

DEXTHERMIC®

The Dirty Air Heat Exchanger (DAHX)®

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The DexThermic makes such significant savings that it pays for itself in less than two years.

”



Introducing DexThermic

A cutting edge commercial heat harvester

The DexThermic recoups heat from the extract air system, enabling you to pay for energy once and use it repeatedly for space heating and hot water.

Who is Dext?

The team came together in 2009 with decades of combined industry experience to share. Dext is a fast growing company, committed to staying at the forefront of heat recovery technology.

We build sustainable systems that withstand the rigours of real world use in fast-paced and demanding industries.

Our technology brings powerful yet sustainable performance, lowers energy bills, recoups heat, and reduces emissions. These systems work intelligently for clients, and for the environment.

We are fully conversant with all current legislation, committed to best working practices, and insistent upon attention to detail.



Who is already working with Dext?

Nando's was one of the first big players in the hospitality sector to realise the potential of Dext's first product, the DexTherm. Our pillow plate heat exchanger can now be found in more than 400 Nando's restaurants across the UK.

Following a very successful onsite trial, the DexThermic will soon also be rolled out at Nando's sites up and down the country.

Industry-leading heat pump supplier Daikin, and Sheffield Hallam University are another two of the well respected organisations already proud to partner with Dext in bringing this state of the art technology to market.

Nando's Head of Construction
Michele Matonti said:

"There's already a DexTherm in 400+ Nando's restaurants across the country, and we were first in line when the opportunity to develop the DexThermic rose."

"As a like-minded company, eager to work ever more sustainably, Nando's is firmly behind what DEXT is doing. Not only do they have this innovative approach to energy, and reducing waste – they make sure the technology is robust and practical enough to withstand the challenges of everyday use in high traffic environments."



With Dext, you don't need to compromise on profitability in order to benefit the environment.

Our sustainable technology is not only designed to reduce your carbon footprint and meet your organisation's ESG goals, it measurably boosts your bottom line.

These hard-working systems combine purpose, performance and practicality.

We offer a complete design process for heat recovery technology. Each system is tailored bespoke to your site, to fully optimise performance and save the most heat, the most energy, and the most money.

"The DexThermic captures an already paid-for 'by product' (the expelled heat from cooking etc) and directs it back into the restaurant's heating and hot water system.

"It uses Daikin heat pump technology and the warm extract air stream as a consistent heat source.

"Years of investment and research and development have gone into the evolution of the DexThermic to ensure it can withstand all the variables of working in a contaminated exhaust system; its innovative design means it recovers heat that would be wasted with conventional heat recovery technologies.

"With Nando's, the DexThermic recovers waste heat from things like the cooking process, lighting, and from the body heat of diners in the restaurant. This reduces the company's reliance on traditional gas or electric heating systems.

"For comparison, direct electric heating systems are 100% efficient or less (you pay for 1kWh of electricity, and you get 1kW of heat) whereas heat pump technology is around 300% efficient. You gain much, much more than you pay for."



Dext's Commercial Director
Neil Bracewell explains



The DexThermic makes such significant savings that it pays for itself in less than two years.



Dext's Technical Director
Dr. Gareth Evans explains

The Technical Details

How Our Heat Recovery System Works

Our unique **DexThermic®** design, the Dirty Air Heat Exchanger (DAHX)®, is for installation within a contaminated extract air stream. It recovers waste heat from processes where conventional heat recovery methods are prone to failure.

A re-imagined Air-to-Fluid heat exchanger, optimised through advanced analytical simulation and testing to create a system with high levels of air boundary interaction, high heat recovery rates and optimised heat transfer performance.

- Developed, tested, and quantified using state-of-the-art methodology and test equipmentⁱ;
- Minimises physical obstructions in the air stream, reducing the barriers that cause fouling and blockages. The design utilises a longer air flow channel than traditional Finned Tube Coil Heat Exchangers which allows space for the core technology to function effectively;
- Our unique Fluid Fin-Panel (FFP) Technology; Creates a cushion of air to encourage the particulate matter away from the surface of the recovery fin-panels while stimulating heat transfer through complex turbulent flow regimes external to the recovery surface, resulting in optimised external heat transfer and fouling resistance;
- The design encourages complex internal fluid flow regimes that ensure turbulent flow and complete mixing of the heat transfer fluid internal to the recovery Fluid Fin-Panels (FFP), resulting in optimised internal heat transfer and fluid distribution.

The DexThermic product range is specifically designed to provide heat for:

-  Incoming Air
-  Underfloor Heating
-  Radiator Heating
-  Hot Water

Key Design Features

Air and Fluid Handling

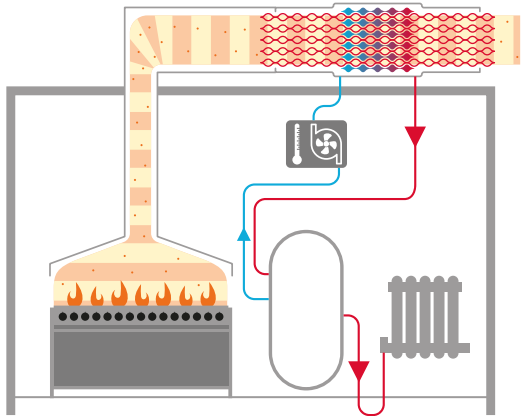
- Low air pressure drop design with increased air passage ratio minimising physical obstructions in the air stream; reducing the physical barriers that cause fouling and blockages;
- Configurable to suit site requirements; Unit is bidirectional and can accept inlet air flow and fluid connections from either sideⁱⁱ.

Physical Attributes

- Fluid Fin-Panel (FFP) Array with internal fluid channel design; Simplifies thermal path between air and working fluid;
- Designed be retrofitted into existing extract systems with minimal effect on specific fan power requirements;
- Precision manufactured modular constructionⁱⁱⁱ;
- Designed to be floor or ceiling supported;
- Opening cassette design allows service, cleaning and inspection while extract system is still in operation;
- Incorporated drains for condensate, contaminants and washdown waste.

Ancillary Options

- Mounting points for Control & Ancillary Unit (CAU)^{iv};
- Full performance I/O networking capable. DAHX performance can be remotely monitored to show real-time performance and energy savings;
- Multiple insulation options to suit the specific site requirements.

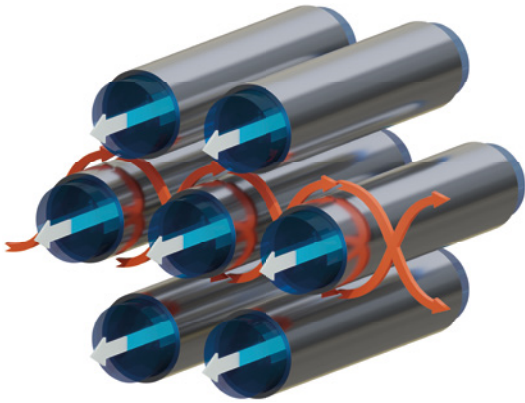


Our Core Technology

We carefully balanced the trade-offs between heat transfer rate, pressure drop, and overall surface area to create our unique Fluid Fin-Panel (FFP) array. By applying fundamental principles of physics and design found in Tube Coil and Finned Tube Coil Heat Exchangers, we developed a solution that reduces fouling and particle resistance on the air-side.

This was achieved through the incorporation of advanced geometries for both the air-side and fluid-side, which introduce turbulence into the airflow and fluid flow pathway. The result is an increased heat transfer rate relative to the overall surface area, resulting in improved performance and durability.

Tube Coil Heat Exchanger

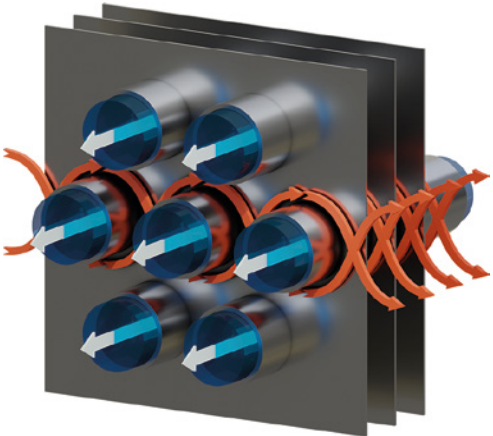


The design of a Tube Coil Heat Exchanger transfers heat between the air and fluid via the wall of the tubes. The fluid flows through a series of tubes, while the air passes over the tubes, transferring heat energy to the fluid.

Advantages: This design has a simple thermal resistance pathway, where the resistance is determined by the tube material's thermal conductivity, the thickness of the tube wall, and the heat transfer coefficient between the fluid inside the tubes and the surrounding air. This offers several advantages, including simplicity, ease of manufacture and cost-effectiveness.

Disadvantages: Using a simple flow regime with non-turbulent flows has several disadvantages. One of which is that it results in low heat transfer coefficients for both air and fluid flows. To compensate for this, more tubes can be added, and flow rates can be increased, but this can lead to reduced fouling resistance, increased pressure drop, and increased specific fan power requirements.

Finned Tube Coil Heat Exchanger

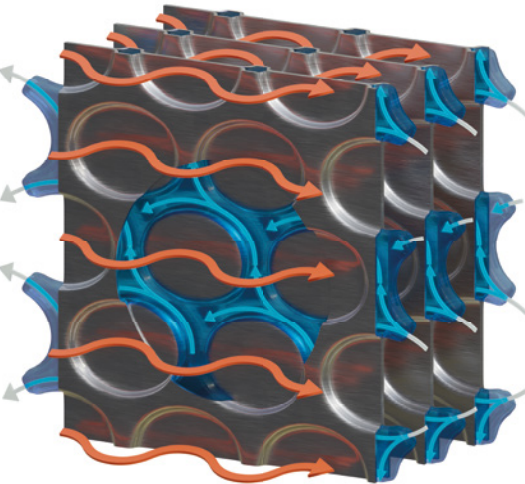


The Finned Tube Coil Heat Exchanger was initially created to enhance the performance of the Tube Coil Heat Exchanger through the introduction of extended surfaces (Fins). As a result, this design employs a more intricate thermal resistance network.

Advantages: The presence of extended surfaces (fins) increases the heat transfer area and alters the air flow patterns, resulting in a more complex thermal resistance pathway. More complex external flow regimes create turbulence and higher heat transfer coefficients for the air flow pathway. This, combined with the increased surface area, results in improved thermal performance and a reduction in overall tube lengths and fluid pressure drop.

Disadvantages: The increased surface area and complexity of the thermal resistance pathway in a heat exchanger result in a higher potential for fouling, air side pressure drop, and increased specific fan power requirements.

Fluid Fin Panel Array



Our innovative solution combines the best of Tube Coil and Fin Tube Coil designs to deliver an application-specific product that actively resists fouling.

Advantages: The system facilitates efficient heat exchange between air and fluid by utilising a simple thermal resistance pathway, which enhances high heat transfer coefficients between the fluid enclosed within the Fin-Panels and the surrounding air. The fluid and air circulate through a complicated network of internal and external passages, consistently altering direction and generating turbulence. This design improves fouling resistance, reduces pressure drop, and lowers specific fan power requirements.

Disadvantages: For Dext, the disadvantage of this design was that it required us to go back to the drawing board and carry out extensive, in-depth research & development, testing, and validation; requiring significant investment and several years of hard work. The result was exceptional though, thanks to Dext's determination and the support of a UKRI research projectⁱ.

This new Fin-Panel technology has the potential to revolutionize the field.

Design Pathway



Heat Suitability Matrix

A heat suitability matrix is presented below outlining appropriate conditions for each system. **Source** represents Dirty Extract Temperature, and **sink** shows options for Domestic Hot Water (DHW) Space Heating (SH) Space Pre-Heating (SPH).

Note: Space pre-heating will require a main heating source to satisfy demand.

Product Configuration	Source: Dirty Extract Temp			Sink: Heat Output		
	≤ 35°C	> 40°C	≥ 90°C	DHW	SH	SPH
Product: CO Heat Pump Version System: HP						
Product: QO Run Around Version System: RA						
Product: QO High Temperature Version System: HT						

Product Range

D

To wring every last drop of value from the DexThermic system, it must be accurately specified and intelligently integrated into your premises... Otherwise, it's a bit like having a high-performance battery constantly charged up, and not plugging anything into it!

The DexThermic is not an isolated product, it is designed to connect and work in synergy with your organisation's systems and equipment, and has three possible configurations.

The clearest way to think about integrating the DexThermic is by considering two concepts: Heat sources & sinks, and heat quality & quantity.

Sources & Sinks

A **source** of heat is where the heat energy originates or is generated. It is a location or system that has excess or unused heat available. (Think cooking, industrial processes, and power plants for example).

A **sink** is a location or system that can accept / absorb the heat and use it for another purpose. (Think space heating, hot water, dishwashers etc)

By connecting a source and a sink together effectively, you establish a heat recovery system. Recovering heat from the source and transferring it to the sink means it can be utilised instead of wasted. This ensures you make the most of the available heat energy, reduce waste, save costs, and operate much more sustainably.

Quality and Quantity

When we talk about **quality** in heat recovery, we are referring to the temperature (°C) of the recovered heat and its value for performing various tasks. Heating hot water, for example, requires much higher temperatures than heating incoming air.

If your process currently produces relatively low temperatures, we can use a heat pump to bolster those temperatures improve the *quality* of the heat. Your operations may already produce very high temperatures, negating the need for a heat pump. That's why there are different variants of the DexThermic system available to suit your needs.

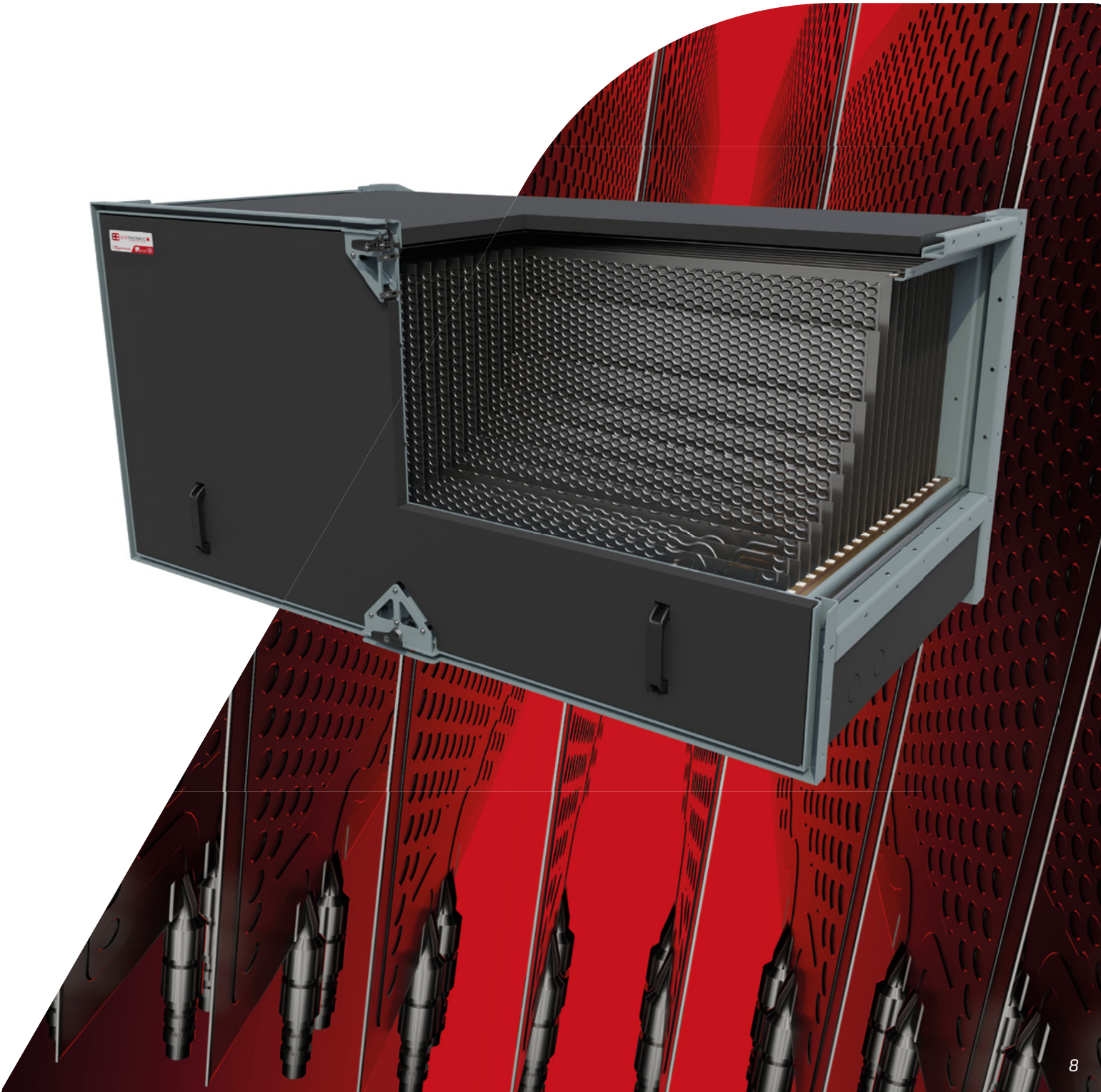
Quantity, as you'd expect, refers to the measurable amount of 'heat energy' that can be captured and reused (kW). The more heat we can recover, the greater the potential for saving energy and reducing waste.

Product Code Guide

The DexThermic is available in a number of configurations to suit your specific circumstances. We can assess the heat **source** and the available heat redistribution **sinks**, and find the best way to balance heat quality and quantity to meet your requirements.

Let's call the core technology the **Product**, and the distribution system required to integrate the product into your premises the **System**.

The product is currently available in one duct size (W850xH550xL1800), two product variants; **Quality Optimised (QO)** or **Coefficient Optimised (CO)** and three system configurations; Heat Pump (HP), Run Around (RA) or High Temperature (HT) to suit the specific heat recovery application.



Product Code Guide

DAHx-850-550-1800-19-500H-1595-C2-COHP

A B C

Duct Parameters

D E F G H I

Core Parameters

A - Width
B - Height
C - Length
D - Number of Panels
E - Panel Height

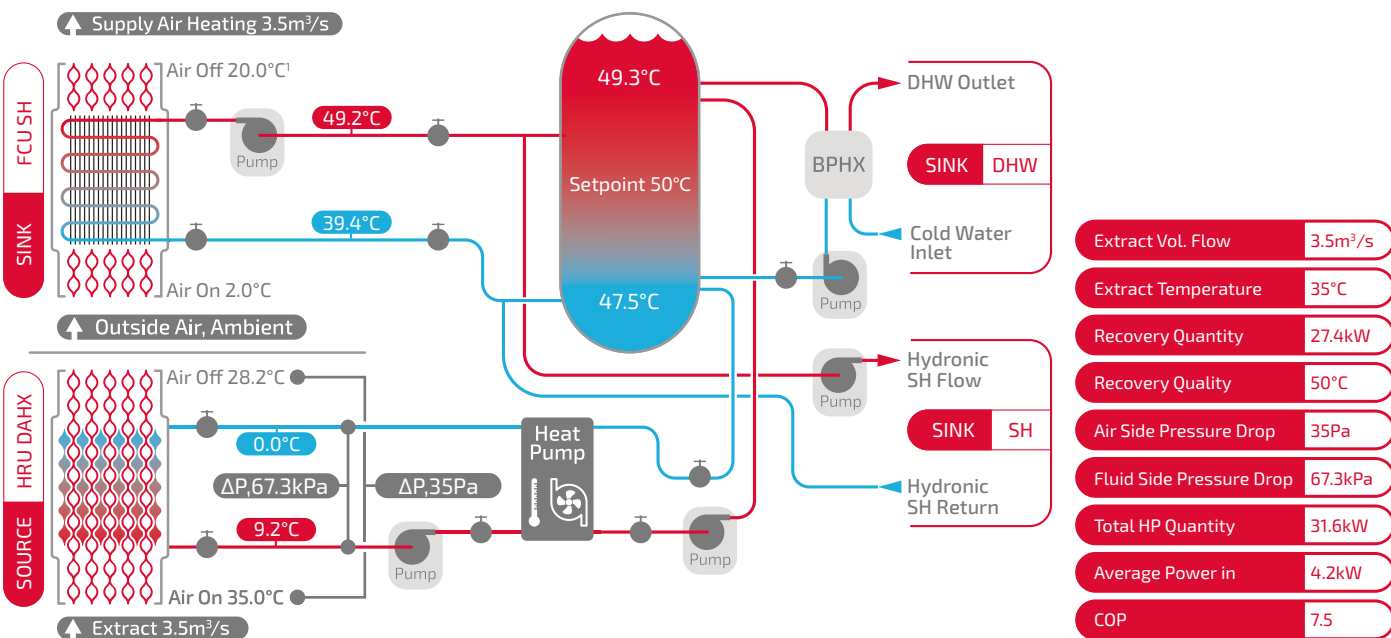
F - Panel Length
G - FP Pattern
H - Product Configuration
I - System Configuration
 Coefficient Optimised: Heat Pump
 Quality Optimised: Run-Around
 Quality Optimised: High Temperature

What's the difference between the three systems?

E

DexThermic CO-HP

DAHX-850-550-1800-19-500H-1595-C2-COHP Heat Pump Version



The DexThermic-CO-HP system reduces your reliance on conventional gas and electric heating systems.

HP in the product code stands for heat pump.

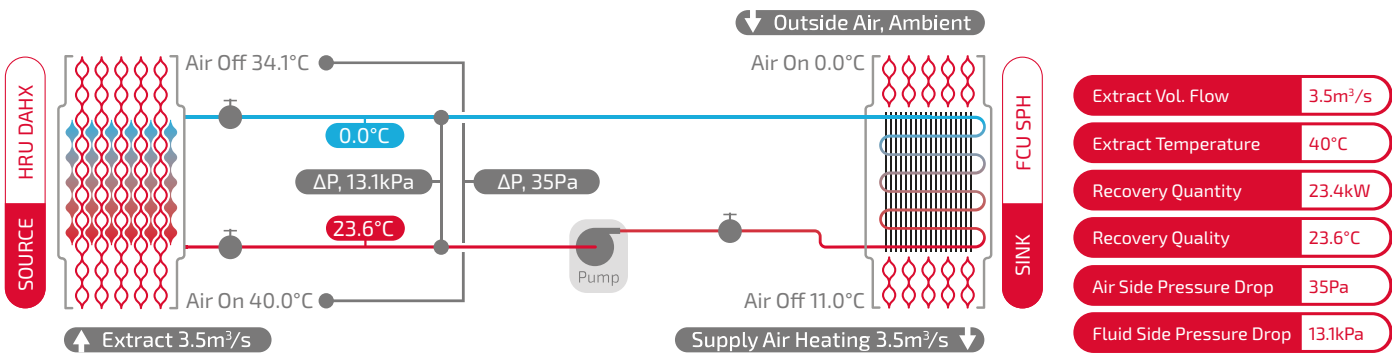
It uses the contaminated extract air stream as a source of consistently warm temperatures for a heat pump to perform optimally. This meticulously designed system can deliver remarkable efficiencies, boasting coefficient of performance (COP) values ranging from 3 to 7+.

The DexThermic-CO-HP system efficiently generates heat from the heat recovery unit (HRU) for space heating via the hydronic **sink** (eg. radiator, underfloor, door curtain) and fan coil unit (FCU) **sink**, as well as domestic hot water (DHW) **sink**. While space heating is required only during the 170-day heating season², the DexThermic-CO can provide domestic hot water (DHW) throughout the year.

It is designed for average extract air temperatures below 35°C, catering to the continuous demand for hot water and a seasonal demand for Space Heating (SH). The system can be configured to suit your needs and can provide heat for one, two or all three of the '**sinks**'.

DexThermic QO-RA

DAHX-850-550-1800-19-500H-1595-C2-QORA Run Around Version

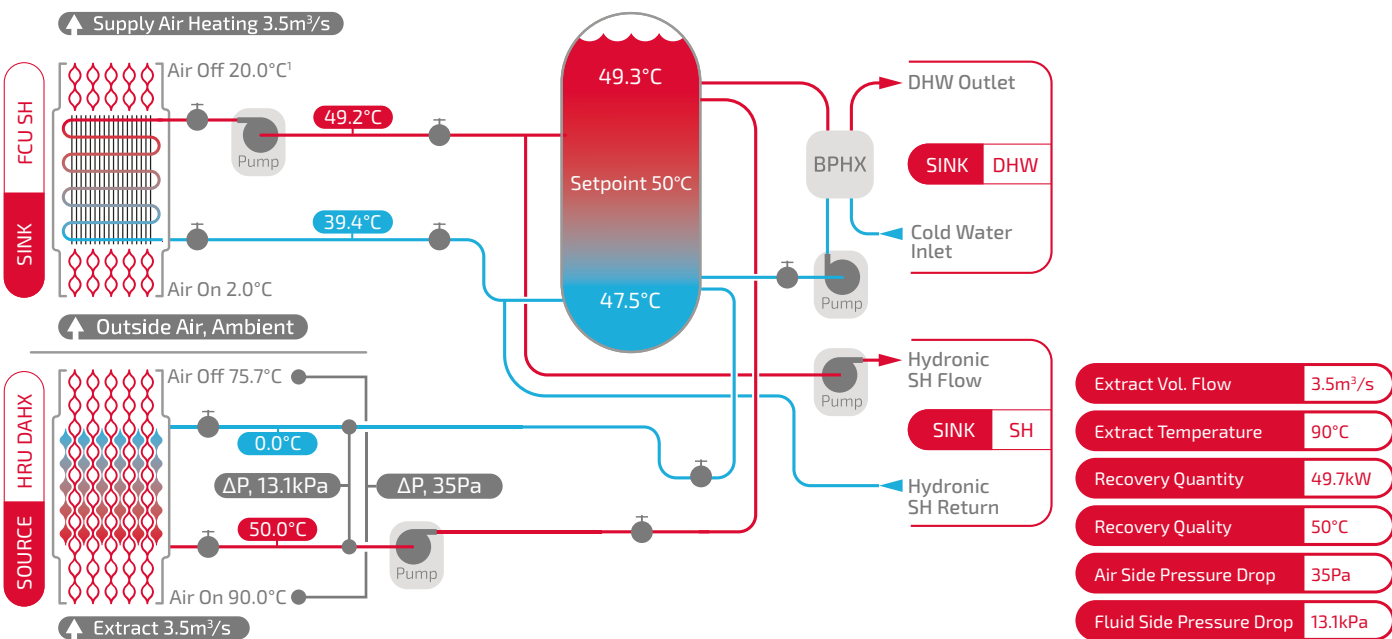


The DexThermic QO-RA introduces a simplified approach to heat recovery, producing an initial level of heat that you can then 'top up'. In this case, RA in the product code denotes that this is a run around system.

The DexThermic-QO-RA system efficiently generates heat from the heat recovery unit (HRU) DAHX **source** and directs it to the fan coil unit FCU **sink** using a simple pumped hydronic loop. It is specifically designed for average extract air temperatures above 40°C and is a great pairing to existing heating systems, providing space pre-heating to reduce overall energy usage and operational costs.

DexThermic QO-HT

DAHX-850-550-1800-19-500H-1595-C2-QOHT High Temperature Version



The DexThermic-QO-HT has the same functionality as the CO-HP system, but without the need for a heat pump due to the already-high temperatures being consistently produced. You've guessed it, HT in the product code stands for high temperature.

It is specifically suited to extract conditions of above 90°C. This system will primarily suit heavy-duty industrial applications such as: manufacturing, waste management & incineration, chemical and petrochemical industry, oil and gas, food and beverage processing, and the shipping and marine Industry to name just a few.



Technical Data

Materials

DAHX Casing & Cassette = ISO3574-DC01-CR4 Cold Rolled Steel
DAHX Panel = AA1050 Alloy
DAHX Manifold = 6082-T6 Alloy

Insulation

Option 1: 20mm Thick K-Flex ST DUCT Closed Cell elastomeric foam
Fire rating Euro class B-s3,d0
Working Temperature Range: -40°C to +85°C
Thermal Conductivity: 0°C = 0.033 W/(m·K), 40°C = 0.037 W/(m·K)
Option 2: 50mm Rockwool Duct slab foil faced.
Fire rating: A1
Working Temperature Range: -40°C to 230°C
Thermal Conductivity: 10°C = 0.034 W/(m·K), 150°C = 0.060 W/(m·K)
Option 3: Bare Unit.

Dry Mass

Cassette & Fluid Distribution Unit = 96 Kg
Casing & Slides = 116 Kg
Fin-Panel = 3.9 Kg (Per Panel)
Lifting Total + All Ancillaries = 278 Kg

Fluid Volume

Fin-Panel = 1.08 Litres
Manifold = 3.6 Litres Total = 25 Litres

Fluid Type

Suitable Heat Transfer Fluid: Hydratech Thermaflow TPF Propylene Glycol & UltraPure® Water^v

Percentage: 30%

Fluid Pressure

Working Pressure: 1.5 Bar
Max Working Pressure: 4 Bar
Safety Valve Relief Pressure: 3.0 Bar
Working Temperature Range: -15°C – 160°C

DAHX - 850 - 550 - 1800 - 19 - 500H - 1595 - C2 - QO = ΔP, 13.1KPa

DAHX - 850 - 550 - 1800 - 19 - 500H - 1595 - C2 - CO = ΔP, 67.3KPa

Fluid Flow Rate

Max working fluid flow rate: 0.83L/s

DAHX - 850 - 550 - 1800 - 19 - 500H - 1595 - C2 - QO = 0.25L/s

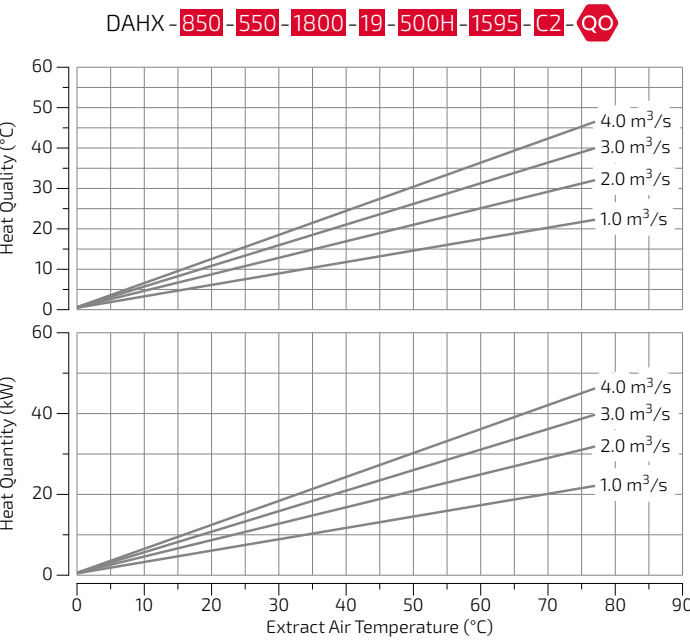
DAHX - 850 - 550 - 1800 - 19 - 500H - 1595 - C2 - CO = 0.7L/s

Fluid Connections

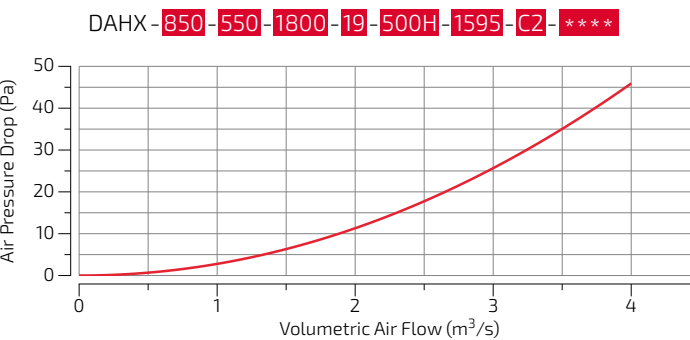
QO Variant = 1 Inch BSPT Female
CO Variant = 1 ½ Inch BSPT Female

Performance

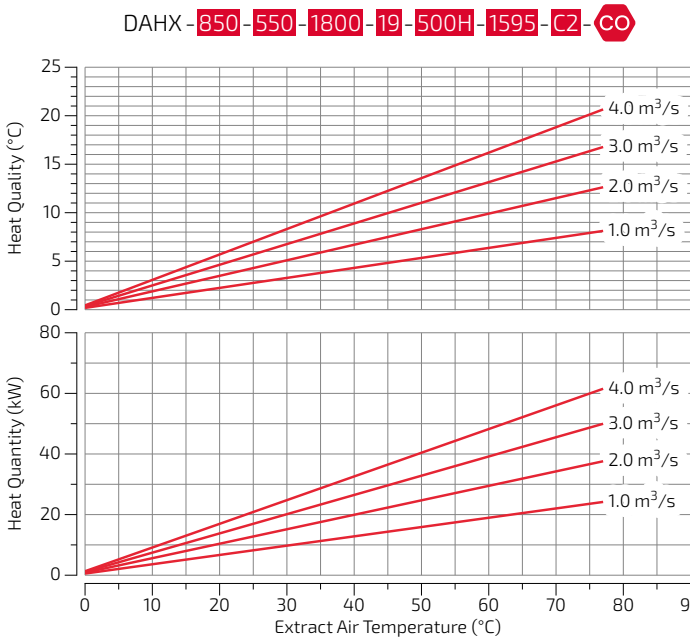
QO Variant



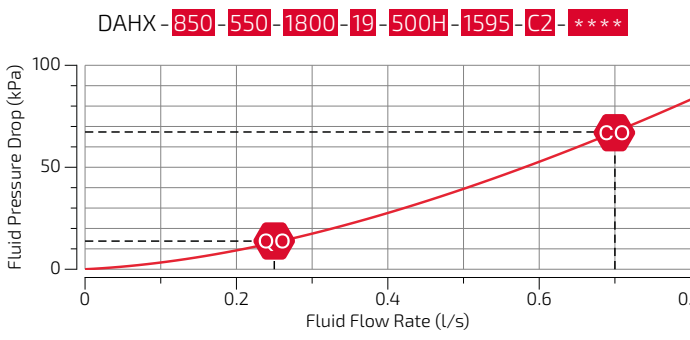
Air Side Pressure Drop



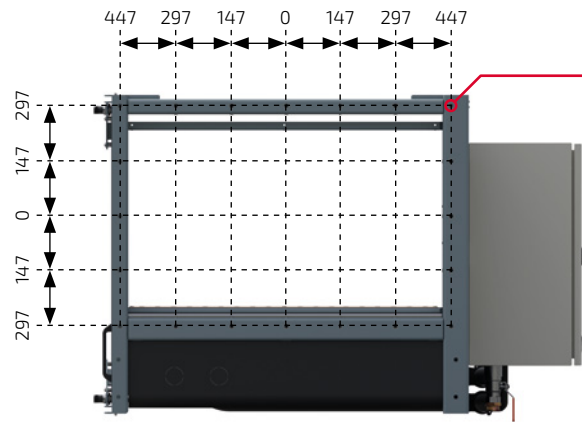
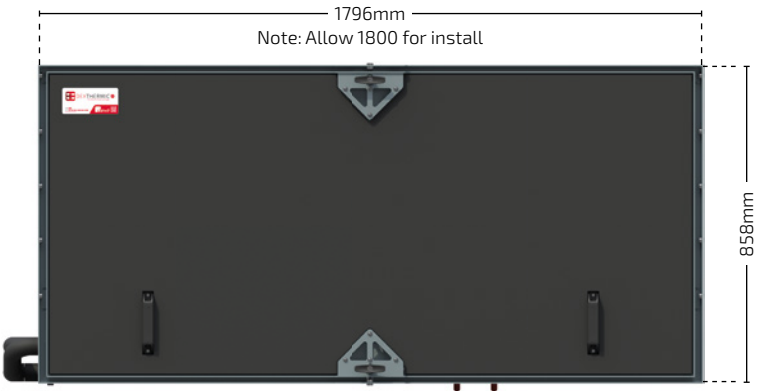
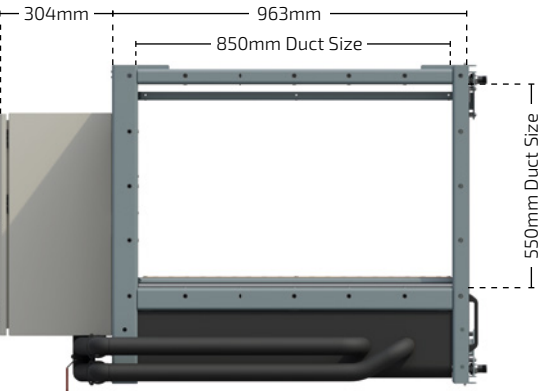
CO Variant



Fluid Side Pressure Drop



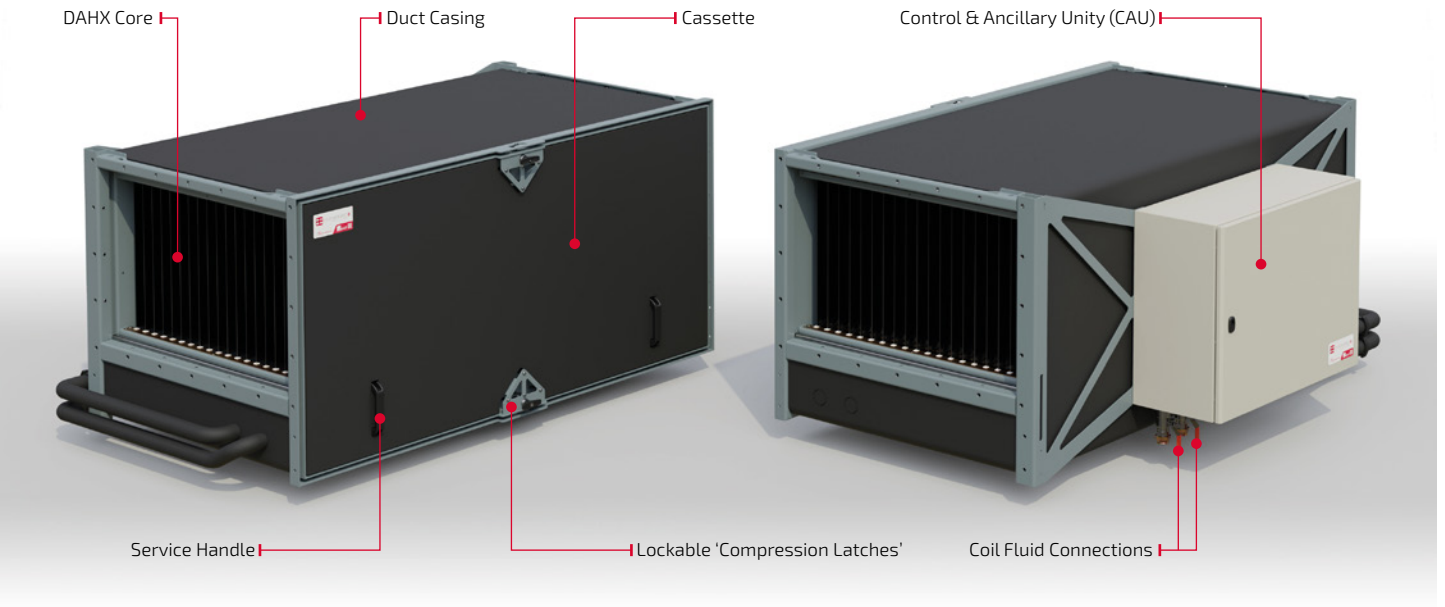
Dimensions



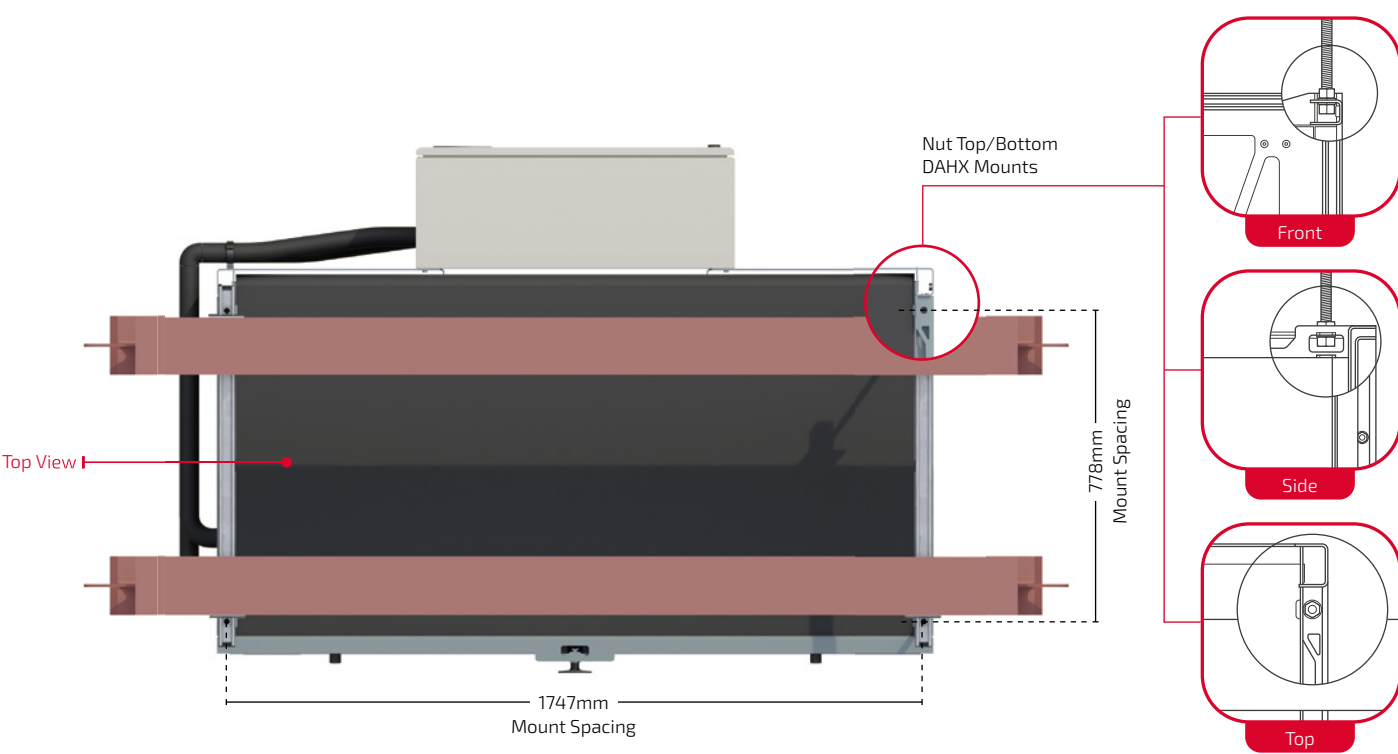
Duct Bolt Pattern
M10 Self-Clinching Nuts

- DAHX Duct connection size**
- Internal width = 850mm;
 - Internal height = 550mm;
 - External width = 963mm;
 - Length = 1796mm (Allow 1800mm for install);
 - Designed to mate to Mez & Doby standard flanges.

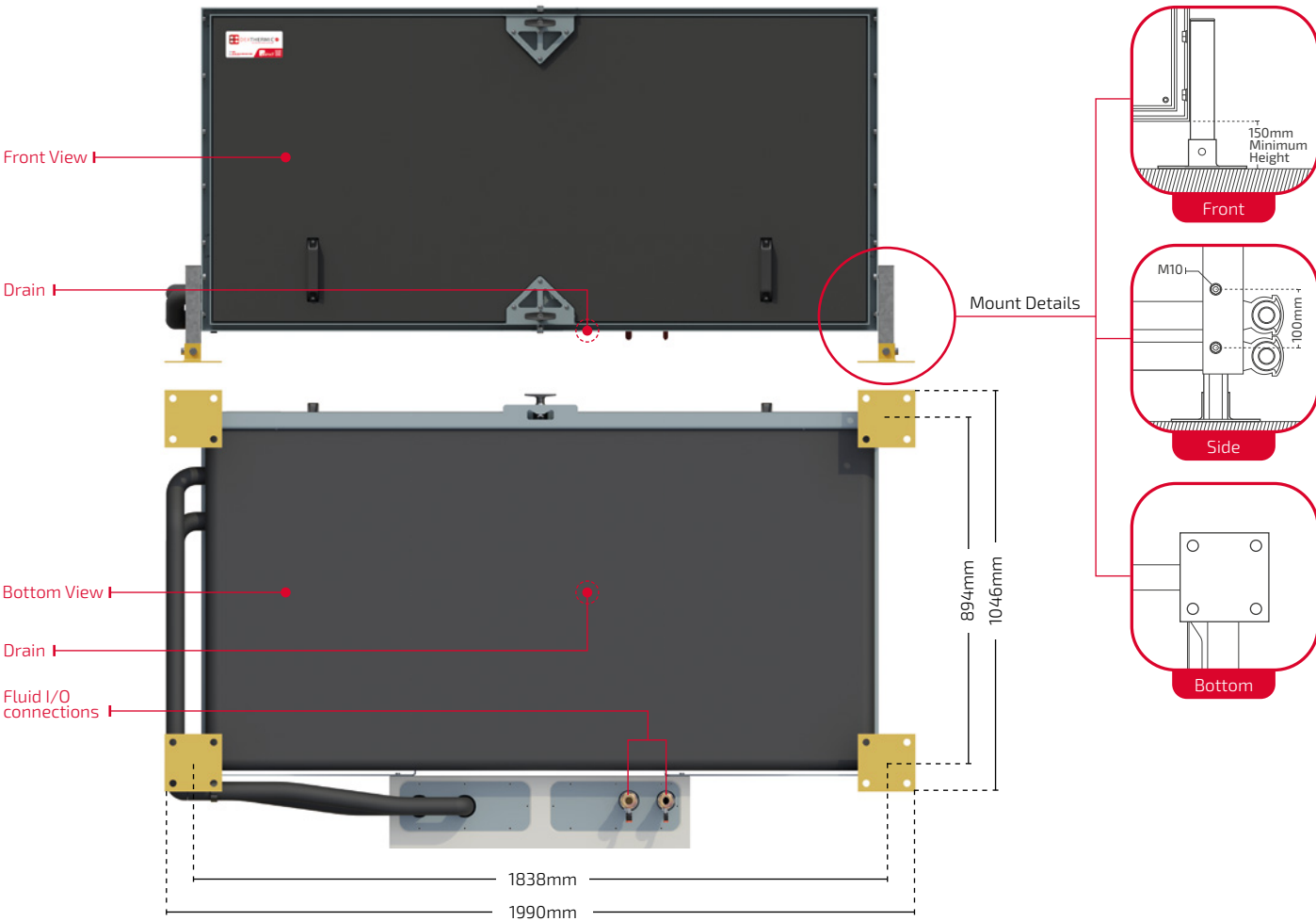
Taxonomy



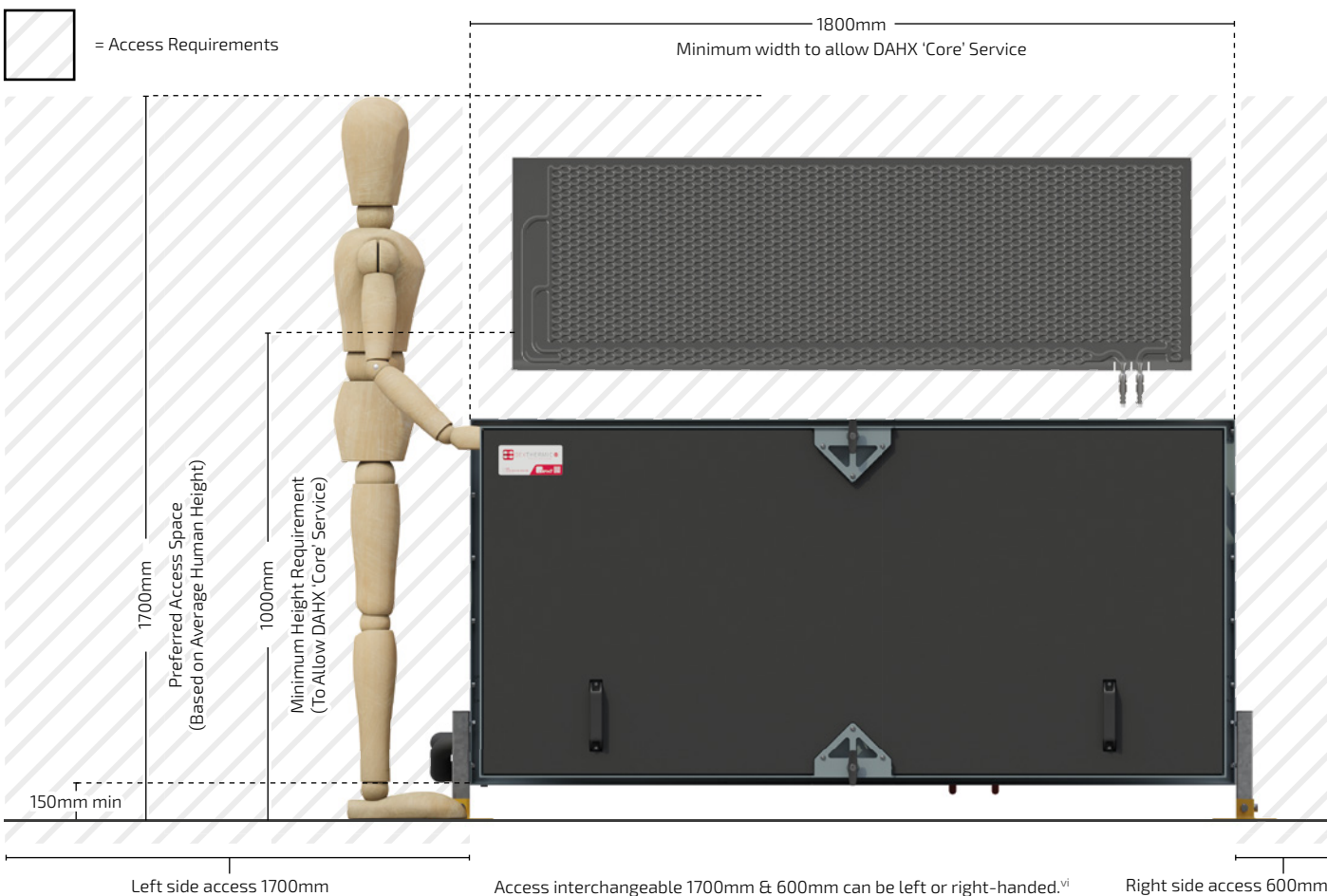
Ceiling



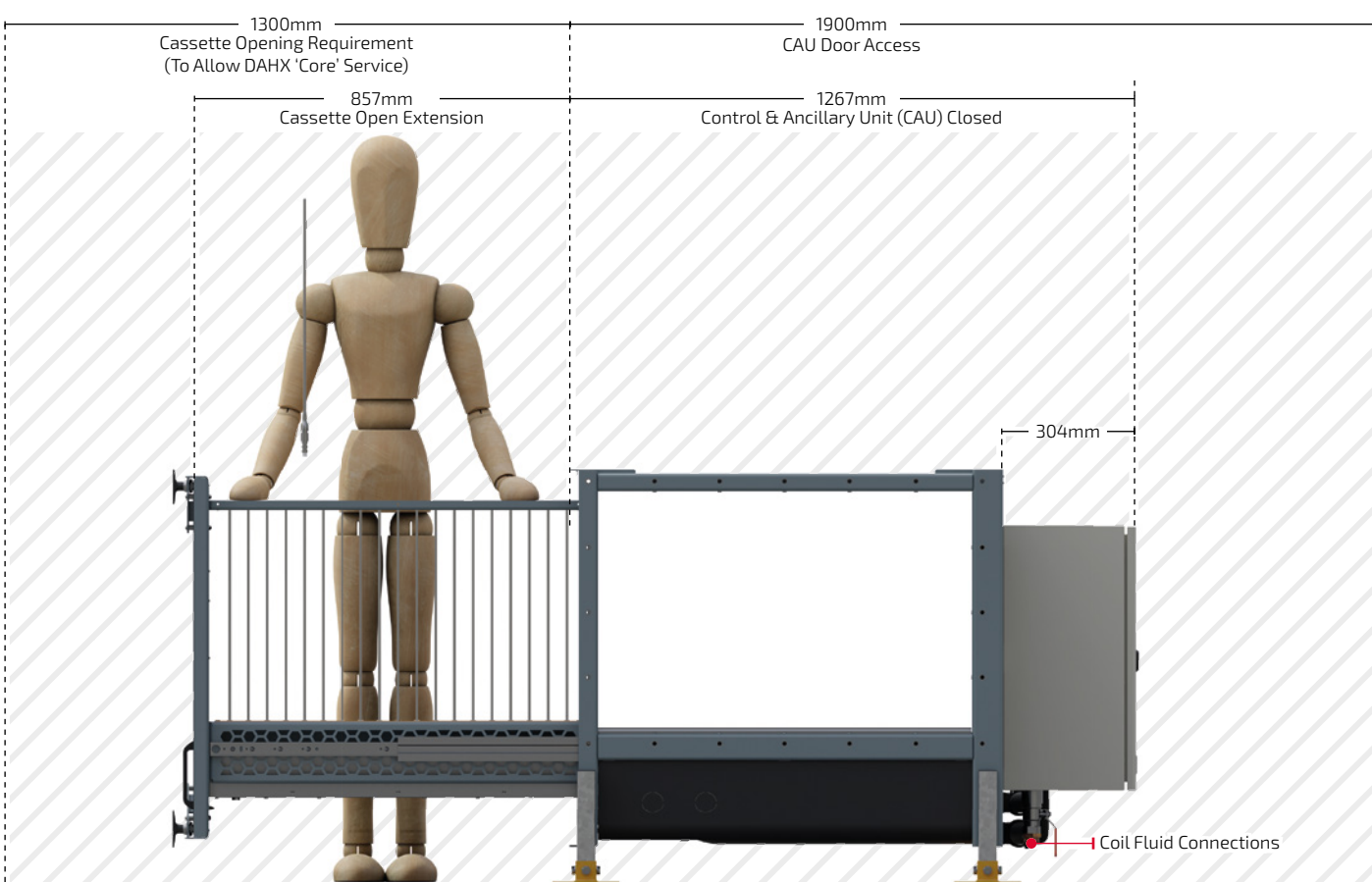
Floor



Front



Side



Unit can be supplied with remotely mounted CAU & installed with back against wall in scenarios of limited access.

How is the DexThermic heat exchanger cleaned?

The DexThermic heat exchanger can be cleaned by opening the custom-designed housing of the core heat exchanger located within the extract duct. This allows for easy access to the heat exchanger for periodic cleaning by service personnel or contracted duct cleaners. It is essential to follow TR19 guidelines for cleaning all commercial extract ducts and associated plant equipment. See cleaning guide³.

How much can you save by installing our DexThermic heat recovery system?

Savings will depend on site-specific factors, such as the size and layout of the building, hours of operation, and energy usage patterns. Our development team has created a selection software tool that can calculate these factors and provide accurate figures for potential savings.

The DexThermic system saves you money on your energy bills and operation costs, which swiftly offsets the installation cost of the system.

Does it have any effect on the extract air flow?

The effect of the DexThermic system on the extract air flow is a common concern among HVAC designers and engineers. The system is installed within the air stream, which you might expect to affect the extract fan by causing a restriction and increasing its workload, leading to higher energy consumption. However, the design team overcame this challenge by creating a large pathway for the air flow, resulting in minimal air obstruction. As a result, the system is gentle on the extract fan and does not cause undue strain or increased energy consumption, unlike some other heat recovery systems.

What is the size of the heat exchanger in the extract system?

When it comes to heat exchangers and heat recovery designs, larger surface areas generally result in better performance. We also considered typical ductwork sizes and shapes as well as ease of installation. Our modular design for the DexThermic (DAHx-850-550-1800-19-500H-1595-C2) heat exchanger is 1800mm in length, 550mm in height, and 850mm in width, which allows for easy installation with minimal modifications to the existing ductwork.

Who installs the system?

The DexThermic system can be installed by our team, or we can work with your preferred contractor. We value teamwork, collaboration, and knowledge sharing with other professionals in the industry. It is our passion to demonstrate and teach others about our technology.

What happens when the restaurant isn't cooking food, can your systems still recover energy?

Yes, our system can still recover heat, but the HVAC system needs to be running so there is air flow through our technology. The air inside the restaurant usually contains more energy than the outside air, even if there is no cooking happening.

Where can the heat exchanger be Installed?

The DexThermic heat exchanger can be installed either indoors or outdoors, depending on your site's needs and available space. We are often asked if it needs to be placed close to the kitchen where the cooking heat is generated. While being closer to the heat source has some advantages, it is not always practical. The commercial extraction system contains energy throughout, so as long as we are connected, our DexThermic can save you energy and money.

How can we use the heat?

Great question! Basically, our system can be used wherever you need to increase the temperature, and it offers a low-cost solution compared to other heating systems. This is one of the reasons why we like to work with others in the industry, as together we can identify where the heat can be best used, and other partners may provide complementary solutions. We love answering questions and discussing our systems, so let's work together.



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Disclaimer

Every effort is made to ensure that the information contained in DEXT Evolution literature, drawings and correspondence is accurate, but no warranty is given in this respect and the Company shall not be liable as a result of any inaccuracy. The Company reserves the right to alter at any time, without prior notice, the design, specification, packaging, or price of any article and without incurring any obligation.

End Notes

- i A product of an extensive research program conducted in partnership with the United Kingdom Research & Innovation (UKRI), National Centre of Excellence for Food Engineering (NCFE) and the European Regional Development Fund.
- ii Configurable at manufacture to be counterflow. Unit can accept hot-side air flow from either left or right side.
- iii Enables staged configurations for recovery banks to be coupled to multiple heat pump units.
- iv CAU has provision to be mounted on the main body or custom site location and is a neat solution to housing all control and data I/O components.
- v The hydronic system must use Hydratech Thermaflow TPF pre-mixed working fluid only.
- vi Access requirements can be adjusted for scenarios with limited/confined spaces – Contact DEXT to discuss.

References

- 1 CIBSE, "CIBSE Guide A: Environmental Design," 6th ed., London, U.K.: Chartered Institution of Building Services Engineers, 2021.
- 2 Building Research Establishment, Department of Energy & Climate Change., Report 4: Main Heating Systems, Department of Energy & Climate Change, 2013.
- 3 Dext Evolution Ltd, DexThermic - Cleaning Guide, Sheffield, South Yorkshire: DEXT Evolution, 2023, WEB-20230525-G3R32.pdf

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