BULLETIN

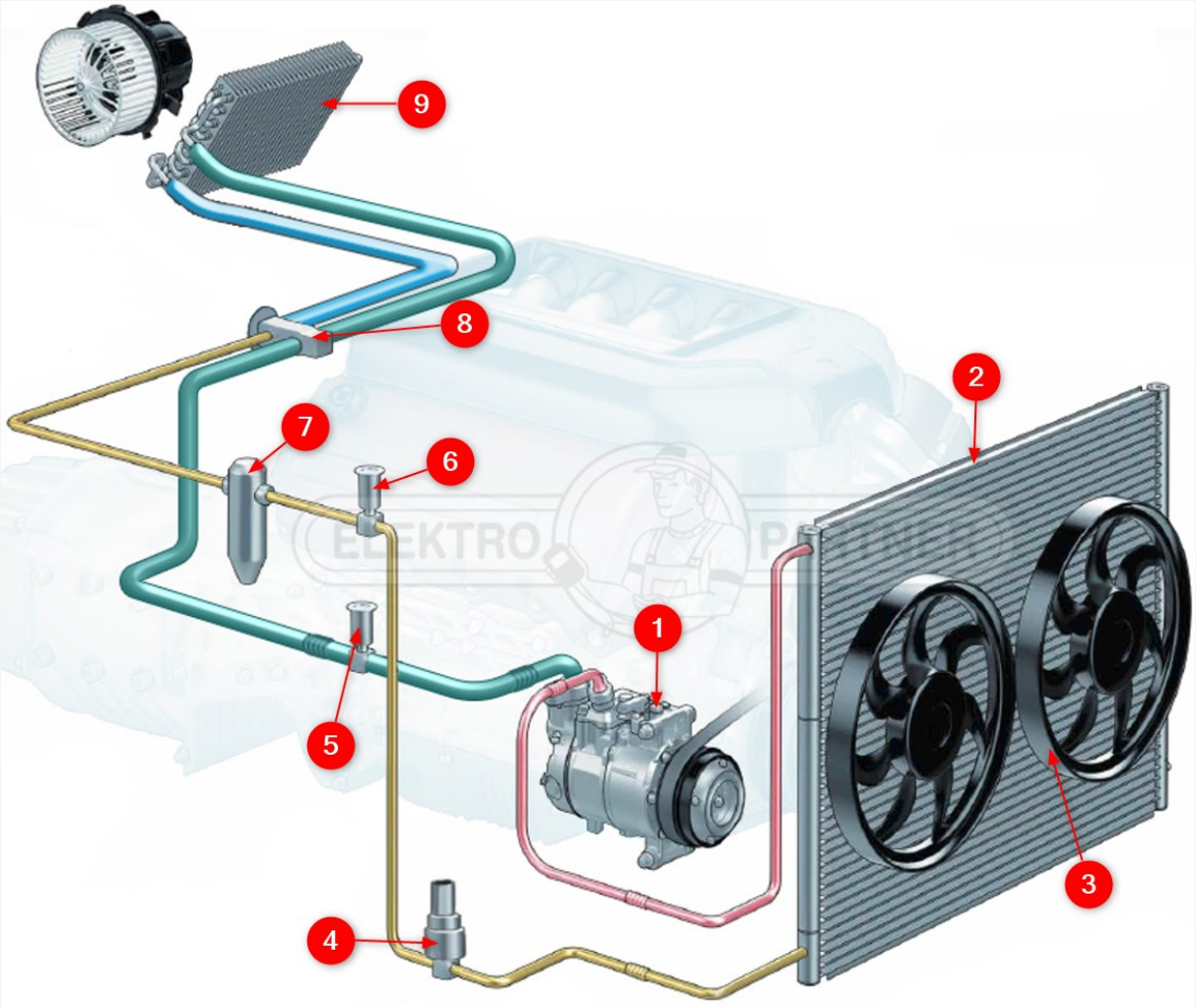
MAKE / MODEL:	YEAR:	ENGINE CODE:
All	**1992**	**All**

SUBJECT / SYMPTOM / TROUBLE CODE:

A/C system - General functional description R134a, R1234yf

SOLUTION:

System overview:

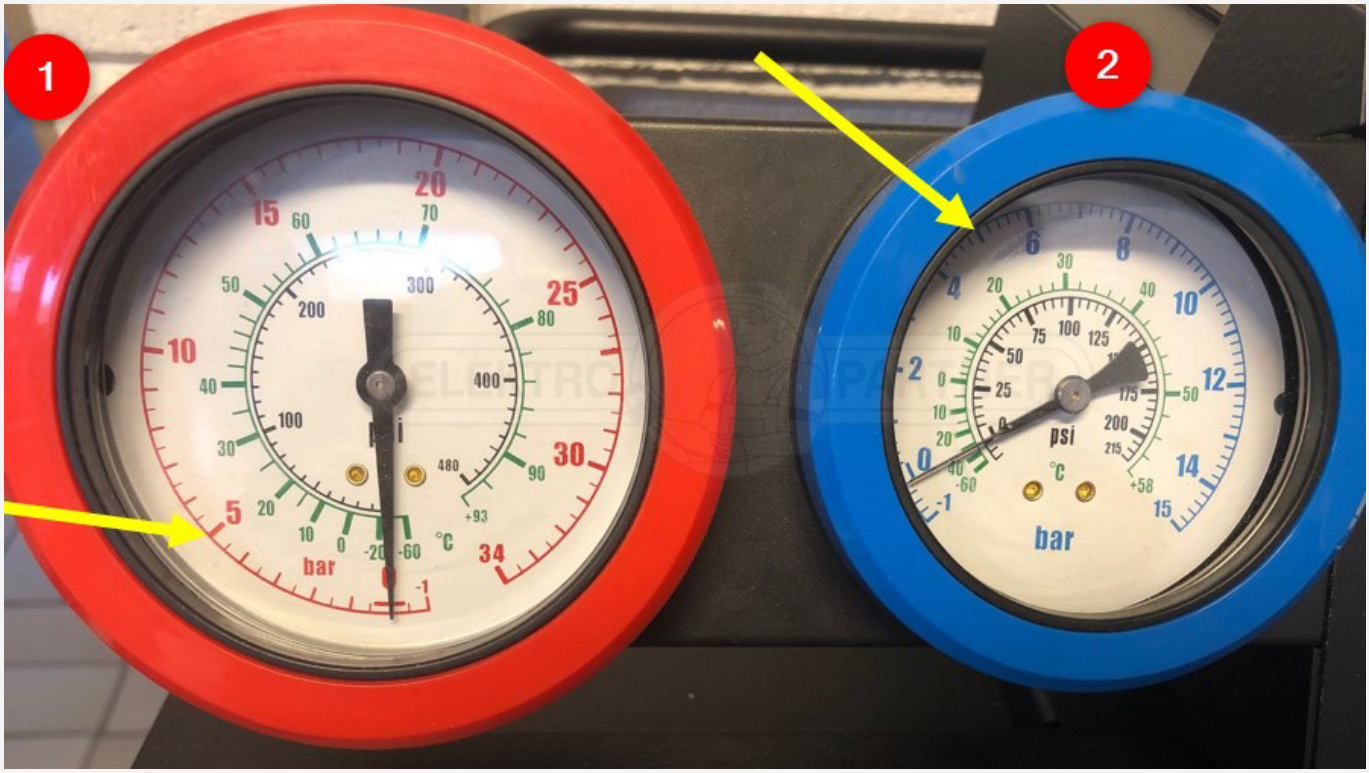


1. **Compressor**
2. **Condenser**
3. **Fans**
4. **Sensor to high-pressure (if fitted)**
5. **Hose connector to low-pressure**
6. **Hose connector to high-pressure**
7. **Drier filter**
8. **Expansion valve (some systems use an orifice instead)**
9. **Evaporator**

SOLUTION CONTINUED:

In order to understand how A/C works, it is important to know that pressure and temperature go hand in hand.

Most manometers in A/C service stations have both a pressure- and a temperature gauge.
Often you work in a room temperature of +20°C.
If you connect the service station to an air conditioning system, which is not running (engine stopped), both low-pressure and high-pressure display the same pressure of 5 bars. If you read off the temperature at 5 bars, it displays approx. 20°C.
This means that when both needles are at 5 bars/20°C, the A/C compressor is inactive.



If the pressure in the cooling system is low, the temperature is also low - and vice versa, high pressure will entail a high temperature. This means that a temperature increase = a pressure increase, and vice versa.

In order to work on an air conditioning system in Denmark, a KMO certificate is required.
This because you must have:

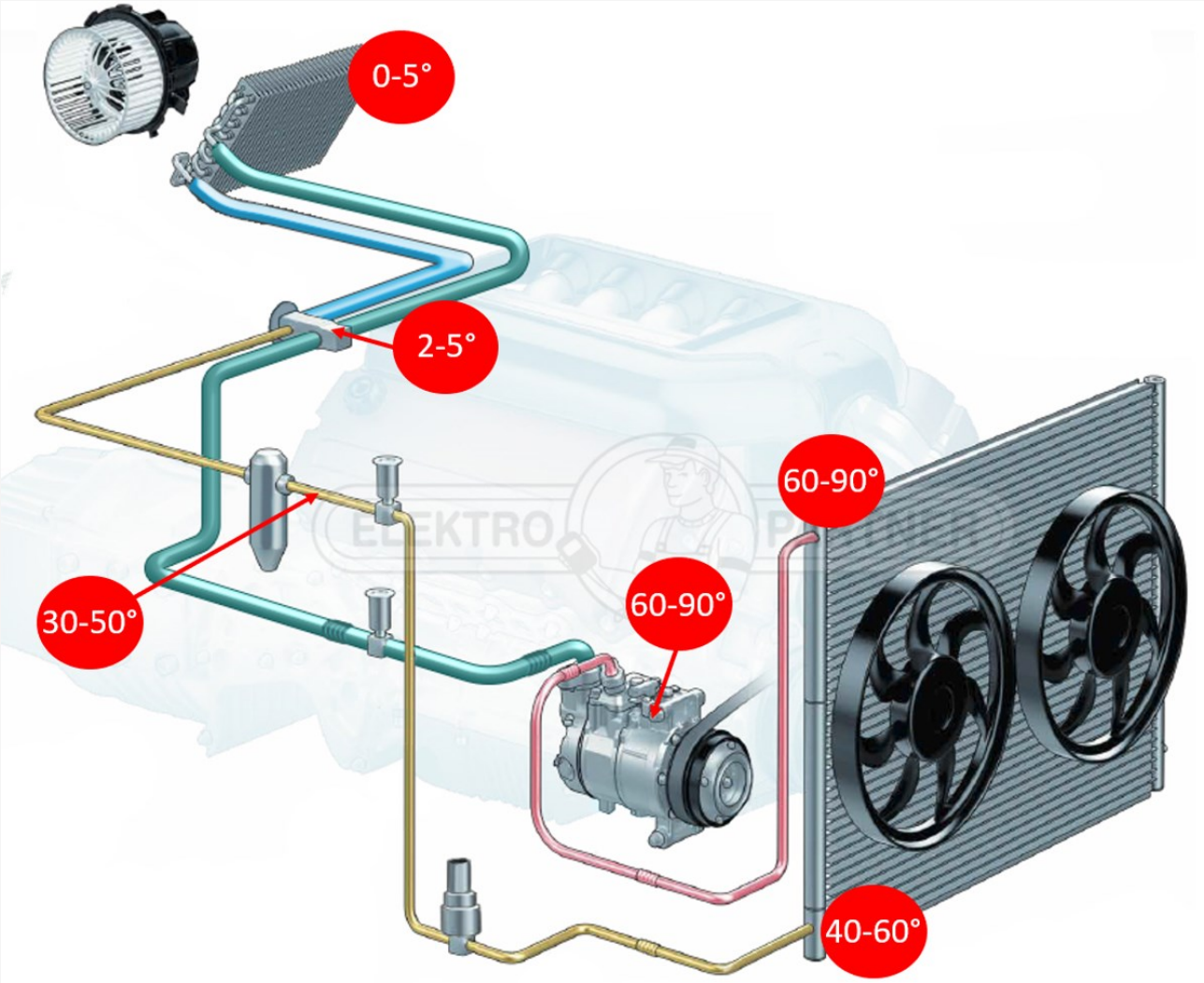
- **Knowledge of how the coolant affects the environment**
- **Personal safety**
- **Basic knowledge of how to repair/service an air conditioning system**

CONTINUED...

SOLUTION CONTINUED:

Here you can see what the temperature should be when system performance is in top.
This means

- **The engine has reached operating temperature**
- **The A/C system is ON**
- **The cabin blower is at its highest speed**



Again, you can compare the temperature with the pressure scale of the dial gauge seen on the previous page.
E.g. the evaporator temperature must be 0-5°C.
If this is converted on the pressure scale, it means a pressure of approx. 2 bars.
As regards low-pressure, this is a normal pressure.

You should focus on the system temperature because during troubleshooting you can only measure pressure 2 places.

- **Low-pressure**
- **High-pressure**

As opposed to pressure, you can measure temperature in most of the system with the right temperature sensor.
See an example of this in bulletin No. 5748.

CONTINUED...

SOLUTION CONTINUED:

Refrigerant:

There are different kinds of refrigerant:

- **R12/Freon - Used until 1992. Use and service is prohibited today**
- **R134a - Replaces R12 and introduced continuously from 1991 to 2017 (GWP-1430)**
- **R1234yf - Introduced continuously from 2010 and subsequently used in cars manufactured after 2017- (GWP-4)**
- **CO2/R744 - Continuously from 2016 (GWP-0)**
- **Several replacement gases such as 152A (not approved for cars). We recommend to not use other refrigerants than the one recommended by the manufacturer**

(GWP Global Warming Potential)

R12/Freon:
Particularly dangerous to the ozone layer
Maximum pressure: 30 bars

R134a:
Maximum pressure: 30 bars

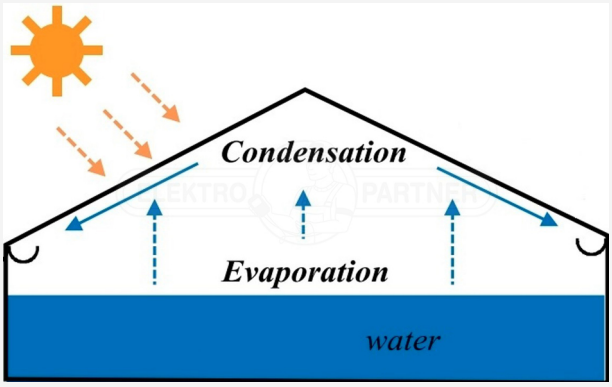
R1234yf:
This gas is slightly flammable!
Oil to this refrigerant is very hygroscopic
Maximum pressure: 30 bars

CO2(R744):
Maximum pressure: 170 bars
Operating pressure low-pressure: 30-35 bars
Operating pressure high-pressure: 135-145 bars

If necessary, see bulletin No. 5769 regarding false refrigerants.

Refrigerants are used to transport the heat from the cabin (evaporator) to the condenser.
Here the heat is transferred via air during driving or via the fan during standstill.
The compressor makes the coolant move and by doing so it moves the heat.

There are different dimensions of filler necks, so that you cannot fill incorrect refrigerant by accident.



Condensation:
If you remove sufficient heat from the gas, fluid will reform. Gas - Fluid.

Evaporation:
If sufficient heat is added to the fluid, it will change into gas. Fluid - Gas.

This means that in the refrigerant circuit, heat/energy is exchanged to the environment as the state of refrigerant is changed (pressure changes).

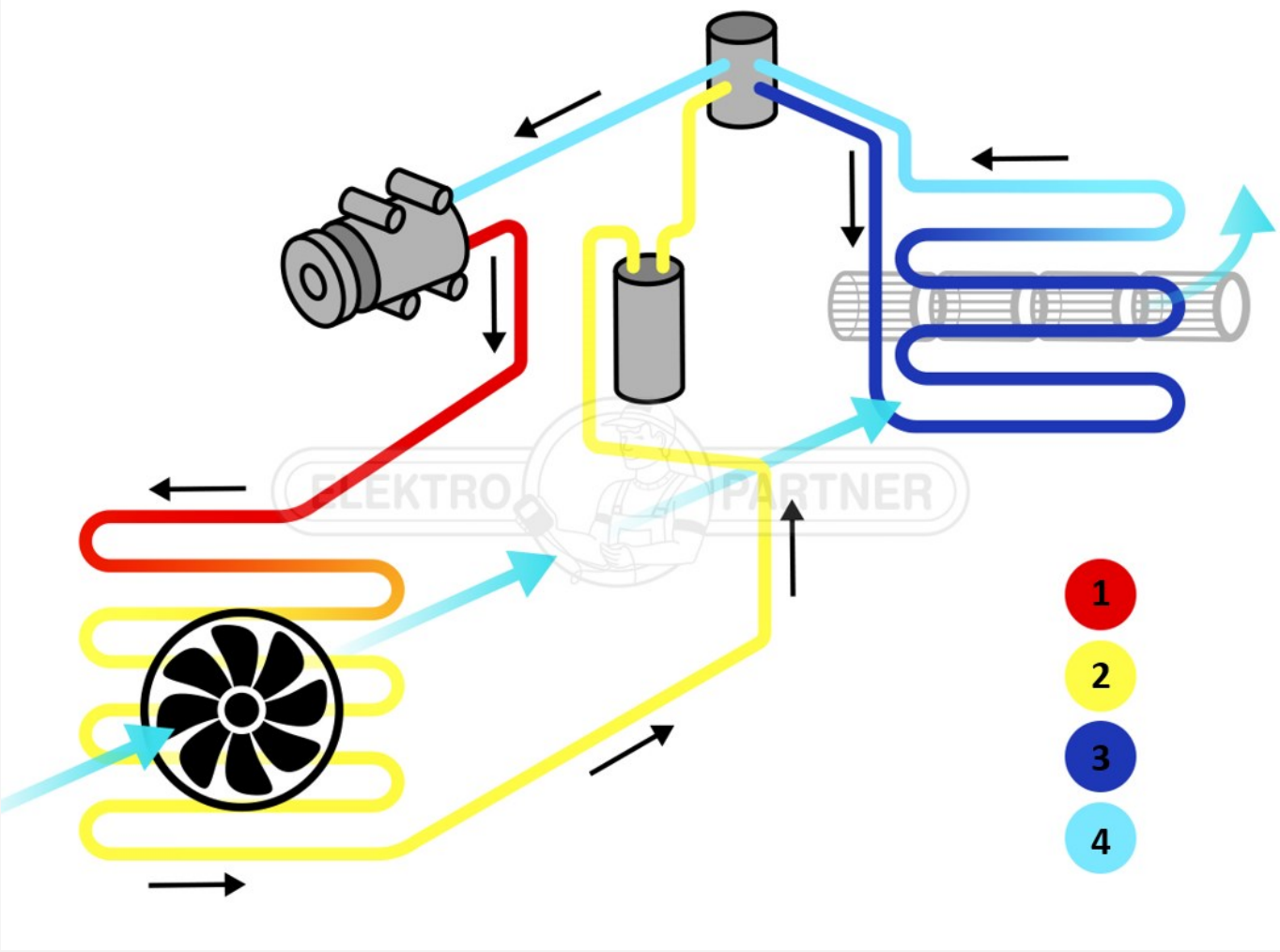
Gas changes to fluid = heat emission.
Fluid changes to gas = heat absorption.

CONTINUED...

SOLUTION CONTINUED:

Refrigerant constantly changes between gas and liquid form depending on where it is in the system.

The refrigerant enters the compressor as gas at low pressure and temperature and is then compressed in the compressor. This entails a higher pressure.
It exits the compressor as warm gas at high pressure. Then the gas is directed through the condenser, which decreases the heat from the gas.
As a result, the temperature decreases and thus the pressure.
It exits the condenser as fluid.
When the fluid reaches the expansion valve, the fluid is vaporised so it can turn into gas and evaporate inside the evaporator.
The evaporation pulls out the heat. The pressure decreases significantly, and thus also the temperature.
It reaches the compressor entry as gas at low pressure and the process starts from the beginning.
It is divided into low-pressure side and high-pressure side. They are separated by the valve plate inside the compressor and the expansion valve.



1. **High-pressure gas**
2. **High-pressure fluid**
3. **Low-pressure fluid**
4. **Low-pressure gas**