Using air curtains without heat, to maintain the correct temperature in cold storage is a sensible choice. Energy losses are reduced, delicate products are better protected, and the accessibility by people and vehicles is improved.

An air curtain is also a sensible choice from a safety aspect as visibility is improved, and because eliminating condensation prevents ice build-up on floors.

It is important to select an air curtain that is efficient. Thanks to our ThermZONE technology we can offer air curtains with a consistent air stream and optimal balance between air speed and air volume giving a superior performance. The low sound performance of Frico air curtains is also an important factor to create a pleasant working environment.

The ability to adjust the airflow to local conditions is fundamental to achieving the desired result. Frico air curtains are therefore designed for flexible adjustment, and are also supplied with a simple but efficient adjustment gauge that helps you set the air curtain for optimal performance.

Frico has been developing and manufacturing products for a comfortable climate since 1932. Today, Frico is the leading supplier of air curtains, radiant heaters and fan heaters in Europe. We have a wide range of professionally designed products that are reliable, functional and of superior quality.

"Lowered energy losses
Ice build-up on the floor prevented
Improved visibility
Improved accessibility
Better protection"
Advantages with air curtains in cold storage

Economy
- Less cold losses. To cool down air is expensive, and large savings can be made.
- The cooling equipment will have longer life and increased efficiency as ice build-up is reduced.
- Energy is also saved through reduced need for defrosting.
- Avoiding accidents caused by ice built-up on the floor and reducing maintenance on cooling equipment also means reduced costs for equipment being idle.

Safety
- Improved visibility due to reduced condensation, and less equipment to obscure line of sight.
- Ice build-up on the floor is prevented.

Hygiene
- A more stable temperature means better product quality control.

Accessibility
- Easier access for people and vehicles.

Thermozone technology
Thermozone technology gives optimum curtain effect with perfect balance between air volume and air velocity. This provides the best possible separation with the lowest possible air flow.

Low sound level
The fans we use together with our optimized air flow geometry provides a low sound level.

Top control systems
Many of our air curtains have the intelligent control system SIRe that provides a range of options and enables an automatic process for the air curtain operation.
- The Compact range of air curtains is equipped with an integrated simple and smart system, with remote control.
- PAEC has stepless regulation of air flow which allows precise adjustment and makes a perfect choice in cold storage applications.

Design
Frico cooperates with leading architects and product designers to create smart aesthetic products for today’s projects.

Air curtain experts
Frico knows air curtains. The company was founded in 1932 and we developed our first air curtains 45 years ago. Frico is the initiator and holds the chair of the air curtain group at Eurovent, the European Committee for manufacturers of HVAC. We are happy to share our knowledge and experience and we are always available to help you choose the right product.

The market’s lowest operating cost
The air curtain-series PAEC combines EC-motors with Fricos unique fan geometry. This provides air curtains with the market's lowest operating cost.

Air curtains for every application
Frico offers a wide range of options with or without heat and for all openings from service hatches to air craft hangars.
Why use air curtains in cold storages?

**Cold storage is a demanding application.** The large temperature differences result in energy losses, temperature increase in the cold sections, condensation, and ice build-up on the floor and on cooling equipment. Thanks to Thermozone technology these problems can be avoided.

**Airflow due to temperature differences**
Warm air is less dense and lighter than cold air which causes a pressure difference at the door opening. Cold air streams out at the bottom of the opening and forces warm air in through the upper part of the doorway. See Fig. 1.
Measurements done by Frico in cooperation with Malmö University, Sweden, confirm this. See Fig. 2.

**Airflow counteracted by Thermozone technology**
Frico air curtains with Thermozone technology have a consistent air stream and optimal balance between air speed and air volume giving an efficient separation of the air masses. See Fig. 3.

**The importance of a correctly adjusted air curtain**
Adjustment is fundamental to achieve the desired result from your cold storage air curtain. Frico air curtains are therefore designed for flexible adjustment and are also accompanied by a simple but efficient feature that makes it easy to set the air curtain for optimal performance, see Fig. 3. The illustrations Fig. 4 and 5 show measurements done on air curtains that are not correctly adjusted.

The dark red colour shows room temperature and the darkest blue colour the lowest measured cold storage temperature. The value on the x-axis indicates the distance in centimetres from the air curtain, the value on the y-axis indicates the distance in centimetres from the floor. To the right of each diagram is a key to the colours/temperature relationship.

The test was made with Thermozone ADA Cool and carried out by Malmö University, Malmö, Sweden. Read more about the test in our Air curtain catalogue.

---

**Fig. 1** Airflow due to thermal pressure differences

**Fig. 2** Opening without air curtain

**Fig. 3** Opening with a correctly adjusted Thermozone air curtain

**Fig. 4** Opening with an air curtain set at the wrong angle

**Fig. 5** Opening with an air curtain, velocity too high
At Manuel Carvalho SA in Portugal the differences in efficiency between plastic strips and the Frico air curtain ADA Cool were measured. The temperature rise was measured over 24 hours, four days before the installation of ADA Cool and four days after.

ADA Cool proved to be much more efficient in keeping the cold air inside the cold storage. Manuel Carvalho SA found further advantages compared with plastic strips. Easier access is a benefit but furthermore the risk of accidents is reduced when build-up of ice on the floor is prevented, when the visibility is improved and trucks cannot get stuck in the plastic strips.

**Temperature increase over 24 hours with plastic strips**

<table>
<thead>
<tr>
<th>Time</th>
<th>Temperature Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defrost</td>
<td></td>
</tr>
<tr>
<td>Working day</td>
<td></td>
</tr>
<tr>
<td>Lunch break</td>
<td></td>
</tr>
<tr>
<td>Working day ends</td>
<td></td>
</tr>
</tbody>
</table>

Average temp. before noon: -13 °C  
Average temp. after noon: -17 °C

**Temperature increase over 24 hours with Frico air curtain**

<table>
<thead>
<tr>
<th>Time</th>
<th>Temperature Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defrost</td>
<td></td>
</tr>
<tr>
<td>Working day</td>
<td></td>
</tr>
<tr>
<td>Lunch break</td>
<td></td>
</tr>
<tr>
<td>Working day ends</td>
<td></td>
</tr>
</tbody>
</table>

Average temp. before noon: -17 °C  
Average temp. after noon: -19 °C

Customer: Manuel Carvalho SA, Portugal  
Cold storage dimension: 23 x 11 x 6m  
Dimension of opening: 2,2 x 2,5m  
Cold storage temperature: -23 °C  
Outside temperature: +20 °C  
Door opened 100 times per day
Independent tests show that a correctly installed air curtain can reduce energy losses at an open door by up to 80%. A correctly installed air curtain covers the width and height of the opening and is adapted for the stresses that it is exposed to.

- Ghent University, Belgium, ‘Study of air curtains used to restrict infiltration into refrigerated rooms’, 2009
- Technical University of Catalonia, Spain, ‘Application of Air Curtains in Refrigerated Chambers’, 2008
- University of Coimbra, Portugal, – Department of Mechanical Engineering – Luís P. C. Neto - ‘Study of aerodynamic sealing by air curtains’, 2006

Special solutions with high IP class available on request.
Example of energy savings

Cold room case

Input

- Door width: 2.5 m
- Door height: 2.5 m
- Mounting: Horizontal mounting
- Estimated floor area in the premises: 200-1000 m²
- Temperature in the room outside the cold room: 18 °C
- Temperature in the cold room: -23 °C
- Number of days per week the door is in use: 5 days
- Number of hours the business are open daily: 8 hours/day
- Average time the door is open daily: 30 seconds
- Estimated opening time: 500 seconds/day
- Number of months when these conditions are fulfilled: 12

Result

- Openings per day: 120
- Average time between openings: 210 seconds
- Airflow through the door due to temperature differences: 0 m³/s
- Estimated loss of energy without Frico air curtains: 22 500 kWh
- Energy savings with Frico air curtains: 13 900 kWh
- Energy savings: 62%

Contact us at Frico for advice

The above calculation is only an example. You are very welcome to contact us if you want to discuss the requirements for your doors. With some information from you we can give an estimate of the possible energy savings. See the following checklist with useful parameters.

- Door’s width and height
- Premises type and size
- Days per week the door is in operation
- Hours per day that the door is open
- Temperatures in/outside the cold room
Adjustment - for a perfect result

The direction and velocity of the air stream must be adjusted as follows to obtain optimum function from the air curtain. If the air velocity is too high, turbulence will occur which reduces the protective effect and the comfort inside the door. If velocity is too low, the barrier does not reach the floor and cannot protect the opening.

Cold storage and freezer rooms
Adjustment can be made using an anemometer. An alternative method is to attach a piece of thin paper on a rod. By moving it up and down the doorway it's easy to see how the air stream behaves. Start with middle speed and with the minimum unit angled outwards towards the hot side. Change to a higher or lower speed and try different angles (3 positions - 5, 10, 15°) so that it neither blows inwards or outwards, but it may blow slightly towards the warm side.

Adjustment to adapt to your installation
Conditions vary between different installations, adjustment ensures that the air curtain functions perfectly in your particular installation.

Controls take care of the rest
Adjustment is usually carried out once when commissioning, if and when the external influences change, the controls automatically compensate.

Function test
When the air curtain is not running or is not properly adjusted the fog leaks out through the opening. With a properly adjusted air curtain the cold stays in the cold room.
Frico has access to one of Europe’s most modern and advanced air and sound laboratories. It helps us to ensure that our products deliver what we promise.

We regularly carry out tests and measurements during the development of new products, but also to improve existing products. The measurements are carried out according to the AMCA and ISO standards.

At our head office in Gothenburg, we also have a test laboratory, including a cold room for real life tests.
PA-series

PA-series has a modern and discreet design to blend in well in any environment. The air curtains have many mounting solutions to fit to any entrance. PA is available for both vertical and horizontal mounting, and recessed installation. In addition, they can also be linked together to cover large doorways or many entrance doors in a row.

Control
With a well developed control system can further energy be saved. SIRe is an intelligent control system that enables an automatic solution for the air curtain operation.

Our alternative Compact range of air curtains is equipped with an integrated simple and smart system, with remote user control panel.

PAEC has stepless regulation of air flow which allows precise adjustment and makes a perfect choice in cold storage applications.

ADA Cool can be controlled with ADACR, a 5-step fan speed control and connection kit.

Good choice

AXP300, collision protection
Floor placed protection against impact from e.g. shopping trolleys.

AXP500, collision protection
Floor placed protection against impact from e.g. forklifts. Height 1 m. Colour: red, other colours on request.

Suspension

Wall brackets
Brackets for installing unit horizontally on a wall.

Ceiling mounted
Either with ceiling brackets, wire suspension, hanging brackets or threaded bars.

External intake filter

For PA-series

Intelligent and integrated control system SIRe. (PA2500, PA3500, PA4200)

Remote and integrated control. (PA2200C, PA3200C)

Stepless airflow regulation with internal/external potentiometer. Door contact optional (PAEC2500, PAEC3200)

ADACR, 5-step fan speed control. (ADA Cool)
# Technical specifications

**Ambient, no heat - PA2200CA**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PA2210CA</td>
<td>0</td>
<td>900/1200</td>
<td>67</td>
<td>42/51</td>
<td>230V~</td>
<td>0,45</td>
<td>1050</td>
<td>16</td>
</tr>
<tr>
<td>PA2215CA</td>
<td>0</td>
<td>1150/1800</td>
<td>67</td>
<td>40/52</td>
<td>230V~</td>
<td>0,50</td>
<td>1560</td>
<td>24</td>
</tr>
<tr>
<td>PA2220CA</td>
<td>0</td>
<td>1800/2400</td>
<td>68</td>
<td>43/53</td>
<td>230V~</td>
<td>0,90</td>
<td>2050</td>
<td>32</td>
</tr>
</tbody>
</table>

**Ambient, no heat - PA2500 A**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PA2510A</td>
<td>0</td>
<td>900/1300</td>
<td>70</td>
<td>43/53</td>
<td>230V~</td>
<td>0,50</td>
<td>1050</td>
<td>16</td>
</tr>
<tr>
<td>PA2515A</td>
<td>0</td>
<td>1250/2100</td>
<td>71</td>
<td>44/54</td>
<td>230V~</td>
<td>0,70</td>
<td>1560</td>
<td>23,5</td>
</tr>
<tr>
<td>PA2520A</td>
<td>0</td>
<td>1800/2600</td>
<td>72</td>
<td>44/55</td>
<td>230V~</td>
<td>1,00</td>
<td>2050</td>
<td>32</td>
</tr>
</tbody>
</table>

**Ambient, no heat - PA3200C A**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PA3210CA</td>
<td>0</td>
<td>1100/1750</td>
<td>73</td>
<td>46/57</td>
<td>230V~</td>
<td>0,70</td>
<td>1068</td>
<td>22</td>
</tr>
<tr>
<td>PA3215CA</td>
<td>0</td>
<td>1700/2750</td>
<td>74</td>
<td>46/59</td>
<td>230V~</td>
<td>1,0</td>
<td>1578</td>
<td>32</td>
</tr>
<tr>
<td>PA3220CA</td>
<td>0</td>
<td>2300/3500</td>
<td>75</td>
<td>50/60</td>
<td>230V~</td>
<td>1,3</td>
<td>2068</td>
<td>42</td>
</tr>
</tbody>
</table>

**Ambient, no heat - PA3500 A**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PA3510A</td>
<td>0</td>
<td>900/2000</td>
<td>78</td>
<td>41/61</td>
<td>580</td>
<td>230V~</td>
<td>2,6</td>
<td>1039</td>
</tr>
<tr>
<td>PA3515A</td>
<td>0</td>
<td>1400/3100</td>
<td>79</td>
<td>42/62</td>
<td>880</td>
<td>230V~</td>
<td>3,9</td>
<td>1549</td>
</tr>
<tr>
<td>PA3520A</td>
<td>0</td>
<td>1750/4000</td>
<td>79</td>
<td>43/63</td>
<td>1130</td>
<td>230V~</td>
<td>5,0</td>
<td>2039</td>
</tr>
<tr>
<td>PA3525A</td>
<td>0</td>
<td>2400/5250</td>
<td>80</td>
<td>44/64</td>
<td>1500</td>
<td>230V~</td>
<td>6,5</td>
<td>2549</td>
</tr>
</tbody>
</table>

**Ambient, no heat - PA4200 A**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PA4210A</td>
<td>0</td>
<td>950/2400</td>
<td>82</td>
<td>46/66</td>
<td>920</td>
<td>230V~</td>
<td>4,0</td>
<td>1039</td>
</tr>
<tr>
<td>PA4215A</td>
<td>0</td>
<td>1300/3500</td>
<td>83</td>
<td>47/67</td>
<td>1260</td>
<td>230V~</td>
<td>5,5</td>
<td>1549</td>
</tr>
<tr>
<td>PA4220A</td>
<td>0</td>
<td>1900/4800</td>
<td>84</td>
<td>48/68</td>
<td>1840</td>
<td>230V~</td>
<td>8,0</td>
<td>2039</td>
</tr>
<tr>
<td>PA4225A</td>
<td>0</td>
<td>2300/5900</td>
<td>85</td>
<td>49/69</td>
<td>2140</td>
<td>230V~</td>
<td>9,3</td>
<td>2549</td>
</tr>
</tbody>
</table>

**Ambient, no heat - ADA**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ADAC090</td>
<td>0</td>
<td>800/1150</td>
<td>70</td>
<td>43/54</td>
<td>230V~</td>
<td>0,50</td>
<td>900</td>
<td>9,6</td>
</tr>
<tr>
<td>ADAC120</td>
<td>0</td>
<td>1100/1400</td>
<td>67</td>
<td>44/51</td>
<td>230V~</td>
<td>0,55</td>
<td>1200</td>
<td>11,8</td>
</tr>
</tbody>
</table>

*) Recommended installation height and width varies depending on the relevant premises.

**) All data is preliminary and subject to change without notice
Frico offers a wide range of options with or without heat and for all openings from service hatches to air craft hangars. Frico air curtains give a comfortable indoor climate, free from drafts, and the losses of heated or cooled air are significantly reduced with correctly installed air curtains. The air curtain also keeps out insects and emissions.

Solves special needs for loading docks

Hygiene
Keeps out insects and emissions.

Safety
Loading platforms are often exposed to both heat and cold during the winter. This can result in an ice build-up leading to a dangerous working environment which complicates the loading and unloading of goods. Air curtains prevent the ice build-up on the floor when eliminating the hot air escaping onto the loading platform.

Visit www.frico.se to take advantage of our full product range of air curtains.

References