

CO₂-Based Cooling Units from Pfannenberg

CO₂ Protecting the Environment – Who Would Have Thought It?

At first glance the combination of environmental protection and CO₂ appears paradoxical. CO₂ is perceived as the greenhouse gas par excellence. As such, it is on an imaginary black list. However, when used as cooling agent in cooling units, it is considerably less harmful to the environment than those substances used previously. This is one of the major reasons why tesa AG decided to use a Pfannenberg CO₂-based cooling unit to cool switch cabinets for the central production control for adhesive tape at its plant in Hamburg-Hausbruch.

As a cooling agent, the global warming potential of CO₂ is 1300 times less than that of the fluorinated hydrocarbons (FKW, e.g. R134a) used previously. As well as the environmental properties, there are also physical reasons in favour of using CO₂ as a cooling agent. The specific heat capacity of CO₂ is approximately 2.5 times greater, and its specific refrigerating capacity is about 5 times greater than R134a. This means that heat can be transported through pipes with smaller internal diameters, and a CO₂ compressor can be used that only requires a fifth of the displaced volume of an R134a compressor. The result is that significantly smaller cooling units can be manufactured.

[Picture]
tesa self-adhesive tape and tesa factory in Hamburg

Breakthrough in CO₂-Based Cooling Units

For a long time the use of CO₂ as a cooling agent for cooling units was regarded as technically difficult to realise. The cooling technicians at Pfannenberg

[Picture]

Author

Nils Peter Halm, technical manager, Pfannenberg GmbH, Hamburg

GmbH in Hamburg saw this as a challenge. A while ago they achieved a decisive breakthrough in the development of environmentally friendly CO₂-based cooling units for switch cabinets. In the meantime, the units have developed to such an extent that they are already successfully employed in industry. For some months a CO₂-based Pfannenberg

cooling unit has been used to cool a switch cabinet for the central production control of adhesive tapes at the Hamburg plant of the Beiersdorf subsidiary 'tesa'. This means that the multinational concern is successfully using Pfannenberg's innovative and environmentally friendly technology before official production has even begun. The CO₂-based

[Picture]

The CO₂-based cooling unit tested at tesa is a special variant of the Pfannenberg DTI 9441 cooling unit for partially counter-sunk door or side installations, with a cooling performance of two kW. The current name of the prototype is "DTI 9441 CO₂".

cooling unit is a special variant of Pfannenberg DTI 9441 cooling unit for partially counter-sunk door or side installation with a cooling performance of two kW. The current name of the prototype is "DTI 9441 CO₂". The motivation behind the field test at tesa was the unsatisfactory performance of cooling units used previously. During the course of communication between tesa and Pfannenberg, a decision was ultimately made to test a Pfannenberg CO₂ cooling unit, as this also takes environmental aspects into account.

Pfannenberg are understandably proud to be able to demonstrate the fruits of tireless development work over recent years. As well as the environmental aspects, the people at tesa are also impressed by how user-friendly the units are. As with almost all Pfannenberg cooling units, assembly is possible without the use of any screws. For Andreas

[Picture]

"With the development of new CO₂-based cooling units, we have done nothing more than follow our philosophy: safety for man, machine, and the environment."

[Picture]

Laboratory test on the usage of CO₂ as a cooling agent in Pfannenberg air climate control devices.

Pfannenberg, managing partner at Pfannenberg GmbH, the issue is obvious: "With the development of new CO₂-based cooling units, we have done nothing more than follow our philosophy: safety for man, machine, and the environment."

Economy and Environmental Protection Need Not Be Mutually Exclusive

Within the cooperation between Pfannenberg and tesa, it has once again been proven that economy and environmental protection are not mutually exclusive, but actually go hand in hand with each other. This is backed up by the fact that the philosophies of the two companies demonstrate large intersections with regard to sustainable environmental management. At both Pfannenberg and tesa, work and production processes are constantly checked and optimised with this in mind. In 2005, tesa AG was rewarded for its commitment with the environmental prize from the German Environmental Management Association (B.A.U.M. e.V.). Pfannenberg is also promoting sustainable environmental management

[Picture]

The complete Pfannenberg cooling unit range from 300W to 4000W.

through a range of comprehensive measures. Legal specifications are regarded as a minimum requirement. In 2004, the company was certified for the introduction of a quality and environmental management system ISO 14001. This means Pfannenberg is committed to doing far more for environmental protection during development, production and distribution than is required by law. Furthermore, every effort is made to develop and provide the market with innovative, environmentally-friendly technology. In keeping with these efforts, a CO₂-based model has been added to the current Pfannenberg DTI/DTS cooling unit programme (a partially counter-sunk installable and connectable version with 300W to 4000W of cooling performance). This is precisely the model that is ensuring perfect production results at tesa.

50 Years of Pfannenberg

Pfannenberg was founded over 50 years ago, and is a medium-sized company with 160 employees in Germany. The product portfolio contains ventilators, cooling units for sensitive controls, and optical and audible signal systems for diverse application areas. The company's headquarters are in Hamburg, but it also has sites in England, France, Italy, USA, Singapore, and Shanghai. Every year Pfannenberg invests about eight percent of its revenue in research and development

work. In Germany, these costs amounted to over € 30 million in 2004. 47 developments were registered for patents within the last three years.

More Efficiency with CO₂

CO₂- based cooling technology is not only significantly friendlier to the environment, but, under certain circumstances and operational conditions, it is also more efficient. Its specific cooling performance is more than five times as great as technology using fluorinated hydrocarbons. This means that the capacity of the

compressor pistons for R134a must be about 5.3 times larger than when using CO₂ in order to achieve the same cooling performance with the same hub. This means that CO₂ components theoretically allow a far more compact design than the old technology.

CO₂ Against Fluorinated Hydrocarbons

Chlorofluorocarbons (CFC) or fluorinated hydrocarbons are extremely damaging to the ozone layer. Carbon dioxide (CO₂), on the other hand, is a natural gas and is, therefore, about 1300 times more environmentally

friendly as a cooling agent than CFC or substitute materials such as the fluorinated hydrocarbon R134a. There is currently no legal principle that prohibits the use of fluorinated hydrocarbon-based cooling agents. However, the industry is already showing a trend towards the increased use of CO₂. For example, it is used in the automotive industry for manufacturing air conditioning units, or in the drinks industry for equipping vending machines.