thread for sealing cap M8 x 1 and provision for O-ring

4 - O ring for sealing cap

5 - Sealing cap

87-30



A/C refrigerant system, pressures and temperatures

A/C refrigerant system with expansion vale and receiver drier

Pressures and temperatures in the A/C system vary depending on engine speed (RPM), coolant fan speed, engine coolant temperature, A/C clutch engagement, outside temperature and humidity, cooling demand etc.

Pressure and temperature specifications are to be used as a reference only, and are based on the following operating conditions:

- Engine speed 1500 - 2000 RPM
- Outside temperature of 20° C

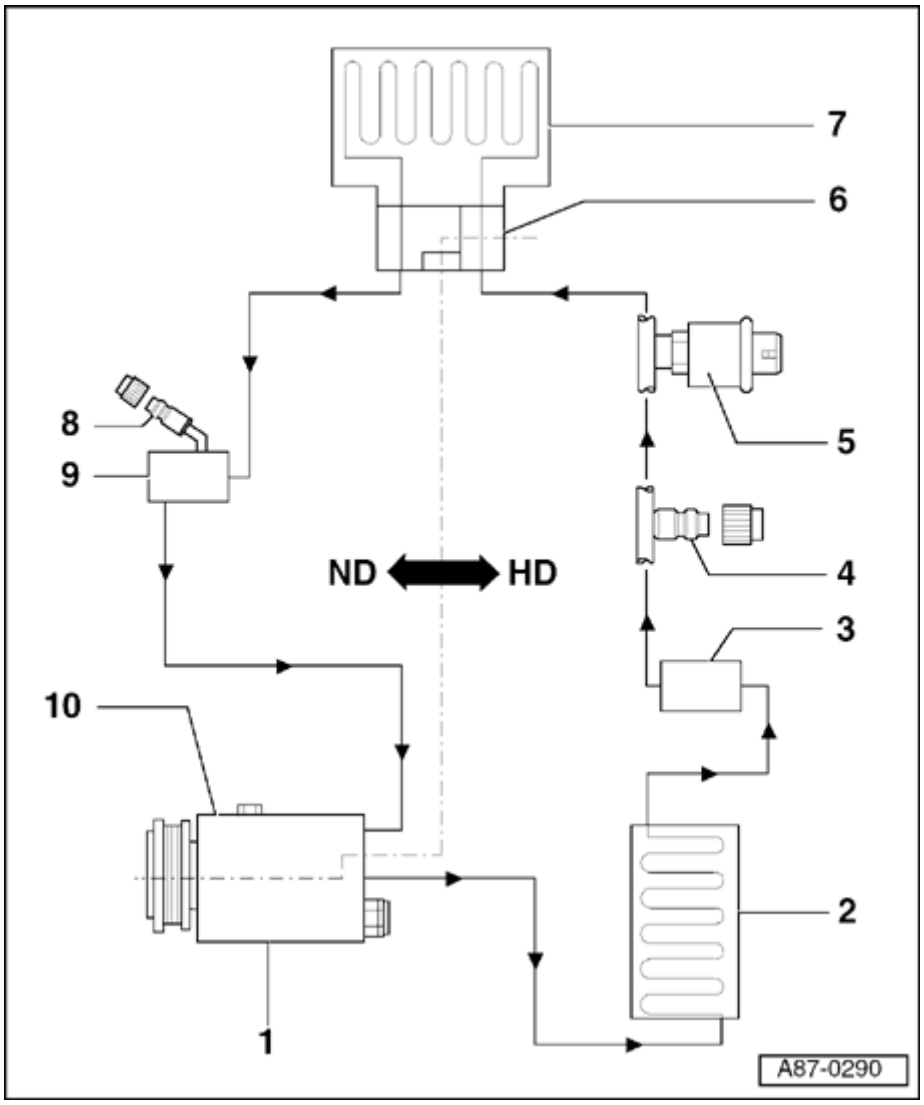
(68 ° F)

Component listing, pressure and temperature specifications ⇒ page 87-32 .

To check system pressures, pressure testing equipment must be connected to the service valves. Checking refrigerant system pressures ⇒ page 87-133 .

Refer to Notes on following page.

87-31



Notes:

- *Small - arrows- indicate direction of refrigerant flow.*
- *At 20° C (68° F) with engine not running, refrigerant system pressure equalizes to approx. 4.7 bar (68.2 psi) ⇒ page 87-13 .*
- *Refrigerant system pressures are regulated and maintained within certain tolerances by the variable displacement compressor independent of engine speed (RPM).*

ND = low pressure side

HD = high pressure side

87-32

Pressure and temperature specifications

- Refer to pages ⇒ Page 87-30 and ⇒ Page 87-31 for placement of components (listed below) in refrigerant circuit.

Component	Refrigerant state	Pressure	Temperature
1 - Compressor, high pressure side	Gas	to 20 bar (290 psi)	to 70° C (158° F)
2 - Condenser	from Gas/Vapor	to 20 bar (290 psi)	inlet to 70° C (158° F)
	to Liquid		outlet to 55° C (131° F)
3 - Receiver drier	Liquid	to 20 bar (290 psi)	to 55° C (131° F)
4 - High pressure service valve			
5 - Pressure switch/sensor			
6 - Expansion valve	high pressure side from Liquid to Vapor	high pressure side to 20 bar (290 psi)	high pressure side to 55° C (131° F)
	low pressure side Gas/Vapor	low pressure side more than 1.4 bar (20.3 psi)	low pressure side higher than -5° C (23° F)
7 - Evaporator, inlet to outlet	from Vapor to Gas	more than 1.4 bar (20.3 psi)	higher than -5° C (23° F)
8 - Low pressure service valve	Gas/Vapor		
9 - Damper	Gas		
10 - Compressor, low pressure side			