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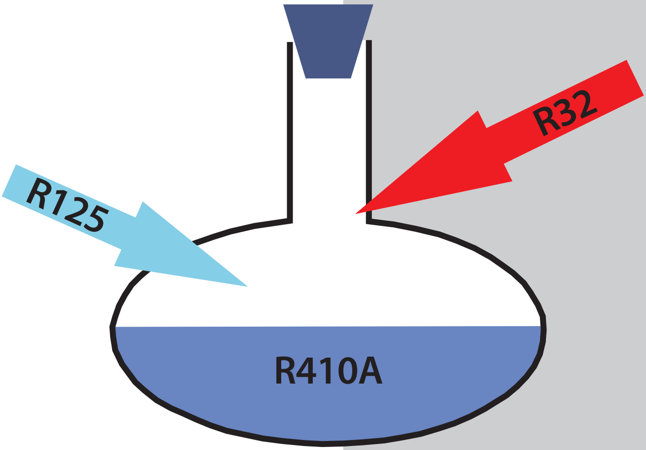

...R410A

MITSUBISHI
ELECTRIC
Changes for the Better
AIR CONDITIONING

Contents

The texts, illustrations, diagrams and examples in this manual are only intended as help for the handling and proper use of the refrigerant R410A. All information contained in this brochure was carefully researched and checked.

If you have any questions regarding the installation and operation of the equipment described in this manual, please do not hesitate to contact the following address:

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Art. no. XXXXXX
© 11/2002

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What is R410A?

R410A is a refrigerant that was developed as a substitute for R22 and R13 B1. R410A is nearly azeotropic and is a mixture of equal parts of R32 and R125. In practical terms, R410A has the same properties as R22.

The refrigerant R407C has no ozone depletion potential (ODP).

Because of the relatively high density and the high energetic efficiency it is possible to reduce the size of device components (condenser / compressor unit, the evaporator part, piping, etc.). The very high condenser pressures compared to the R22 (R22: 43 °C, 15.8 bar; R410A: 42 °C, 26 bar) prevent the conversion of older systems to R410A refrigerant. Because all components such as compressors, liquefiers, collectors, evaporators, piping, etc. must all be designed or developed to withstand these high pressures.

As refrigeration equipment oil an ester oil is used, as was the case prior to the introduction of R407C and with other refrigerants.

During installation there are no special points that need to be observed in comparison to R407C refrigerant. Just as a reminder, here are the most important points again:

- ✔ Always work with absolute cleanliness!
- ✔ Solder only under safety gas!
- ✔ Evacuate the system properly!
- ✔ Always fill the system exclusively with fluid!

Expressions

ODP Ozon Depletion Potential

The Ozone Depletion Potential of R11 was standardized to 1. There is no unit or measurement for ODP, only comparative classifications.

R410A has an ODP of 0, therefore no ozone depletion potential.

GWP Global Warming Potential

The Global Warming Potential indicates the ability of a gas to store energy as well as the residency period of the gas in the atmosphere.

As a basis for comparisons carbon dioxide [CO2] is used. CO2 resides in the atmosphere for over 500 years. The GWP100 refers to a 100 year residency period. If other periods of time are selected, then it is indicated by a footnote (e.g. GWP20).

Properties

R410A – an azeotropic mixture:

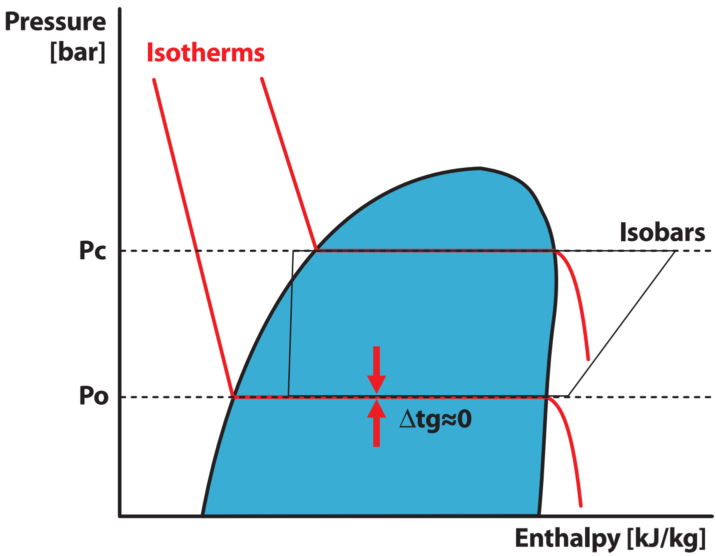
The refrigerant R410A is a mixture of refrigerants that was developed as a substitute for CFC, e.g. R22 and R502.

R410A is a mixture (or blend) of:

R32	60%
R125	40%

Properties of azeotropic mixtures:

In contrast to R407C (zeotropic mixture) the phase change of azeotropic mixtures takes place at almost constant temperature during the liquefaction or evaporation process. So R410A has a negligibly small ”temperature glide”.



➜ Δtg = temperature glide, for R410A nearly 0 K

Copper pipe work

- ✔ Use only copper pipes complying with DIN (German Industrial Standards) regulations.
- ✔ Cut the piping only with a pipe cutter.
- ✔ Remove burrs with care.
- ✔ Make sure that no swarf or other impurities get into the piping.
- ✔ Solder joints must be bare and clean.
- ✔ Do not clean the pipe connections with emery paper as this leaves traces on the soft surface of the copper. Solder flows best on smooth surfaces.
  To clean the copper pipes use steel wool or a cleaning fleece.
- ✔ Ensure that solder joints are made only using safety gas.

  Use dry nitrogen or forming gas. During soldering without a safety gas, oxygen can get to the solder joint and copper oxide is produced at the pipe surface. The copper oxide is washed off the surface of the pipe once the refrigerator is put into operation and it then circulates with the refrigerant. Due to the high compressor final temperature, the oxides can cause the refrigerant and refrigeration unit oil to decompose.

  The result is defects in operation.

Proper evacuation

A decisive factor for the problem-free operation of the air-conditioning system is proper evacuation of the cooling system. Through the evacuation air and moisture are removed from the piping and all system components.

Why do refrigeration systems have to be evacuated?

Through the evacuation the following harmful effects are prevented:

- Foreign gas collects in the condenser. That causes the pressure in the condenser to increase and the compression temperature to rise.
- Moisture leads to undesirable reactions in the refrigerant circuit and can result in the injection valve icing up.
- The polyester oils used in the R410A refrigeration units are hydroscopic, i.e. they take up moisture from the air. Moisture (water) must be removed at all costs to prevent chemical reactions in the system (hydrolysis). Hydrolysis products are polyvalent alcohols and carboxylic acids.
- Air (oxygen) reacts with the refrigeration unit oil and may lead to faults (e.g. compressor failure).

To be able to remove water from the system it must be evaporated. For that the pressure in the piping must be reduced to such an extent that the ambient temperature is sufficient to evaporate the water.

The boiling point

By way of example: the boiling point of water at sea level is 100 °C. However, at a height of 4800 m and an atmospheric pressure of 555 mbar the boiling point has fallen to 84 °C.

Therefore, in this case it means, depending on the season, attaining a pressure in the piping system that causes the water in the system to evaporate at ambient temperatures of 25 °C in summer or at about 5 °C at colder times of year. It is evident that in summer it is relatively easy to reach the required pressure. In winter, however, it is hardly possible to evacuate a system properly.

The boiling point is dependent on the pressure being exerted on the fluid. The higher the pressure, the higher is the boiling temperature; the lower the pressure, the lower is the boiling point.

Steam pressure curve	
t	**Ps**
5 °C	0,009 bar
10 °C	0,012 bar
15 °C	0,017 bar
20 °C	0,023 bar
25 °C	0,042 bar

To know what pressure has to be attained to cause the fluid in the system to evaporate at the corresponding ambient temperature, a glance at the adjacent table should suffice:

At an atmospheric temperature of 15 °C the refrigerant circuit must be evacuated to a minimum of 0.017 bar to obtain system drying.

The right tools

The right tools are required to enable the refrigeration system to be properly evacuated and dried. These include:

- Selection of the vacuum pump
- The right pressure gauge
- Selection of vacuum measuring instruments

Selection of the right vacuum pump

In order to attain these low vapor pressures a modern vacuum pump is required. The required pumping capacity of the pump Sv depends on the size of the air-conditioning unit:

- small air conditioners up to 2.5 kW cooling capacity — $Sv = 1\ m^3/h$
- small and middle air conditioners from 2.5 up to 11 kW cooling capacity — $Sv = 4–8\ m^3/h$
- big air conditioners above 11 kW cooling capacity — $Sv = 8–15\ m^3/h$

A one or two-step rotary slide valve vacuum pump should be used. Its pumping performance is down to approx. 0.3 mbar for one-step and approx. 0.05 mbar for the two-step vacuum pump.

The pressure gauge

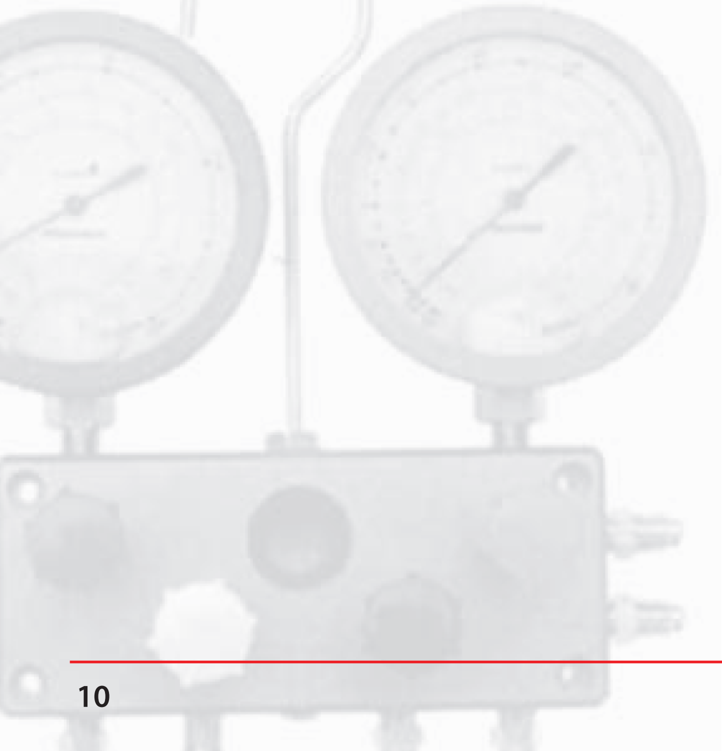
☞ The low pressure gauge mounted on the pressure gauge is not suitable for measuring vacuum.

One cannot rely on conventional displays when determining the pressure attained in the system. In areas of low pressure they are too inaccurate and hard to read because of their small dimensions.

Use an absolute vacuum measuring meter for determining the vacuum.

Suitable vacuum measuring gauges

To determine accurately the pressure in the system and whether the desired vacuum has been attained a vacuum or torr meter is indispensable. A professional evacuation requires such an instrument.



Handy tips for evacuation

- ✔ Before a system evacuation can be undertaken a check for potential leaks is absolutely essential. Such leaks may be discovered at soldering joints or flange screw connections. The evacuation can only start once the system has been properly pressure tested and found to be leakproof.
- ✔ In the case of large systems it is recommended to ”break” the vacuum. That means, at a pressure of about 12 mbar to fill the system with dried nitrogen and then to re-evacuate it again. This causes the residual water vapour in the piping to be ”diluted” and enables it to be pumped out more easily.
- ✔ In order to save time, evacuation should be carried out simultaneously on the suction and pressure sides. Also the use of tubes that are as short and of large a diameter ($^1/_2$") as possible saves time as well.

Conclusion

If you follow closely the few instructions in this small brochure and always work cleanly, just as you have learnt in training, you will have no problems in handling the refrigerant R410A.

Satisfied customers will be grateful to you.

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Specifications subject to change without notice.

Printed in Germany 11/2002

Art.no. 148033