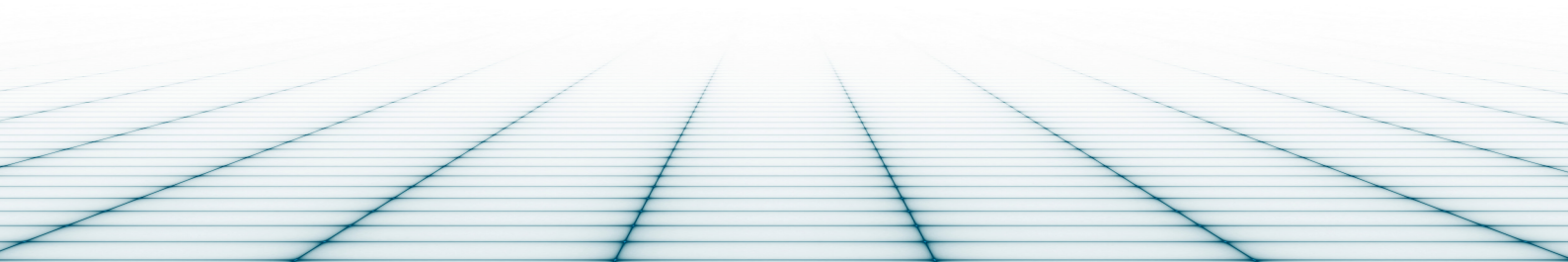


Cold Corridors® for a new generation of data centres

Flexible, modular & optimally integrated

By Niek van der Pas



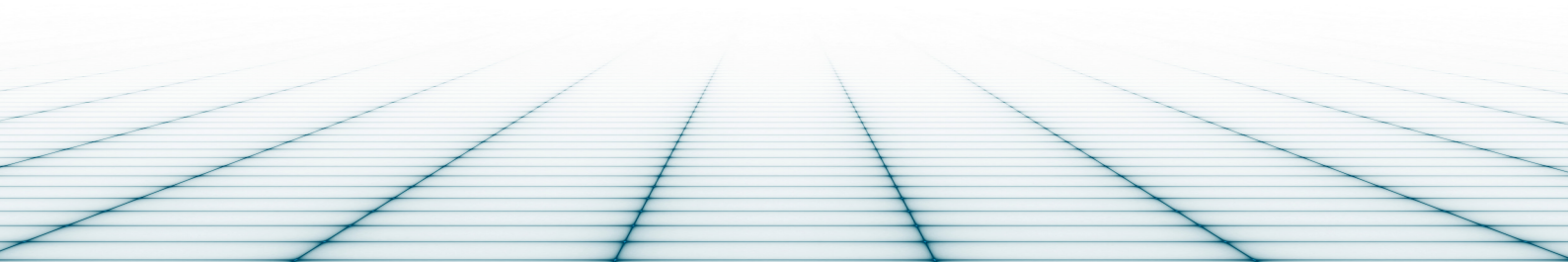
Summary

Cold Corridors® form the solution to a challenge that data centres have been presented with for many years: optimising the cooling and energy-efficiency through optimal separation of hot and cold airflows. However, in the current data centre world optimisation of cooling and energy-efficiency are not the only challenges that data centre managers and owners face.

Because of a shorter life cycle for IT-equipment, data centre managers and owners have been faced with a higher rate of change in the centre. Traditional Cold Corridors offer insufficient flexibility and modularity to deal with this dynamic of a higher rate of change. Next to this, data centre managers and owners are more and more often being faced with systems - like storage equipment - which are not provided with standard housing and are therefore difficult to fit into a traditional Cold Corridor. Furthermore, traditional systems offer insufficient opportunities for optimal integration of, for example, sensors for adequate management, or of the multiple cooling systems.

The presented challenges require Cold Corridor solutions which offer a higher flexibility and modularity, as well as more integration options. With the Next Generation Cold Corridor® and the Free Standing Cold Corridor®, Minkels offers data centre managers and owners 'future proof' solutions which offer flexibility and modularity to be able to anticipate the dynamic of the data centre of today. Through the continuous innovation, furthermore, data centres are capable of even more energy-efficient operation than was possible with the traditional Cold Corridors, partly because of optimal integration of, for example, sensors for management and the cooling techniques that are being applied within the data centre.

With the Next Generation Cold Corridor and the Free Standing Cold Corridor, Minkels offers the best solution for every situation. This white paper is created to support data centre managers, data centre owners, architects and consultants in making the optimal choice.





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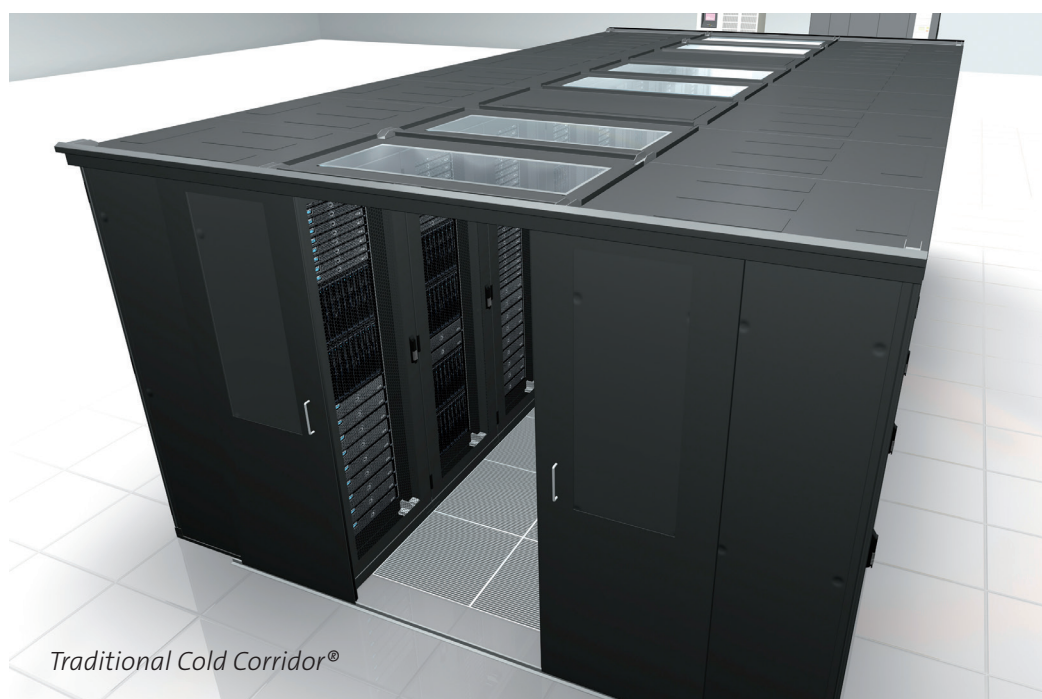
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Introduction

For many organisations, the need for data centre space is highly dynamic and, because of this, hard to predict. As a result of this uncertainty, there is a need for flexibility, modularity and easy integration options in the areas of sensors, cooling systems, wiring and housing with many data centres. Minkels fills this need with the Next Generation Cold Corridor and the Free Standing Cold Corridor. In this white paper both solutions will be elaborated upon.

Traditional Cold Corridors

Cold Corridors form the solution to a challenge that data centres have been presented with for many years: optimising the cooling and energy-efficiency through optimal separation of hot and cold airflows. Servers are housed in closed corridors. Cold air is blown through these corridors to cool the servers. The hot air that the servers produce is extracted at the end of the corridor.



Traditional Cold Corridor®

¹ For more information on the optimisation of airflows, see Minkels white paper 04, 'Rack Airflow Optimisation' by Patrick Timmers. www.minkels.com/whitepaper

Through this placement cold air is prevented from mixing with hot air, and no energy is lost¹. Because of this, the savings in energy realised through a Cold Corridor can reach up to forty percent. In addition, a Cold Corridor allows for more focused cooling. Through this focused cooling, the occurrence of hot spots in the data centre can be avoided and the power per rack can be increased.

New requirements for Cold Corridors

In 2006, Minkels was the first data centre provider to commercially introduce Cold Corridor-solutions to the Western European market.

² Data Centre Study, 'Flexibility and Modularity.' Pb7 Research commissioned by Minkels, Peter Vermeulen, September 2014. For this study, 81 data centre decision makers and other IT decision makers of Dutch organisations were interviewed.

Flexibility, modularity and integration

In 2006, Minkels was the first data centre provider to commercially introduce Cold Corridor®-solutions to the Western European market, and with success. However, the data centre-world has changed. Because of a shorter life cycle for IT-equipment, data centre managers and owners have been faced with a higher rate of change in the centre. Thus, the need for floor area, power and bandwidth are difficult to predict for a longer period.

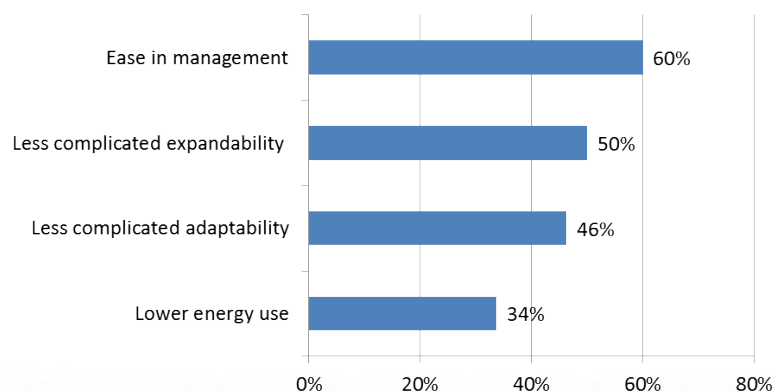
Traditional Cold Corridors offer insufficient flexibility and modularity to deal with this dynamic of a higher rate of change. Next to this, data centre managers and owners are more and more often being faced with systems - like storage equipment - which are not provided with standard housing. These 'proprietary housings' are difficult to fit into a traditional Cold Corridor, which would promote the realisation of an optimal energy-efficiency. After all, cabinets which for this reason will have to be placed outside of the Cold Corridor cannot profit from the energy-saving measures in the Cold Corridor, and in the worst case can cause hot spots in the data centre.

Furthermore, traditional systems offer insufficient opportunities for optimal integration of, for example, sensors for adequate management, or of the multiple cooling systems. A study recently undertaken by Pb7 Research and commissioned by Minkels² even shows that 'integration' is the top requirement set by data centre and IT decision makers for modular data centres.

"The need for data centre space is highly dynamic, and because of this difficult to predict, for many organisations. With an average investment horizon of 3,7 years, it is important to design a flexible data centre which is capable of reacting to unexpected developments."
~ Peter Vermeulen, Director of Pb7 Research.

The same study by Pb7 Research shows that as many as 43 percent of the interviewed see a modular set-up as the most important means for dealing with uncertainty caused by, amongst others, the higher rate of change in data centres. The expectation of the interviewed is that a modular set-up of the data centre will lead to, amongst others, ease in management (60 percent), less complicated expandability (50 percent), less complicated adaptability (46 percent) and a lower energy use (34 percent). Furthermore, Cold Corridors must offer sufficient flexibility to integrate cabinets with varying dimensions.

Advantages



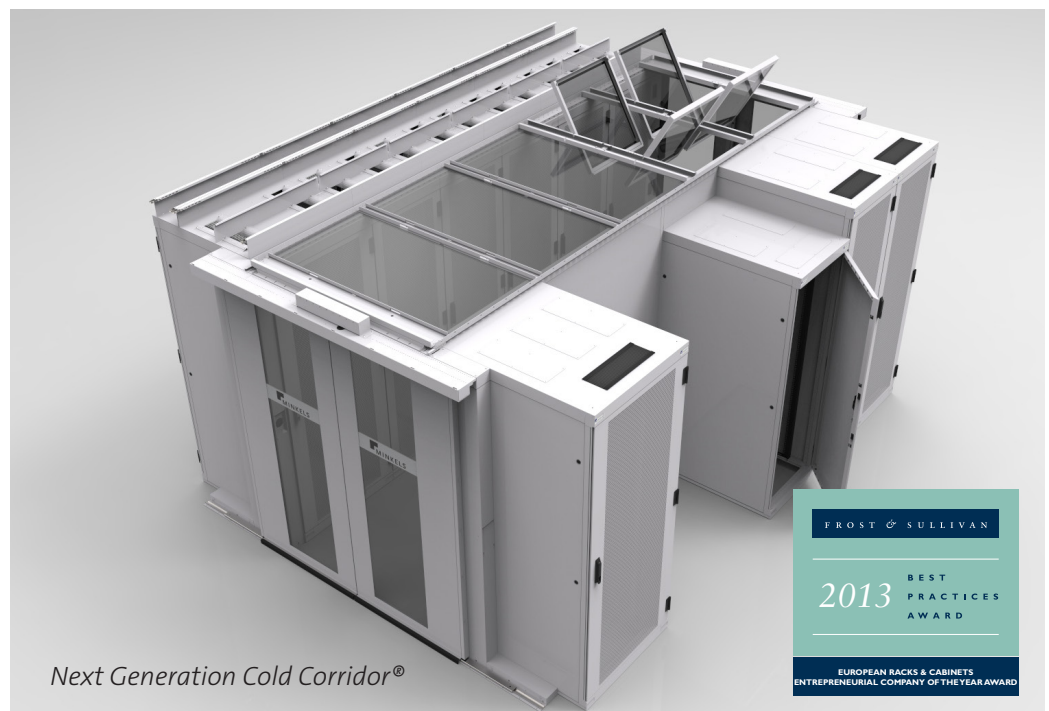
“In terms of modularity, data centres are mainly looking for easy integration possibilities in the areas of sensors, cooling systems and cabling. The benefits that flexible wall and roof panels offer for making the energy use more efficient, are insufficiently recognised.”
~ Peter Vermeulen, Director of Pb7 Research.

The need for higher flexibility, modularity and possibility for integration which has been identified by Pb7 Research, however, cannot be met by the traditional aisle-containment solutions. Minkels fills these needs with the Next Generation Cold Corridor and the Free Standing Cold Corridor.

Next Generation Cold Corridor®

In 2013, the Next Generation Cold Corridor was presented as Minkels’ answer to the ever increasing need for flexible and modular solutions. With this concept, for example, roof panels that are fitted to rails and not fixed to the cabinets, are used. When one or more cabinets in row need to be installed later, the openings can be closed with a flexible wall panel system.

The Next Generation Cold Corridor is an enormous step forward in terms of flexibility, modularity and system integration



Important characteristics of the Next Generation Cold Corridor are:

■ **Modularity.** With the highly modular concept of the Next Generation Cold Corridor, Minkels offers extensive options to implement a Cold Corridor solution in phases and thus cost-efficiently.

■ **Flexibility.** It is possible to flexibly adapt the Next Generation Cold Corridor to a specific building environment because of its modular structure.

■ **Ease of installation.** Modularity in construction details ensures that the solution can easily and cost-efficiently be installed.

■ **Energy-efficiency.** With the Next Generation Cold Corridor, Minkels offers a solution which is more energy-efficient than the Cold Corridor models that were on the market previously.

■ **Optimal integration.** The Next Generation Cold Corridor can be integrated with row based cooling systems that place the cooling close to the heat source, but also with more traditional ways of cooling that require a raised floor. Next to this, the concept offers plug-and-play integration with, for example fire detection and extinguishing systems³, security systems, monitoring sensors and entry control. With the use of a ‘pivot roof’ system, the rotating roof panels –which open when the extinguishing system turns on- are guided by the building’s managing system (active) or by using a thermal fuse (passive).

Minkels believes that every scenario calls for a different solution. For example, there are always systems with abnormal dimensions which are not as easily integrated in a Next Generation Cold Corridor. Moreover, an expansion of the corridor also brings with it some remodeling: the door system must be disassembled and, after addition of the new cabinets, re-assembled. The roof also must be elongated, and sensors for, for example, the VESDA-system and the temperature measuring system must be added. These measures can lead to the entire system needing to be re-certified.

An option would be to place a Next Generation Cold Corridor which is calculated to allow for growth, including the cabinets we are expecting to be necessary. However, this is an option that brings with it a high initial investment and some vacant cabinets.

³ For more information about the integration of fire extinguishing and detection systems within the Minkels Cold Corridors, see Minkels White paper 05, ‘Integration of the Cold Corridor® with Fire Suppression Systems’, by Patrick Timmers. www.minkels.com/whitepaper

DISTINGUISHING CONCEPT REWARDED BY FROST & SULLIVAN

In comparison to traditional aisle-containment systems, the Next Generation Cold Corridor is an enormous step forward in terms of flexibility, modularity and system integration. Therefore, the innovative concept won Minkels the ‘2013 European Frost & Sullivan Award’ for ‘Entrepreneurial Company of the Year’.

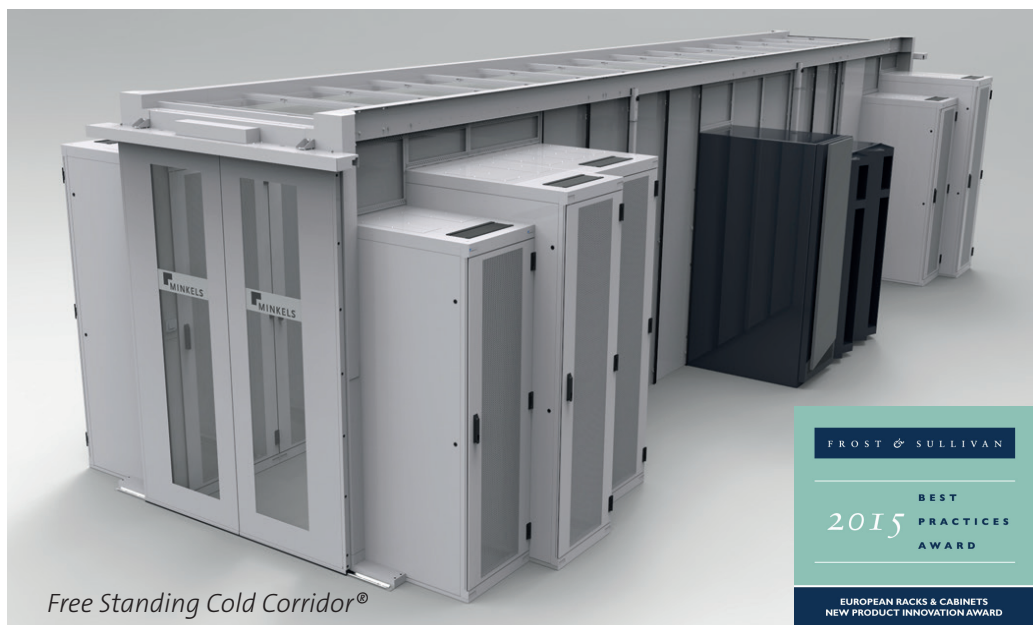


Free Standing Cold Corridor®

With the Free Standing Cold Corridor, Minkels offers the ultimate freedom to add or switch cabinets, or integrate equipment and cabinets with abnormal dimensions during the product's life cycle.

The Free Standing Cold Corridor uses the same doors and roof panels as the Next Generation Cold Corridor, but the difference is that the former is a 'self-carrying' construction. Where previously a mechanical link to the cabinets was always required, a Free Standing Cold Corridor is lifted over a row of cabinets, as it were.

With the Free Standing Cold Corridor, Minkels offers the ultimate freedom



The self-carrying character of the Free Standing Cold Corridor offers a large number of advantages.

The Free Standing Cold Corridor offers amongst others:

■ **Low start-up costs (Capex):** Because the construction doesn't use racks for support, an initial investment in cabinets that carry the construction is not necessary. The Free Standing Cold Corridor has the same energy-efficiency as a regular Cold Corridor design with data centre cabinets directly after implementation. With this, Minkels offers a pay-as-you-grow model for an energy-efficient separation of hot and cold airflows.

- **Ultimate modularity:** Through the lack of a mechanical connection between the cabinets and the aisle containment, it is possible to install, remove or change the cabinets quickly and easily.
- **Optimal flexibility:** The design of the Free Standing Cold Corridor offers the flexibility to fit different types and sizes of cabinets –for example, for storage and network equipment– at a later time.
- **Optimal system integration from day one:** It is possible to fit all integration parts for, for example, monitoring, security and the extinguishing system before placement, even for the cabinets which have not yet been installed. In this way, the risk of downtime caused by alterations later in the life cycle of the Cold Corridor is minimised and certification is guaranteed.



MINKELS IN 2015 AGAIN REWARDED WITH FROST & SULLIVAN AWARD

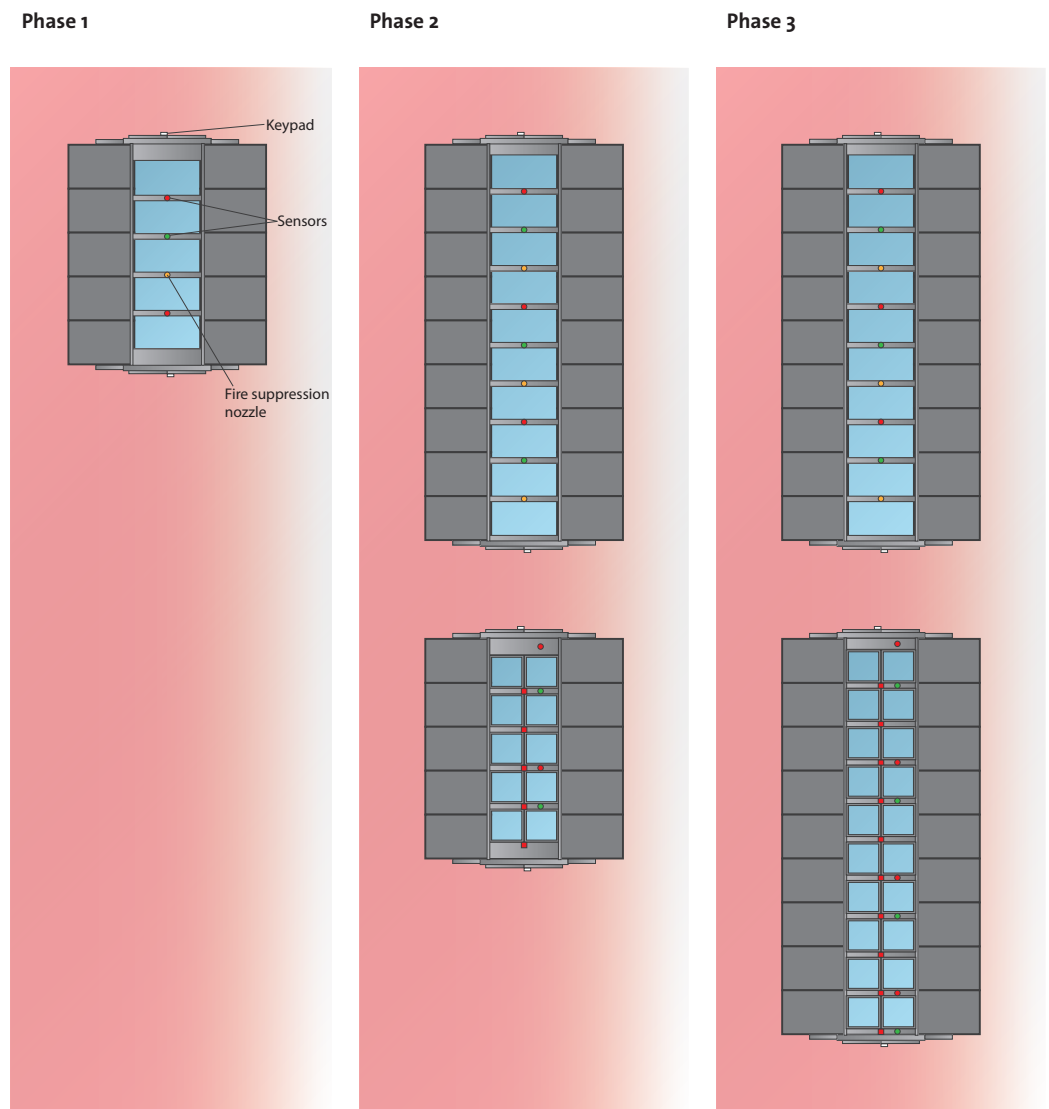
Also in 2015 the Minkels' Free Standing Cold Corridor is recognised as a ground breaking solution in terms of modularity and flexibility, which will provide significant benefits to the end user. With its strong overall performance, Minkels has earned Frost & Sullivan's 2015 New Product Innovation Award.

Next Generation or Free Standing?

With the Next Generation Cold Corridor and the Free Standing Cold Corridor, Minkels offers two modular and flexible cold-containment solutions which are suitable for use with the different cooling techniques that are available on the market. The main difference between both options is the way in which an expansion of the number of cabinets can be realised. As shown in figure 2, in the case of a Free Standing Cold Corridor the containment is placed in one go and gradually filled with new and also deviating cabinets. An expansion or re-installation of sensors, security systems or the 'pivot roof' is not necessary with this solution. In the case of a Next Generation Cold Corridor an expansion of the number of cabinets means the expansion or addition of a containment, see figure 1.

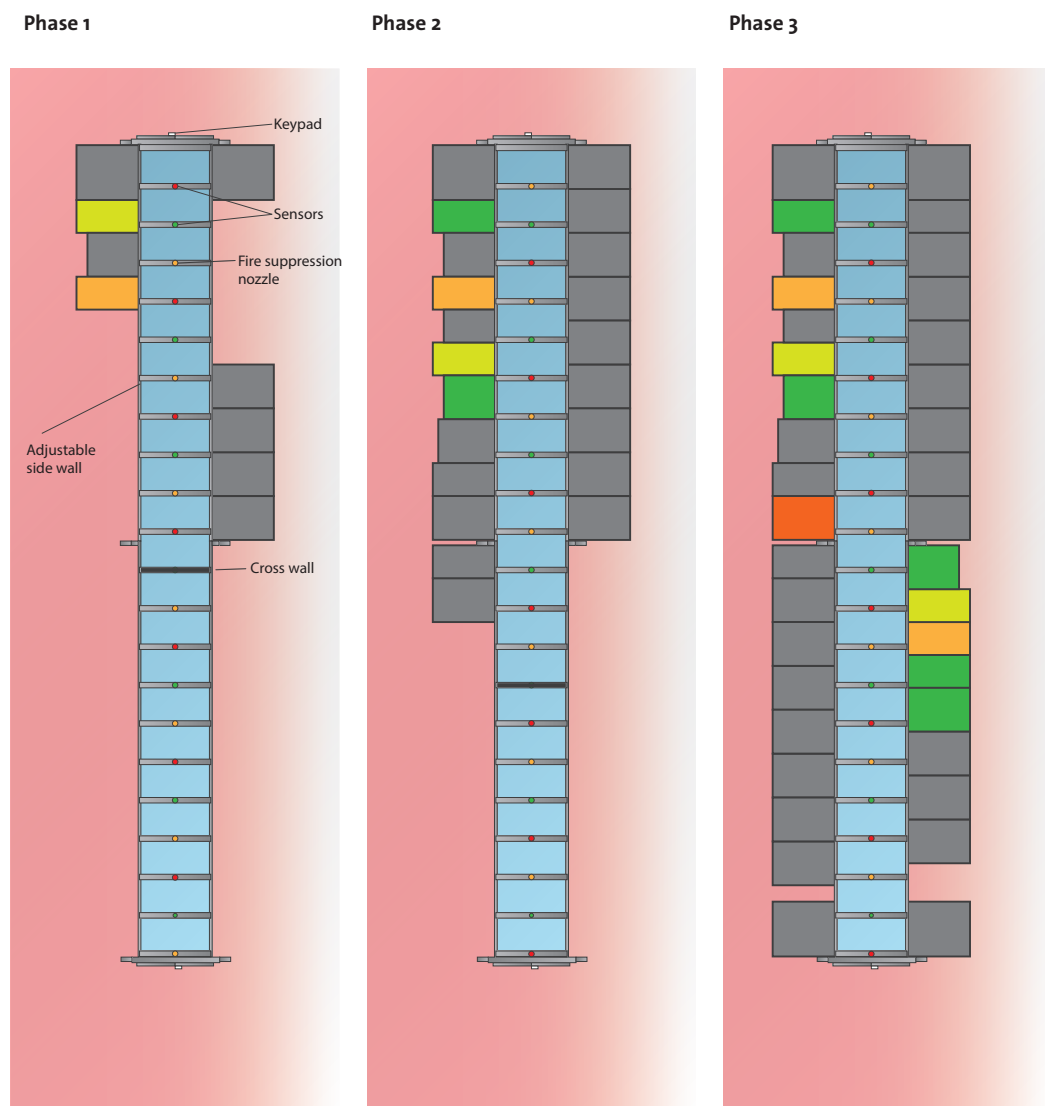
"For many managers it's difficult to form well-sealed corridors in a data centre that contains many cabinets of different brands and types. With the Next Generation Cold Corridor and the Free Standing Cold Corridor Minkels offers flexible and modular cold containment solutions that integrate with different types of data centre cooling. This makes the data centre management easier and also provides an organised installation, because there are no more unintegrated pieces of equipment in the room." ~ Niek van der Pas, Strategic Product Designer Data Centres at Minkels.

Figure 1: Theoretic example of the step-by-step expansion of a Next Generation Cold Corridor.



Phase 1	Phase 2	Phase 3
Next Generation Cold Corridor with 10 standard cabinets.	The first Cold Corridor is extended and second Cold Corridor is build. From one side the Cold Corridor doors are demounted and reassembled.	The 2nd Cold Corridor is extended by demounting and reassembling the doors.
Auto sliding doors with keypad.	A pivoting roof is installed in the second Corridor to avoid recertification of the extinguishing system.	The extended part is equipped with pivoting roof panels and new sensors.
Sensors installed in the roof of the corridor.	New sensors are installed in the roof of the extended and new corridor.	The sensors, the security system and the pivoting roof system have to be configured in the management system.
Corridor is equipped with nozzles for a fire suppression system.	The sensors, the security system and the pivoting roof system have to be configured in the management system.	
The sensors and the security system are configured in the management system.		

Figure 2: Theoretic example of the step-by-step expansion of a number of cabinets within a Free Standing Cold Corridor.



Phase 1	Phase 2	Phase 3
Free Standing Cold Corridor with 8 standard cabinets and 2 integration cabinets.	Different sized cabinets are added. One cabinet is replaced by a new cabinet.	Different sized cabinets are added.
Auto sliding doors with keypad and the possibility to place a cross wall to save costs.	No reprogramming of management systems is needed.	Gradually the data centre is filled without installation or reassembling of doors, roofs, sensors or fire extinguishing systems.
Sensors installed in the roof of the corridor.	Move the cross wall	
Corridor is equipped with nozzles for a fire suppression system.		
The sensors, the security system are configured in the management system.		

With the Next Generation Cold Corridor and Free Standing Cold Corridor, Minkels offers the best scenario for every situation. Which scenario eventually will be chosen depends strongly on the demands that are asked of the Cold Corridor (see also table below). A Next Generation Cold Corridor, for example, can be preferred when busbars and cable management systems which are placed atop of the cabinets are used. If there is a high uncertainty in regard to the amount of cabinets to be placed and a large diversity in systems, the Free Standing Cold Corridor might be the preferred option.

Table 1: The choice between a Next Generation Cold Corridor and a Free Standing Cold Corridor depends on the demands that are asked of the Cold Corridor.

	Next Generation Cold Corridor	Free Standing Cold Corridor
Integration different depth cabinets	●●●	●●●
Integration different height cabinets	●●○	●●●
Integration different width cabinets	●●○	●●●
Integration different brand cabinets	●○○	●●●
Modularity	●●○	●●●
Integration sensors	●●●	●●●
expandability with cabinets	●●○	●●●
Row Based Cooling	●●●	●●○
Integration fire extinguishing system	●●●	●●●
Initial investment*	●●○	●●●
Separation hot and cold air	●●●	●●●
Pivoting Roof	●●●	●●●
Cold Corridor setup	●●●	●●●
Hot corridor setup	●●●	●●●
Avoidance hot spots	●●●	●●●
Enabling Energy efficiency	●●●	●●●
Power per m2	●●●	●●●
Top of the rack cable management**	●●●	●●○
Busbar Integration	●●●	●●○
Cross wall	○○○	●●●
Adjustable side wall	●●○	●●●
Flexibility in cabinet changes/replacement	●○○	●●●

* Including supporting racks (necessary)

** Minkels development

Conclusion

With the Next Generation Cold Corridor and the Free Standing Cold Corridor, Minkels offers data centre managers and owners 'future proof' solutions which offer flexibility and modularity to be able to anticipate the high dynamic of the data centre of today. Through the continuous innovation, data centres are capable of even more energy efficient operation than was possible with the traditional Cold Corridors. Partly because of optimal integration of, for example, sensors for management and the cooling techniques that are being applied within the data centre.

However, this does not end the innovation. Minkels continues to innovate her products to reach a more optimal integration of parts within the Free Standing Cold Corridor, for example of the parts which are placed on top of the rack in the Next Generation Cold Corridor. With this, Minkels proves that, as a knowledge-driven organisation, it is constantly examining possibilities to further integrate the modularly structured solution portfolio.



