HYBRID VENTILATION
High-performance, low carbon ventilation

Monodraught

HTM
We are
Pioneering British Greentech
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We are
With you all the way
As a pioneering British Greentech company, we design, install and maintain ventilation, cooling, heating and lighting solutions to commercial buildings in the most sustainable way possible.

We believe that businesses like ours have a responsibility to invest in our community. We purchase our materials from local suppliers, recycle where possible and are proud to partner with a local mental health charity, Buckinghamshire Mind.

Monodraught are committed to minimising the carbon footprint of every building to which we supply our products and services. Our in-house design team model the building, select the most energy efficient equipment and design controls to maximise comfort whilst reducing running costs. We continue to monitor performance post-installation ensuring that it continues to be effective year after year. Our installation and maintenance team are always on hand for support.

Trading for over 45 years, we are proud of our record of awards for innovation from prestigious organisations. These include Ashden, CIBSE and the Queen’s Award for Enterprise.

Awards & Accreditations:

- Queen’s Awards for Enterprise: Innovation 2018 - COOL-PHASE
- CIBSE Building Performance Awards 2017 Shortlist - COOL-PHASE Hybrid
- Best Product/Service Range Category at the 2016 Best Business Awards
- Company of the Year Award 2016 - Buckinghamshire Business First
- Best Business in Wycombe District 2016 Award - Buckinghamshire Business First
- Ashden - Award for Energy Innovation for COOL-PHASE
- ISO 9001 and ISO 14001: Established quality and environmental management certificates
- BSI (British Standards Institute) Members
- CIBSE Building Performance Award 2012 - COOL-PHASE
Design Standards

The Hybrid Thermal Mixing range of systems were originally developed in 2013 for the Priority School Building Programme (PSBP) in accordance with the Facility Output Specification. The PSBP was a centrally managed programme set up to address the needs of schools considered in need of urgent repair.

The current programme of works that replaced PSBP is the Priority School Building Programme 2 (PSBP2) this is also a capital funded and an updated Output Specification details the required design parameters. From the Output Specification, Technical Annex F details the ventilation requirements for the schools in this programme.

The future developments for School building programmes includes the Offsite Schools Framework for the delivery of schools by design for manufacture and assembly (DfMA) and offsite construction methods. Monodraught are working with a large number of construction companies looking to deliver within this programme.

• Understanding PSBP
Was launched in 2014. The aim was to address the needs of schools that were most in need of repair. Phase 1 included 214 schools delivered using public funding and 46 schools delivered using private finance funding.

• Understanding PSBP2
Is also a capital funded project, which will undertake rebuilding and refurbishment projects across 277 schools from 2015 to 2021. Both programmes are managed centrally by the Education Funding Agency.
Room Temperature
Comply with Criteria 1. Criteria 2 and 3 to be reported for information only.

C1 - Room operative temp not to exceed max adaptive temp by 1°K or more, for >40 hours.
C2 - Duration of temp. is 6 or less.
C3 - Max operative temp not exceed max adaptive temp by > 4°K.

Modelled 9:00 to 16:00 Mon to Fri 1st May to 30th September (no heat gains 12-1) using a representative CIBSE DSY1 2020 (50th Percentile) weather file.

Air Quality
Ventilation in practical spaces based on min exhaust rates for pollutant control. Mechanical or Hybrid ventilation preferred. In Science room a boost facility should be provided to allow at least 5 l/s/m².

Science / Practical Teaching Spaces

Air Quality & Temperature
Sports (General): Normal operative temperature of 17°C and TM 52 Category III.
Examination: Normal operative temperature of 20°C and TM 52 Category II.
Office Areas: 10 l/s per person
Rooms Containing Printers: 20 l/s per machine
Impervious to avoid the transfer of smells from dining areas to other areas of school.

Sports halls for exams, to be weekdays 09:00 - 12:00 & 13:00 - 16:00, 1st May - 8th July. Criteria 1 reduced to 18 hours for this period.
**Special Education Needs Teaching Areas**

**Air Quality**
Lower occupancy compared to mainstream schools.

**Teaching spaces:** min of 2.3 l/s/m² or 8 l/s/person whichever is the greater. Ventilation capable of controlling internal temp and draughts.

**Specialist Teaching Areas:** Supply air to replace process extract. Heat recovery is preferred.

**Hygiene/Washrooms:** 7.5 l/s/m² Preference for mechanical extract.

**Laundries/Cleaners:** 3.8 l/s/m²

**Halls, Gym, Dining and Physio:** 8 l/s or 2.5 ac/hr whichever is greater. Ventilation to limit CO₂ and control odours.

**BB93 - Version 17 - 2015**

**Primary/Secondary Classrooms**

**Acoustic Levels**
Nursery, Primary, Secondary & Lecture classrooms (Laeq, 30mins):

<table>
<thead>
<tr>
<th></th>
<th>New Building</th>
<th>Refurb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. of 35 dB</td>
<td>Max. of 40 dB</td>
<td></td>
</tr>
</tbody>
</table>

Table 1

**Science/Practical Teaching Spaces**

**Ventilation Conditions - Table 2**

**Natural Ventilation**
Normal Operation = Table 1 value +5dB, Summertime (hottest 200 hours under local control) & Intermittent boost = less than 55 dB

**Hybrid Ventilation**
Normal (Total noise level) = Table 1 +5dB, Summertime = less than 55 dB,

**Mechanical Ventilation**
Normal = Table 1, Summertime & Intermittent boost = Table 1 +5dB.

Depending on the ventilation conditions Table 1 values are revised.

**Acoustic Levels - Table 1**

Music rooms and Drama rooms to have max ambient noise of New Build 35 dB and Refurb 40 dB.

Science rooms, Design & Technology, Textiles, Food Tech, Graphics, Art and ICT rooms to have max noise of New Build 40 dB and Refurb 45 dB.

**Ventilation Conditions - Table 2**

As per standard Teaching spaces

With the addition of Process extract mode – includes noise of extract systems this can be automatic ventilation for safety and/or under local control = +10 dB (based on Acoustics of schools: A design Guide - Nov 2015).
SEN pupils are generally more sensitive to acoustics. The required reverberation times are shorter, sound insulation between spaces is higher and indoor ambient noise levels (capacity for distraction) lower.

Pupils with hearing impairment, autism are often very sensitive to specific types of noise, with strong tonal, impulsive or intermittent characteristics.

**Acoustic Levels - Table 1**

Sports hall, Dance studio, Gymnasium/Activity Studio, Study Rooms, Meeting Rooms and Libraries to have max of New Build 40 dB, Refurb 45 dB.

Open plan teaching areas, Offices and Resource/Breakout areas to have a max of 40 dB for New Build, 45 dB for Refurb.

Dining areas and Atrium areas to have a max of 45 dB for New Build, 50 dB for Refurb.

**Ventilation Conditions - Table 2**
The +5 dB does not apply if the Table 1 is greater than or equal to 45 dB.

**Special Education Needs Teaching Areas**

SEN pupils are generally more sensitive to acoustics. The required reverberation times are shorter, sound insulation between spaces is higher and indoor ambient noise levels (capacity for distraction) lower.

Pupils with hearing impairment, autism are often very sensitive to specific types of noise, with strong tonal, impulsive or intermittent characteristics.

**Acoustic levels - Table 1**

Teaching space intended specifically for students with special hearing and communication needs to have:

<table>
<thead>
<tr>
<th></th>
<th>New Building</th>
<th>Refurb</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEN Calming Room</td>
<td>Max. of 35 dB</td>
<td>Max. of 35 dB</td>
</tr>
</tbody>
</table>

www.monodraught.com
info@monodraught.com
Hybrid Ventilation
WHAT IS HYBRID THERMAL MIXING?

Hybrid Thermal Mixing (HTM) systems are designed to provide natural ventilation and hybrid ventilation incorporating mixed tempered air for winter periods. In addition, the systems have the ability to provide secure night time cooling, and boosted levels of ventilation during summer. The HTM systems are designed to work in conjunction with natural ventilation and can be used in single sided or cross flow ventilation strategies.

The HTM system is comprised of an intelligent and fully automatic control system coupled with a low energy ventilation system which switches between operational modes dependant on season, external/internal temperature conditions and indoor air quality (IAQ).

The Monodraught HTM systems have exceptionally low specific fan powers and feature an intelligent control system, which is supplied as standard, with full data logging facility, temperature and CO₂ controls. With the optional BACnet and Modbus modules, each unit has the ability to output key performance data to a central BMS.
WHY CHOOSE HYBRID THERMAL MIXING?

The Hybrid Thermal Mixing system creates a healthy and productive environment by monitoring internal air quality and ensuring there is a supply of fresh air.

The HTM is able to provide the ideal environment to school classrooms/areas. Designed to provide mixed tempered air during winter, boosted levels of ventilation during summer and secure night time cooling.

The HTM comprises an intelligent and fully automatic control system coupled with a low energy ventilation system which switches between operational modes dependant on season, external/internal temperature conditions and indoor air quality (IAQ).

The system is supplied as standard with full data logging facility, temperature and CO₂ controls. With optional BACnet and Modbus module, each unit has the ability to output key performance data to a central BMS.

Following the release of the Facilities Output Specification for the PSBP programme, Monodraught have utilised their extensive knowledge, product testing, and building simulation skills to develop low energy ventilation systems which meet the FOS requirements in a cost efficient manner.

The HTM systems have been designed specially to meet and exceed BB93, Priority School Building Program and Annex F Facility Output Specification requirements.

Ideal Environment

Smart Control

Regulation Compliance
HTM systems work in conjunction with other forms of natural ventilation openings i.e. manual or automatic window / louvre openings to provide year round ventilation requirements.

With the addition of an internal LTHW coil, the Hybrid system is able provide the primary heat source within the space removing the requirement for additional radiators.
Three versions of Monodraught’s HTM system are available, the HTM F, the HTM FS and the HTM FT. The “F” and “FT” types have been designed to have one unit per classroom, and the “FS” type two units per classroom.

A powder coated steel frame makes the system robust and easy to install. This frame supports a body constructed from specialist acoustic panels which when combined with a low energy fan means that the systems maximum daytime operation sound level is well below 35dB.

A combination of an intelligent controls system and sensors measuring the room, external and mixed air temperatures & CO₂ levels allows the system to automatically control the internal environment. This control system can also be utilised for the operation of additional VENTSAIR façade systems and has a full data logging facility.

**Options**

- Below ceiling or above ceiling installation
- Primary/Secondary mode to synchronise multiple units in a single zone
- Inhibit input to enable/disable HTM from BMS or Fire Alarm circuit
- Up to 6kW LTHW heating coil module
- 1kW Electric heating element (5A rated current)
- BACnet, MODBUS or BMS connection
- The external weather louvre and transition can be provided by Monodraught, please contact us for more details.
- More colours available on request
- Attenuator module and G4 & F7 filter modules.
### OPERATION MODES

#### HEATING & COOLING MODES

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-heating Mode</strong></td>
<td>If the internal temperature of the unoccupied space is too low, the system activates the pre-heating mode where the system will actively heat the space by recirculating room air through the HTM system which is then blown across the LTHW coil heating the space ready for the occupants.</td>
</tr>
<tr>
<td><strong>Occupied Heating Mode</strong></td>
<td>If the internal temperature of an occupied space is too low, the system will actively heat the space by recirculating room air through the HTM system. It also has the ability to warm external fresh air should the CO₂ level rise too high.</td>
</tr>
<tr>
<td><strong>Cooling Mode</strong></td>
<td>If the internal temperature of an occupied space is too high, the system will actively cool the space by recirculating room air through the HTM system. It also has the ability to cool external fresh air should the CO₂ level rise too high.</td>
</tr>
<tr>
<td><strong>Mixed Mode</strong></td>
<td>When the external air temperature is below the minimum set threshold and the indoor air quality (IAQ) requires ventilation, the HTM system will modulate the external and internal volume control dampers and operate the fan to provide mixed ventilation through the system. It will provide ventilation proportionally to meet the requirements of the space, by opening the external damper and varying the fan speed until the desired CO₂ levels are reached.</td>
</tr>
<tr>
<td><strong>Boost Mode</strong></td>
<td>If the internal temperature or CO₂ level rise too high, the system will operate in Boost Mode. In this mode, the system will open the external damper and blow air into the room until levels drop to acceptable levels.</td>
</tr>
<tr>
<td><strong>Natural Ventilation</strong></td>
<td>During the occupied period, when the external air temperature is above the minimum set threshold or the indoor air quality (IAQ) requires ventilation, the HTM system will modulate the external and internal volume control dampers to provide natural ventilation through the system.</td>
</tr>
<tr>
<td><strong>Seasonal Night Time Cooling</strong></td>
<td>During the summer season the HTM system will assist the thermal comfort of the room by purging the room with cool night time air or until such time that the IAQ is within threshold.</td>
</tr>
<tr>
<td><strong>Off Mode</strong></td>
<td>When IAQ is within set point levels both internal and external damper will close and the fan will not operate. The following mode is only utilised during summer season and in night mode.</td>
</tr>
</tbody>
</table>

*In Heating/Cooling Modes the off coil air temperature and flow rate are limited as to not create an uncomfortable environment.*
The Hybrid Thermal Mixing (HTM) system from Monodraught is designed to provide natural ventilation, hybrid ventilation (incorporating mixed tempered air for winter periods), secure night time cooling and boosted levels of ventilation during summer.

The HTM systems are designed to work in conjunction with natural ventilation and can be used in single sided and cross flow ventilation strategies.

Each HTM is comprised of an intelligent and fully automatic control system coupled with a low energy ventilation system. It switches between operational modes dependant on season, external/internal temperature conditions and indoor air quality (IAQ).

**Performance**

- The HTM systems are the most technologically advanced Hybrid ventilation systems supplied complete with an integrated intelligent and fully automatic control system.
- Able to provide 350l/s (SFP 0.16) of daytime ventilation and 530l/s (SFP 0.34) for night purge ventilation when required.
- The system is supplied as standard with full data logging facility, temperature and CO₂ controls. With an optional BACnet or Modbus module, each unit has the ability to output key performance data to a central BMS.
- A composite panel body provides high levels of acoustic attenuation.
- Available as an exposed unit with white fascia panels or as a ducted system with a plenum box and 4-way diffuser.
- An integrated exhaust path within the system’s body removes the need for additional exhaust paths, therefore reducing the require number of façade openings.

**Environment**

- The HTM F has been designed specially to meet and exceed BB93, Priority School Building Programme (PSBP) and Annex F facility output specification requirements.
- The HTM is designed to provide single sided and cross flow ventilation strategies bringing fresh air into the room and reducing the CO₂ level to create an ideal environment to school classrooms/areas.
- The system is designed to provide mixed tempered air during winter, boosted levels of ventilation during summer and secure night time cooling.
- The system works in conjunction with natural ventilation provided by manual or automatic windows and VENTSAIR louvres.
## TECHNICAL SPECIFICATIONS

### Materials
- Powder coated mild steel frame
- Specialist acoustic panels
- ABS low maintenance panels

### Dimensions
- 900(w) x 500(h) x 1000 (l)

### Installation
- Units supported via a minimum of 3 No. fixings
- Minimum ceiling void of 550mm - if required

### System Requirements
- External weather louver with minimum free area of 0.23m²
- Louvre panel to be supplied-fitted with anti-bird mesh
- 230V AC mains with switched fused 3A Spur

### Weight
- 57 kg

### Guarantee
- 5 year warranty
- Mechanical and electrical components have a 1 year warranty

### Flowrates/SFP
- Max Day - 350 l/s - SFP: 0.16
- Max Night - 530 l/s - SFP: 0.34

### Sensors
- External temp. sensor -20˚C to +90˚C
- Recirculation temp. sensor -20˚C to +90˚C
- Mixed air supply temp. sensor -20˚C to +90˚C
- Room temp. sensor within wall controller -20˚C to +90˚C
- Room CO₂ sensor within wall controller 0-2000 ppm

### Data Monitoring
- Data logging functionality as standard: all system operations, sensor readings and damper positions logged every 1 minute

### Additional Functions
- Self-Test Mode via wall controller
- Integrated exhaust path

### Options
- BACnet / Modbus
- Filter module EU-G4 bag filter
- Filter module EU-F7 bag filter
- Attenuation module

### Flowrates/SFP
- Max Day - 350 l/s - SFP: 0.16
- Max Night - 530 l/s - SFP: 0.34

### Sensors
- External temp. sensor -20˚C to +90˚C
- Recirculation temp. sensor -20˚C to +90˚C
- Mixed air supply temp. sensor -20˚C to +90˚C
- Room temp. sensor within wall controller -20˚C to +90˚C
- Room CO₂ sensor within wall controller 0-2000 ppm

### Data Monitoring
- Data logging functionality as standard: all system operations, sensor readings and damper positions logged every 1 minute

### Additional Functions
- Self-Test Mode via wall controller
- Integrated exhaust path

### Options
- BACnet / Modbus
- Filter module EU-G4 bag filter
- Filter module EU-F7 bag filter
- Attenuation module

### Electrical Connections
- System enable input - NC volt-free contact to activate and deactivate the system
- Fault output - NC relay output for fault indication
- CAT5e Slave Connection - 2-4 No. HTM units synchronised to work in a Master/Slave configuration in a single zone
- VENTS/AIR systems acting as automatic natural ventilation opening

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[Grilled/Below Ceiling](#)

[ducted/Above Ceiling](#)
HTM F

Controls Strategy

- The HTM incorporates a fully automatic control system based on seasonal control strategy which is determined by the system’s internal time, date and weather compensation algorithm to pick up unseasonal conditions.

- The system provides natural ventilation as the default method of ventilation indicating when manual windows or automatically opening dampers should be utilised to maximise the IAQ and maintain the comfort levels.

- The control system incorporates a number of temperature sensors integral to the unit to monitor external temperature, mixed air temperature and supply air temperature.

- In addition, a wall mounted controller fitted with an internal temperature, CO₂ sensor and user override controls are included as standard.

- Data is stored per minute on an integral data card for data analysis and compliance requirements.

<table>
<thead>
<tr>
<th>Season</th>
<th>Spring</th>
<th>Summer</th>
<th>Autumn</th>
<th>Winter</th>
<th>CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Date</td>
<td>01 Mar</td>
<td>01 May</td>
<td>01 Oct</td>
<td>01 Dec</td>
<td></td>
</tr>
<tr>
<td>Finish Date</td>
<td>30 Apr</td>
<td>31 Sept</td>
<td>30 Nov</td>
<td>End of Feb</td>
<td></td>
</tr>
<tr>
<td>Nat Vent</td>
<td>21 °C</td>
<td>18 °C</td>
<td>21 °C</td>
<td>22 °C</td>
<td>900 ppm</td>
</tr>
<tr>
<td>Nat Vent + Windows</td>
<td>23 °C</td>
<td>20 °C</td>
<td>23 °C</td>
<td>24 °C</td>
<td>1000 ppm</td>
</tr>
<tr>
<td>Boost</td>
<td>24 °C</td>
<td>22 °C</td>
<td>24 °C</td>
<td>25 °C</td>
<td>1100 ppm</td>
</tr>
<tr>
<td>Mixed Mode</td>
<td>23 °C</td>
<td>22 °C</td>
<td>23 °C</td>
<td>24 °C</td>
<td>900 ppm</td>
</tr>
<tr>
<td>Night time cooling 22:00 - 07:00</td>
<td>N/A</td>
<td>18 °C</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Acoustic Information

Full acoustic testing has been conducted at SRL (Sound Research Laboratories) and the system was tested with a standard 50mm external louvre arrangement.

<table>
<thead>
<tr>
<th>Sound Power Level at 350 l/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 Hz</td>
</tr>
<tr>
<td>53.4</td>
</tr>
</tbody>
</table>

Sound Reduction Index Rw (C:Ctr) = 31 dB
Operation

- HTM systems have eight operational fan speeds, at which a minimum air flow rate is supplied if installed in accordance with Monodraught recommendations.

- During normal occupied operation, the system will automatically operate between Fan Speeds 1-5 to provide fresh air ventilation and cooling (if conditions permit). The system is limited to a maximum of Fan Speed 5 (maximum AUTO daytime).

- The user is able to Boost the system’s level of ventilation via the wall controller, increasing the system’s operating fan speed by two fan speeds and in doing so the user is allowing the system to operate at an increased sound level.

- The system will time out and revert to its automatic operating fan speed after a default time period of 60 minutes. This time out is set via the wall controller with options of 20, 60 or 180 minutes.

- Fan speed 8 is reserved for night time cooling. During summer periods, when the building is unoccupied and when the internal temperature is above 18°C the system will provide peak ventilation.
The Hybrid Thermal Mixing (HTM) system is designed to provide natural ventilation, hybrid ventilation, secure night time cooling and boosted levels of ventilation during summer. The systems are designed to work in conjunction with natural ventilation and can be used in single sided and cross flow ventilation strategies.

Each HTM system is comprised of an intelligent and fully automatic control system coupled with a low energy ventilation system. It switches between operational modes dependant on season, external/internal temperature conditions and indoor air quality (IAQ).

A HTM FS system is typically comprised of two FS units synchronised to work as a pair in a Primary/Secondary configuration within a single zone.

- The HTM systems are the most technologically advanced Hybrid ventilation systems supplied complete with an integrated intelligent and fully automatic control system.
- Able to provide 180l/s (SFP 0.15) of daytime ventilation and 250l/s (SFP 0.24) for night purge ventilation when required.
- The system is supplied as standard with full data logging facility, temperature and CO₂ controls. With an optional BACnet or Modbus module, each unit has the ability to output key performance data to a central BMS.
- A composite panel body provides high levels of acoustic attenuation.
- Available as an exposed unit with white fascia panels or as a ducted system with a plenum box and 4-way diffuser.
- An integrated exhaust path within the system’s body removes the need for additional exhaust paths, therefore reducing the require number of façade openings.

- The HTM FS has been designed specially to meet and exceed BB93, Priority School Building Programme (PSBP) and Annex F facility output specification requirements.
- The HTM is designed to provide single sided and cross flow ventilation strategies bringing fresh air into the room and reducing the CO₂ level to create an ideal environment to school classrooms/areas.
- The system is designed to provide mixed tempered air during winter, boosted levels of ventilation during summer and secure night time cooling.
- The system works in conjunction with natural ventilation provided by manual or automatic windows and VENTSAIR louvres.
**Materials**
- Powder coated mild steel frame
- Specialist acoustic panels
- ABS low maintenance panels

**Dimensions**
- 900(w) x 300(h) x 1000 (l)

**Installation**
- Units supported via a minimum of 3 No. fixings
- Minimum ceiling void of 350mm - if required

**System Requirements**
- External weather louvre with minimum free area of 0.14m²
- Louvre panel to be supplied-fitted with anti-bird mesh

**Electrical Requirement**
- 230V AC mains with switched fused 3A Spur

**Guarantee**
- 5 year warranty
- Mechanical and electrical components have a 1 year warranty

**Flowrates/SFP**
- Max Day - 180 l/s - SFP: 0.15
- Max Night - 250 l/s - SFP: 0.24

**Sensors**
- External temp. sensor -20˚C to +90˚C
- Recirculation temp. sensor -20˚C to +90˚C
- Mixed air supply temp. sensor -20˚C to +90˚C
- Room temp. sensor within wall controller -20˚C to +90˚C
- Room CO₂ sensor within wall controller 0-2000 ppm

**Data Monitoring**
- Data logging functionality as standard: all system operations, sensor readings and damper positions logged every 1 minute

**Additional Functions**
- Self-Test Mode via wall controller
- Integrated exhaust path

**Options**
- BACnet / Modbus
- Filter module EU-G4 bag filter
- Filter module EU-F7 bag filter
- Attenuation module

**Optional Electrical Connections**
- System enable input - NC volt-free contact to activate and deactivate the system
- Fault output - NC relay output for fault indication
- CAT5e Slave Connection - 2-4 No. HTM units synchronised to work in a Master/Slave configuration in a single zone
- VENTS AIR systems acting as automatic natural ventilation opening
- 8 Core cable to Secondary unit (LSZH 0.35m²) - if required

The above information corresponds to a single HTM FS unit.
Controls Strategy

- The HTM incorporates a fully automatic control system based on seasonal control strategy which is determined by the system's internal time, date and weather compensation algorithm to pick up unseasonal conditions.

- The system provides natural ventilation as the default method of ventilation indicating when manual windows or automatically opening dampers should be utilised to maximise the IAQ and maintain the comfort levels.

- The control system incorporates a number of temperature sensors integral to the unit to monitor external temperature, mixed air temperature and supply air temperature.

- In addition, a wall mounted controller fitted with an internal temperature, CO₂ sensor and user override controls are included as standard.

- Data is stored per minute on an integral data card for data analysis and compliance requirements.

<table>
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<td>23˚C</td>
<td>24˚C</td>
<td>900 ppm</td>
</tr>
<tr>
<td>Night time cooling 22:00 - 07:00</td>
<td>N/A</td>
<td>18˚C</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Acoustic Information**

Full acoustic testing has been conducted at SRL (Sound Research Laboratories) and the system was tested with a standard 50mm external louvre arrangement.

<table>
<thead>
<tr>
<th>Sound Power Level at 180 l/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 Hz</td>
</tr>
<tr>
<td>51.8</td>
</tr>
</tbody>
</table>

**Sound Reduction Index Rw (C:Ctr) = 29 dB**
Operation

- HTM systems have eight operational fan speeds, at which a minimum air flow rate is supplied if installed in accordance with Monodraught recommendations.

- During normal occupied operation, the system will automatically operate between Fan Speeds 1-5 to provide fresh air ventilation and cooling (if conditions permit). The system is limited to a maximum of Fan Speed 5 (maximum AUTO daytime).

- The user is able to Boost the system’s level of ventilation via the wall controller, increasing the system’s operating fan speed by two fan speeds and in doing so the user is allowing the system to operate at an increased sound level.

- The system will time out and revert to its automatic operating fan speed after a default time period of 60 minutes. This time out is set via the wall controller with options of 20, 60 or 180 minutes.

- Fan speed 8 is reserved for night time cooling. During summer periods, when the building is unoccupied and when the internal temperature is above 18°C the system will provide peak ventilation.
The Hybrid Thermal Mixing (HTM) system from Monodraught is designed to provide natural ventilation, hybrid ventilation (incorporating mixed tempered air for winter periods), secure night time cooling and boosted levels of ventilation during summer.

The HTM systems are designed to work in conjunction with natural ventilation and can be used in single sided and cross flow ventilation strategies. Each HTM is comprised of an intelligent and fully automatic control system coupled with a low energy ventilation system. The unit switches between operational modes dependant on season, external/internal temperature conditions and indoor air quality (IAQ).

### Performance
- Monodraught's HTM systems are the most technologically advanced hybrid ventilation systems, and are supplied complete with an integrated intelligent and fully automatic control system.
- Able to provide 355 l/s (SFP 0.15) of daytime ventilation and 510 l/s (SFP 0.24) for night purge ventilation when required.
- The system is supplied as standard with full data logging facility, temperature and CO₂ controls. With an optional BACnet or Modbus module, each unit has the ability to output key performance data to a central BMS.
- A composite panel body provides high levels of acoustic attenuation.
- Available as an exposed unit with white fascia panel or as ducted system with 3No. plenum boxes and 4-way diffuser.
- An integrated exhaust path within the system’s body removes the need for additional exhaust paths, therefore reducing the required number of façade openings.

### Environment
- The HTM FT has been specially designed to meet and exceed BB93, PSBP and Annex F facility output specification requirements.
- The HTM is designed to provide single sided and cross flow ventilation strategies, bringing fresh air into the room and reducing the CO₂ level to create an ideal environment for school classrooms/areas.
- The system is designed to provide mixed tempered air during winter, boosted levels of ventilation during summer and secure night time cooling.
- The system works in conjunction with natural ventilation provided by manual or automatic windows and VENTS AIR louvres.
# TECHNICAL SPECIFICATIONS

**Grilled/Below Ceiling**

<table>
<thead>
<tr>
<th>Materials</th>
<th>Dimensions</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powder coated mild steel frame</td>
<td>1800(w) x 300(h) x 1000 (l)</td>
<td>78 kg</td>
</tr>
<tr>
<td>Specialist acoustic panels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABS low maintenance panels</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Installation**
- Units supported via a minimum of 4 No. fixings
- Minimum ceiling void of 350mm - if required

**System Requirements**
- External weather louvre with minimum free area of 0.28m²
- Louvre panel to be supplied-fitted with anti-bird mesh
- 230V AC mains with switched fused 3A Spur

**Guarantee**
- 5 year warranty
- Mechanical and electrical components have a 1 year warranty

**Flowrates/SFP**
- Max Day - 355 l/s - SFP: 0.15
- Max Night - 510 l/s - SFP: 0.24

**Sensors**
- External temp. sensor -20°C to +90°C
- Recirculation temp. sensor -20°C to +90°C
- Mixed air supply temp. sensor -20°C to +90°C
- Room temp. sensor within wall controller -20°C to +90°C
- Room CO₂ sensor within wall controller 0-2000 ppm

**Data Monitoring**
- Data logging functionality as standard: all system operations, sensor readings and damper positions logged every 1 minute

**Additional Functions**
- Self-Test Mode via wall controller
- Integrated exhaust path

**Options**
- BACnet / Modbus
- Filter module EU-G4 bag filter
- Filter module EU-F7 bag filter
- Attenuation module

**Optional Electrical Connections**
- System enable input - NC volt-free contact to activate and deactivate the system
- Fault output - NC relay output for fault indication
- CAT5e Slave Connection - 2-4 No. HTM units synchronised to work in a Master/Slave configuration in a single zone
- VENTS/AIR systems acting as automatic natural ventilation opening

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Controls Strategy

- The HTM incorporates a fully automatic control system based on seasonal control strategy which is determined by the system's internal time, date and weather compensation algorithm to pick up unseasonal conditions.

- The system provides natural ventilation as the default method of ventilation indicating when manual windows or automatically opening dampers should be utilised to maximise the IAQ and maintain the comfort levels.

- The control system incorporates a number of temperature sensors integral to the unit to monitor external temperature, mixed air temperature and supply air temperature.

- In addition, a wall mounted controller fitted with an internal temperature, CO₂ sensor and user override controls are included as standard.

- Data is stored per minute on an integral data card for data analysis and compliance requirements.

### Acoustic Information

The system was tested with a standard 50mm external louvre arrangement.

<table>
<thead>
<tr>
<th>Sound Power Level at 350 l/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 Hz</td>
</tr>
<tr>
<td>53.8</td>
</tr>
</tbody>
</table>

**Sound Reduction Index Rw (C:Ctr) = 30 dB**
HTM FT

Operation

• HTM systems have eight operational fan speeds, at which a minimum air flow rate is supplied if installed in accordance with Monodraught recommendations.

• During normal occupied operation, the system will automatically operate between Fan Speeds 1-5 to provide fresh air ventilation and cooling (if conditions permit). The system is limited to a maximum of Fan Speed 5 (maximum AUTO daytime).

• The user is able to Boost the system’s level of ventilation via the wall controller, increasing the system’s operating fan speed by two fan speeds and in doing so the user is allowing the system to operate at an increased sound level.

• The system will time out and revert to its automatic operating fan speed after a default time period of 60 minutes. This time out is set via the wall controller with options of 20, 60 or 180 minutes.

• Fan speed 8 is reserved for night time cooling. During summer periods, when the building is unoccupied and when the internal temperature is above 18°C the system will provide peak ventilation.

Typical Schematic

POWER SUPPLY
System is supplied with 1.5m 3 core mains cable to be wired to a 3A switched fused spur, by others.
The Hybrid Thermal Mixing (HTM) system from Monodraught is designed to provide natural ventilation, hybrid ventilation, secure night time cooling and boosted levels of ventilation during summer.

The HTM systems are designed to work in conjunction with natural ventilation and can be used in single sided and cross flow ventilation strategies. Each HTM is comprised of an intelligent and fully automatic control system coupled with a low energy ventilation system. The unit switches between operational modes dependant on season, external/internal temperature conditions and indoor air quality (IAQ).

With the addition of an internal LTHW coil, the HTM F-H is able to provide the primary heat source within the space removing the requirement for additional radiators.

- The HTM systems are the most technologically advanced hybrid ventilation systems, and are supplied complete with an integrated intelligent and fully automatic control system.
- The HTM F-H includes an LTHW coil encased within the HTM unit and installed directly over the supply opening of the system to provide up to 6kW of heating to a space.
- Able to provide 260 l/s (SFP 0.13) of daytime ventilation and 530 l/s (SFP 0.4) for night purge ventilation when required.
- The system is supplied as standard with full data logging facility, temperature and CO₂ controls.
- A composite panel provides high levels of acoustic attenuation.
- Available as an exposed unit with white fascia panel or as ducted system with 1No. plenum boxes and 4-way diffuser.
- An integrated exhaust path within the system’s body removes the need for additional exhaust paths, therefore reducing the required number of façade openings.

- The HTM F-H has been specially designed to meet and exceed BB93, PSBP and Annex F facility output specification requirements.
- The HTM is designed to provide single sided and cross flow ventilation strategies, bringing fresh air into the room and reducing the CO₂ level to create an ideal environment for school classrooms/areas.
- The system is designed to provide mixed tempered air during winter, boosted levels of ventilation during summer and secure night time cooling.
- The system works in conjunction with natural ventilation provided by manual or automatic windows and VENTSAIR louvres.
**TECHNICAL SPECIFICATIONS**

**Materials**
- Unit: Powder coated mild steel frame
- Specialist acoustic panels
- ABS low maintenance panels
- Coil: Copper piping
- Galvanised steel casing
- Aluminium fins

**Dimensions**
900(w) x 500(h) x 1200 (l)

**Weight**
63 kg

**Installation**
- Units supported via a minimum of 3 No. fixings
- Minimum ceiling void of 550mm - if required

**System Requirements**
- External weather louvre with minimum free area of 0.23m²
- Louvre panel to be supplied-fitted with anti-bird mesh
- Suitable hot water supply for required heat output
- Actuated valve with 24V DC (0-10V modulation) actuator

**Electrical Requirement**
- 230V AC mains with switched fused 3A Spur

**Guarantee**
- 5 year warranty / Mechanical and electrical components have a 1 year warranty

**Flowrates/SFP**
- Max Day - 260 l/s - SFP: 0.13
- Max Night - 530 l/s - SFP: 0.4

**Coil Performance**
- Up to 6kW of heat based upon water supply of 80°C / 60°C at 0.1 l/s

**Sensors**
- External temp. sensor -20°C to +90°C
- Recirculation temp. sensor -20°C to +90°C
- Mixed air supply temp. sensor -20°C to +90°C
- Room temp. sensor within wall controller -20°C to +90°C
- Room CO₂ sensor within wall controller 0-2000 ppm

**Data Monitoring**
- Data logging functionality as standard: all system operations, sensor readings and damper positions logged every 1 minute

**Additional Functions**
- Self-Test Mode via wall controller
- Integrated exhaust path

**Options**
- BACnet / Modbus
- Filter module EU-G4 bag filter / Filter module EU-F7 bag filter
- Attenuation module

**Optional Electrical Connections**
- System enable input - NC volt-free contact to activate and deactivate the system
- Fault output - NC relay output for fault indication
- CAT5e Slave Connection - 2-4 No. HTM units synchronised to work in a Master/Slave configuration in a single zone
- VENTSAIL systems acting as automatic natural ventilation opening
The HTM incorporates a fully automatic control system based on seasonal control strategy which is determined by the systems internal time, date and weather compensation algorithm to pick up unseasonal conditions.

The system provides natural ventilation as the default method of ventilation indicating when manual windows or automatically opening dampers should be utilised to maximise the IAQ and maintain the comfort levels.

The control system incorporates a number of temperature sensors integral to the unit to monitor external temperature, mixed air temperature and supply air temperature.

In addition, a wall mounted controller fitted with an internal temperature, CO$_2$ sensor and user override controls are included as standard.

Data is stored per minute on an integral data card for data analysis and compliance requirements.

The HTM (Heating, Ventilation, and Air Conditioning) incorporates a fully automatic control system based on seasonal control strategy which is determined by the systems internal time, date and weather compensation algorithm to pick up unseasonal conditions.

The system provides natural ventilation as the default method of ventilation indicating when manual windows or automatically opening dampers should be utilised to maximise the IAQ and maintain the comfort levels.

The control system incorporates a number of temperature sensors integral to the unit to monitor external temperature, mixed air temperature and supply air temperature.

In addition, a wall mounted controller fitted with an internal temperature, CO$_2$ sensor and user override controls are included as standard.

Data is stored per minute on an integral data card for data analysis and compliance requirements.

### Controls Strategy

- The HTM incorporates a fully automatic control system based on seasonal control strategy which is determined by the systems internal time, date and weather compensation algorithm to pick up unseasonal conditions.
- The system provides natural ventilation as the default method of ventilation indicating when manual windows or automatically opening dampers should be utilised to maximise the IAQ and maintain the comfort levels.
- The control system incorporates a number of temperature sensors integral to the unit to monitor external temperature, mixed air temperature and supply air temperature.
- In addition, a wall mounted controller fitted with an internal temperature, CO$_2$ sensor and user override controls are included as standard.
- Data is stored per minute on an integral data card for data analysis and compliance requirements.

### Heating
- The HTM F-H is designed to preheat the room before the occupied periods, allowing more air at higher temperature to be provided, therefore heating the room more efficiently whilst keeping noise to a minimum during occupied periods.
- The space is actively heated by recirculating room air through the HTM system which is then blown across the LTHW coil. The system is also able to directly heat fresh air and therefore actively ventilate the indoor space by keeping CO$_2$ levels within a range of specific set points without chilling the occupants.

### Acoustic Information

Full acoustic testing has been conducted at SRL (Sound Research Laboratories) and the system was tested with a standard 50mm external louvre arrangement.

<table>
<thead>
<tr>
<th>Sound Power Level at 260 l/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hz</td>
</tr>
<tr>
<td>63</td>
</tr>
<tr>
<td>60.1</td>
</tr>
</tbody>
</table>

**Sound Reduction Index Rw (C:Ctr) = 31 dB**
### Operation

- HTM systems have eight operational fan speeds, at which a minimum air flow rate is supplied if installed in accordance with Monodraught recommendations.

- During normal occupied operation, the system will automatically operate between Fan Speeds 1-5 to provide fresh air ventilation and cooling (if conditions permit). The system is limited to a maximum of Fan Speed 5 (maximum AUTO daytime).

- The user is able to Boost the system's level of ventilation via the wall controller, increasing the system's operating fan speed by two fan speeds and in doing so the user is allowing the system to operate at an increased sound level.

- The system will time out and revert to its automatic operating fan speed after a default time period of 60 minutes. This time out is set via the wall controller with options of 20, 60 or 180 minutes.

- Fan speed 8 is reserved for night time cooling. During summer periods, when the building is unoccupied and when the internal temperature is above 18°C the system will provide peak ventilation.

### LTHW Coil Operation

**Occupied heating** capacity of 6kW based on 80°C/60°C water temperature, 0.08 l/s water flow rate, 160 l/s of ventilation flow rate, air on coil temperature of -3°C and air off coil temperature of 30°C

**Pre-heating** capacity of 6kW based on 80°C/60°C water temperature, 0.08 l/s flow rate, 200 l/s of ventilation flow rate, air on coil temperature of 14°C and air off coil temperature of 40°C.

<table>
<thead>
<tr>
<th>Fan Speed Description</th>
<th>Max Air Flow (l/s)</th>
<th>SFP</th>
<th>Heating Mode</th>
<th>Air On Temp (°C)</th>
<th>Output (kW)</th>
<th>Rated Water Flow Rate (l/s)</th>
<th>Max. Water Flow Rate (l/s)</th>
<th>Coil Water Capacity (l)</th>
<th>Water Pressure Loss at Rated Flow Rate (kPa)</th>
<th>Max. Working Pressure (MPa)</th>
<th>Pipe Connections</th>
<th>Valve and Actuator Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Daytime</td>
<td>260</td>
<td>0.13</td>
<td>Occupied Heating</td>
<td>30</td>
<td>6.0</td>
<td>0.086</td>
<td>0.192</td>
<td>1.0</td>
<td>2.42</td>
<td>1.6</td>
<td>2 No. 3/4&quot; BSP</td>
<td>Valve required to clients requirement with 24VDC actuator with 0-10VDC modulating control</td>
</tr>
<tr>
<td>Preheating</td>
<td>330</td>
<td>0.18</td>
<td>Preheating</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**HTM F-H**

**Typical Schematic**

- **Primary Heating Control Connection**
  - 4-Core LSZH cable, 0.35mm², by others.

- **Power Supply**
  - System is supplied with 3.5m 3 core mains cable to be wired to a switched fused spur (EA Typical, SA heater system), by others.

- **CAT5 to Wall Controller**
  - Supplied by Monodraught, installed by others.

- **HTM System (Master)**
- **LTHW**

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**Monodraught**

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The Hybrid Thermal Mixing (HTM) system from Monodraught is designed to provide natural ventilation, hybrid ventilation, secure night time cooling and boosted levels of ventilation during summer. The HTM systems are designed to work in conjunction with natural ventilation and can be used in single sided and cross flow ventilation strategies. The unit switches between operational modes dependant on season, external/internal temperature conditions and indoor air quality (IAQ). A HTM FS-H system is usually comprised of two HTM FS-H Units synchronised to work as a pair in a Primary/Secondary configuration within a single zone.

With the addition of an internal LTHW coil, the HTM FS-H is able to provide the primary heat source within the space removing the requirement for additional radiators.

The HTM systems are the most technologically advanced hybrid ventilation systems, and are supplied complete with an integrated intelligent and fully automatic control system.

- The HTM FS-H includes an LTHW coil encased within the HTM unit and installed directly over the supply opening of the system to provide up to 6kW of heating to a space.
- Able to provide 130 l/s (SFP 0.17) of daytime ventilation and 250 l/s (SFP 0.4) for night purge ventilation when required.
- The system is supplied as standard with full data logging facility, temperature and CO\textsubscript{2} controls.
- A composite panel provides high levels of acoustic attenuation.
- Available as an exposed unit with white fascia panel or as ducted system with 2No. plenum boxes and 4-way diffuser.
- An integrated exhaust path within the system’s body removes the need for additional exhaust paths, therefore reducing the required number of façade openings.

- The HTM FS-H has been specially designed to meet and exceed BB93, PSBP and Annex F facility output specification requirements.
- The HTM is designed to provide single sided and cross flow ventilation strategies, bringing fresh air into the room and reducing the CO\textsubscript{2} level to create an ideal environment for school classrooms/areas.
- The system is designed to provide mixed tempered air during winter, boosted levels of ventilation during summer and secure night time cooling.
- The system works in conjunction with natural ventilation provided by manual or automatic windows and VENTS\textsuperscript{AIR} louvres.
**TECHNICAL SPECIFICATIONS**

**Grilled/Below Ceiling**

- **Materials**
  - Unit: Powder coated mild steel frame
  - Specialist acoustic panels
  - ABS low maintenance panels
  - Copper piping
  - Galvanised steel casing
  - Aluminium fins

- **Dimensions**: 900(w) x 300(h) x 1200(l)

- **Weight**: 48 Kg

- **Installation**
  - Units supported via a minimum of 3 No. fixings
  - Minimum ceiling void of 350mm - if required

- **System Requirements**
  - External weather louver with minimum free area of 0.14m²
  - Louvre panel to be supplied-fitted with anti-bird mesh
  - Suitable hot water supply for required heat output
  - Actuated valve with 24V DC (0-10V modulation) actuator

- **Electrical Requirement**
  - 230V AC mains with switched fused 3A Spur

- **Guarantee**
  - 5 year warranty / Mechanical and electrical components have a 1 year warranty

- **Flowrates/SFP**
  - Max Day - 130 l/s - SFP: 0.17
  - Max Night - 250 l/s - SFP: 0.4

- **Coil Performance**
  - Up to 6kW of heat based upon water supply of 80˚C / 60˚C at 0.1 l/s

- **Sensors**
  - External temp. sensor -20˚C to +90˚C
  - Recirculation temp. sensor -20˚C to +90˚C
  - Mixed air supply temp. sensor -20˚C to +90˚C
  - Room temp. sensor within wall controller -20˚C to +90˚C
  - Room CO₂ sensor within wall controller 0-2000 ppm

- **Data Monitoring**
  - Data logging functionality as standard: all system operations, sensor readings and damper positions logged every 1 minute

- **Additional Functions**
  - Self-Test Mode via wall controller
  - Integrated exhaust path

- **Options**
  - BACnet / Modbus
  - Filter module EU-G4 bag filter / Filter module EU-F7 bag filter
  - Attenuation module

- **Electrical Connections**
  - System enable input - NC volt-free contact to activate and deactivate the system
  - Fault output - NC relay output for fault indication
  - CAT5e Slave Connection - 2-4 No. HTM units synchronised to work in a Master/Slave configuration in a single zone
  - VENTSAIL systems acting as automatic natural ventilation opening

The information above corresponds to a single HTM FS-H unit.

**Ducted/Above Ceiling**

- **Materials**
  - Unit: Powder coated mild steel frame
  - Specialist acoustic panels
  - ABS low maintenance panels
  - Copper piping
  - Galvanised steel casing
  - Aluminium fins

- **Dimensions**: 900(w) x 300(h) x 1200(l)

- **Weight**: 48 Kg

- **Installation**
  - Units supported via a minimum of 3 No. fixings
  - Minimum ceiling void of 350mm - if required

- **System Requirements**
  - External weather louver with minimum free area of 0.14m²
  - Louvre panel to be supplied-fitted with anti-bird mesh
  - Suitable hot water supply for required heat output
  - Actuated valve with 24V DC (0-10V modulation) actuator

- **Electrical Requirement**
  - 230V AC mains with switched fused 3A Spur

- **Guarantee**
  - 5 year warranty / Mechanical and electrical components have a 1 year warranty

- **Flowrates/SFP**
  - Max Day - 130 l/s - SFP: 0.17
  - Max Night - 250 l/s - SFP: 0.4

- **Coil Performance**
  - Up to 6kW of heat based upon water supply of 80˚C / 60˚C at 0.1 l/s

- **Sensors**
  - External temp. sensor -20˚C to +90˚C
  - Recirculation temp. sensor -20˚C to +90˚C
  - Mixed air supply temp. sensor -20˚C to +90˚C
  - Room temp. sensor within wall controller -20˚C to +90˚C
  - Room CO₂ sensor within wall controller 0-2000 ppm

- **Data Monitoring**
  - Data logging functionality as standard: all system operations, sensor readings and damper positions logged every 1 minute

- **Additional Functions**
  - Self-Test Mode via wall controller
  - Integrated exhaust path

- **Options**
  - BACnet / Modbus
  - Filter module EU-G4 bag filter / Filter module EU-F7 bag filter
  - Attenuation module

- **Electrical Connections**
  - System enable input - NC volt-free contact to activate and deactivate the system
  - Fault output - NC relay output for fault indication
  - CAT5e Slave Connection - 2-4 No. HTM units synchronised to work in a Master/Slave configuration in a single zone
  - VENTSAIL systems acting as automatic natural ventilation opening

The information above corresponds to a single HTM FS-H unit.
HTM FS-H

Controls Strategy

- The HTM incorporates a fully automatic control system based on seasonal control strategy which is determined by the system's internal time, date and weather compensation algorithm to pick up unseasonal conditions.

- The system provides natural ventilation as the default method of ventilation indicating when manual windows or automatically opening dampers should be utilised to maximise the IAQ and maintain the comfort levels.

- The control system incorporates a number of temperature sensors integral to the unit to monitor external temperature, mixed air temperature and supply air temperature.

- In addition, a wall mounted controller fitted with an internal temperature, CO₂ sensor and user override controls are included as standard.

- Data is stored per minute on an integral data card for data analysis and compliance requirements.

### Heating

- The HTM FS-H is designed to preheat the room before the occupied periods, allowing more air at higher temperature to be provided, therefore heating the room more efficiently whilst keeping noise to a minimum during occupied periods.

- The space is actively heated by recirculating room air through the HTM system which is then blown across the LTHW coil. The system is also able to directly heat fresh air and therefore actively ventilate the indoor space by keeping CO₂ levels within a range of specific set points without chilling the occupants.

### Acoustic Information

Full acoustic testing has been conducted at SRL (Sound Research Laboratories) and the system was tested with a standard 50mm external louvre arrangement.

<table>
<thead>
<tr>
<th>Sound Power Level at 130 l/s</th>
<th>63 Hz</th>
<th>125 Hz</th>
<th>250 Hz</th>
<th>500 Hz</th>
<th>1000 Hz</th>
<th>2000 Hz</th>
<th>4000 Hz</th>
<th>8000 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>68 Hz</td>
<td>58.1</td>
<td>59.1</td>
<td>57.2</td>
<td>51.7</td>
<td>42.9</td>
<td>34.1</td>
<td>27.1</td>
<td>25.5</td>
</tr>
</tbody>
</table>

**Sound Reduction Index Rw (CCtr) = 29 dB**

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HTM systems have eight operational fan speeds, at which a minimum air flow rate is supplied if installed in accordance with Monodraught recommendations.

During normal occupied operation, the system will automatically operate between Fan Speeds 1-5 to provide fresh air ventilation and cooling (if conditions permit). The system is limited to a maximum of Fan Speed 5 (maximum AUTO daytime).

The user is able to Boost the system’s level of ventilation via the wall controller, increasing the system’s operating fan speed by two fan speeds and in doing so the user is allowing the system to operate at an increased sound level.

The system will time out and revert to its automatic operating fan speed after a default time period of 60 minutes. This time out is set via the wall controller with options of 20, 60 or 180 minutes.

Fan speed 8 is reserved for night time cooling. During summer periods, when the building is unoccupied and when the internal temperature is above 18°C the system will provide peak ventilation.

### LTHW Coil Operation

<table>
<thead>
<tr>
<th>Fan Speed Description</th>
<th>Max Air Flow (l/s)</th>
<th>SFP</th>
<th>Heating Mode</th>
<th>Air Off Temp (°C)</th>
<th>Output (kW)</th>
<th>Rated Water Flow Rate (l/s)</th>
<th>Max Water Flow Rate (l/s)</th>
<th>Coil Water Capacity (l)</th>
<th>Water Pressure Loss at Rated Flow Rate (kPa)</th>
<th>Max. Working Pressure (MPa)</th>
<th>Pipe Connections</th>
<th>Valve and Actuator Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Daytime</td>
<td>130</td>
<td>0.17</td>
<td>Occupied Heating</td>
<td>30</td>
<td>6.0</td>
<td>0.086</td>
<td>0.14</td>
<td>0.7</td>
<td>5.24</td>
<td>1.6</td>
<td>2 No. 3/4” BSP</td>
<td>Valve required to clients requirement with 24VDC actuator with 0-10VDC modulating control</td>
</tr>
<tr>
<td>Preheating</td>
<td>180</td>
<td>0.25</td>
<td>Preheating</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Occupied Heating** capacity of 5kW based on 80°C/60°C water temperature, 0.08 l/s water flow rate, 130 l/s of ventilation flow rate, air on coil temperature of -3°C and air off coil temperature of 30°C.

**Pre-heating** capacity of 6kW based on 80°C/60°C water temperature, 0.08 l/s flow rate, 180 l/s of ventilation flow rate, air on coil temperature of 12°C and air off coil temperature of 40°C.
Typical Schematic

**POWER SUPPLY**
System is supplied with 1.5m 3 core mains cable to be wired to a switch/fused spur (MA Typical, SA heater system), by others.

**Secondary Signal Connection**
- 8-Core LSZH cable, 0.35mm², by others.

**Secondary Fan Power Connection**
- 3 core mains cable (0.75 - 2.5mm²), by others.

**Primary Heating Control Connection**
- 4-Core LSZH cable, 0.75mm², by others.

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*Valve and Actuator to be supplied and installed by others unless stated at time of order. Actuator must use a 0-10V control signal and be powered by 24VAC to be compatible with Monodraught system.*

www.monodraught.com
info@monodraught.com
The Hybrid Thermal Mixing (HTM) system from Monodraught is designed to provide natural ventilation, hybrid ventilation, secure night time cooling and boosted levels of ventilation during summer.

The HTM systems are designed to work in conjunction with natural ventilation and can be used in single sided and cross flow ventilation strategies. Each HTM is comprised of an intelligent and fully automatic control system coupled with a low energy ventilation system. The unit switches between operational modes dependant on season, external/internal temperature conditions and indoor air quality (IAQ).

With the addition of an internal LTHW coil, the HTM FT-H is able to provide the primary heat source within the space removing the requirement for additional radiators.

**Monodraught’s HTM systems are the most technologically advanced hybrid ventilation systems, and are supplied complete with an integrated intelligent and fully automatic control system.**

- The HTM FT-H includes an LTHW coil encased within the HTM unit and installed directly over the supply opening of the system to provide up to 6kW of heating to a space.
- Able to provide 255 l/s (SFP 0.17) of daytime ventilation and 490 l/s (SFP 0.4) for night purge ventilation when required.
- The system is supplied as standard with full data logging facility, temperature and CO$_2$ controls.
- A composite panel body provides high levels of acoustic attenuation.
- Available as an exposed unit with white fascia panel or as ducted system with 2No. plenum boxes and 4-way diffuser. An integrated exhaust path within the system’s body removes the need for additional exhaust paths, therefore reducing the required number of façade openings.

**The HTM FT-H has been specially designed to meet and exceed BB93, PSBP and Annex F facility output specification requirements.**

- The HTM is designed to provide single sided and cross flow ventilation strategies, bringing fresh air into the room and reducing the CO$_2$ level to create an ideal environment for school classrooms/areas.
- The system is designed to provide mixed tempered air during winter, boosted levels of ventilation during summer and secure night time cooling.
- The system works in conjunction with natural ventilation provided by manual or automatic windows and VENTSARIR louvres.
## TECHNICAL SPECIFICATIONS

### Grilled/Below Ceiling

<table>
<thead>
<tr>
<th>Materials</th>
<th>Unit</th>
<th>Dimensions</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit</td>
<td>Powder coated mild steel frame</td>
<td>1800(w) x 300(h) x 1200 (l)</td>
<td>94kg</td>
</tr>
<tr>
<td>Coil</td>
<td>Copper piping</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Galvanised steel casing</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ABS low maintenance panels</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Specialist acoustic panels</td>
<td>245</td>
<td></td>
</tr>
</tbody>
</table>

### Installation
- Units supported via a minimum of 4 No. fixings
- Minimum ceiling void of 350mm - if required
- External weather louvre with minimum free area of 0.28m²
- Louvre panel to be supplied-fitted with anti-bird mesh
- Suitable hot water supply for required heat output
- Actuated valve with 24V DC (0-10V modulation) actuator

### System Requirements
- 230V AC mains with switched fused 3A Spur
- External weather louvre with minimum free area of 0.28m²
- 2 Louvre panel to be supplied-fitted with anti-bird mesh
- Suitable hot water supply for required heat output
- Actuated valve with 24V DC (0-10V modulation) actuator

### Electrical Requirements
- 230V AC mains with switched fused 3A Spur
- External weather louvre with minimum free area of 0.28m²
- 2 Louvre panel to be supplied-fitted with anti-bird mesh
- Suitable hot water supply for required heat output
- Actuated valve with 24V DC (0-10V modulation) actuator

### Guarantee
- 5 year warranty / Mechanical and electrical components have a 1 year warranty

### Flowrates/SFP
- Max Day - 255 l/s - SFP: 0.17
- Max Night - 490 l/s - SFP: 0.4

### Coil Performance
- Up to 6kW of heat based upon water supply of 80°C / 60°C at 0.1 l/s

### Sensors
- External temp. sensor -20°C to +90°C
- Recirculation temp. sensor -20°C to +90°C
- Mixed air supply temp. sensor -20°C to +90°C
- Room temp. sensor within wall controller -20°C to +90°C
- Room CO₂ sensor within wall controller 0-2000 ppm

### Data Monitoring
- Data logging functionality as standard: all system operations, sensor readings and damper positions logged every 1 minute

### Additional Functions
- Self-Test Mode via wall controller
- Integrated exhaust path

### Options
- BACnet / Modbus
- Filter module EU-G4 bag filter / Filter module EU-F7 bag filter
- Attenuation module

### Optional Electrical Connections
- System enable input - NC volt-free contact to activate and deactivate the system
- Fault output - NC relay output for fault indication
- CAT5e Slave Connection - 2-4 No. HTM units synchronised to work in a Master/Slave configuration in a single zone
- VENTSAIR systems acting as automatic natural ventilation opening

---

**www.monodraught.com**

**info@monodraught.com**
### Controls Strategy

- The HTM incorporates a fully automatic control system based on seasonal control strategy which is determined by the system’s internal time, date and weather compensation algorithm to pick up unseasonal conditions.

- The system provides natural ventilation as the default method of ventilation indicating when manual windows or automatically opening dampers should be utilised to maximise the IAQ and maintain the comfort levels.

- The control system incorporates a number of temperature sensors integral to the unit to monitor external temperature, mixed air temperature and supply air temperature.

- In addition, a wall mounted controller fitted with an internal temperature, CO₂ sensor and user override controls are included as standard.

- Data is stored per minute on an integral data card for data analysis and compliance requirements.

### Heating

- The HTM FT-H is designed to preheat the room before the occupied periods, allowing more air at higher temperature to be provided, therefore heating the room more efficiently whilst keeping noise to a minimum during occupied periods.

- The space is actively heated by recirculating room air through the HTM system which is then blown across the LTHW coil. The system is also able to directly heat fresh air and therefore actively ventilate the indoor space by keeping CO₂ levels within a range of specific set points without chilling the occupants.

### Acoustic Information

The system was tested with a standard 50mm external louvre arrangement.

<table>
<thead>
<tr>
<th>Sound Power Level at 260 l/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 Hz</td>
</tr>
<tr>
<td>60.1</td>
</tr>
</tbody>
</table>

**Sound Reduction Index Rw (C:Ctr) = 30 dB**
Operation

- HTM systems have eight operational fan speeds, at which a minimum air flow rate is supplied if installed in accordance with Monodraught recommendations.
- During normal occupied operation, the system will automatically operate between Fan Speeds 1-5 to provide fresh air ventilation and cooling (if conditions permit). The system is limited to a maximum of Fan Speed 5 (maximum AUTO daytime).
- The user is able to Boost the system’s level of ventilation via the wall controller, increasing the system’s operating fan speed by two fan speeds and in doing so the user is allowing the system to operate at an increased sound level.
- The system will time out and revert to its automatic operating fan speed after a default time period of 60 minutes. This time out is set via the wall controller with options of 20, 60 or 180 minutes.
- Fan speed 8 is reserved for night time cooling. During summer periods, when the building is unoccupied and when the internal temperature is above 18°C the system will provide peak ventilation.

<table>
<thead>
<tr>
<th>Fan Speed Description</th>
<th>Max Air Flow (l/s)</th>
<th>SFP</th>
<th>Heating Mode</th>
<th>Air Off Temp (°C)</th>
<th>Output (kW)</th>
<th>Rated Water Flow Rate (l/s)</th>
<th>Max. Water Flow Rate (l/s)</th>
<th>Max. Water Capacity (l)</th>
<th>Water Pressure Loss at Rated Flow Rate (kPa)</th>
<th>Max. Working Pressure (MPa)</th>
<th>Pipe Connections</th>
<th>Valve and Actuator Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Daytime</td>
<td>260</td>
<td>0.18</td>
<td>Occupied Heating</td>
<td>30</td>
<td>6.0</td>
<td>0.086</td>
<td>0.394</td>
<td>1.9</td>
<td>1.53</td>
<td>1.6</td>
<td>2 No. 3/4” BSP</td>
<td>Valve required to clients requirement with 24VDC actuator with 0-10VDC modulating control</td>
</tr>
<tr>
<td>Preheating</td>
<td>330</td>
<td>0.26</td>
<td>Preheating</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Occupied heating** capacity of 6kW based on 80°C/60°C water temperature, 0.08 l/s water flow rate, 160 l/s of ventilation flow rate, air on coil temperature of -3°C and air off coil temperature of 30°C

**Pre-heating** capacity of 6kW based on 80°C/60°C water temperature, 0.08 l/s flow rate, 200 l/s of ventilation flow rate, air on coil temperature of 14°C and air off coil temperature of 40°C.
HTM FT-H System
(Master)

Primary Heating Control Connection
4-Core LSZH cable, 0.35mm², by others.

POWER SUPPLY
System is supplied with 1.5m 3 core mains cable to be wired to a 3A switched fused spur, by others.

CAT5 to WALL CONTROLLER
Supplied by Monodraught, installed by others

HTM Wall Controller

WIRING DETAILS
The Hybrid Thermal Mixing (HTM) system from Monodraught is designed to provide natural ventilation, hybrid ventilation, secure night-time cooling and boosted levels of ventilation during summer. The HTM FS-C systems benefit from the addition of a LTHW Coil and condensation tray, allowing it to provide the primary heat source and comfort cooling within a space, removing the requirement for additional radiators and cooling systems.

The system actively maintains the pre-set temperature by recirculating room air through the coil. It also delivers fresh air directly to the space all year round utilising the coil to temper the air before delivering it to the space keeping CO₂ levels to within a specific range.

The HTM FS-C can be configured to remotely control an individual Air Source Heat Pump or as part of a larger full building heating system by utilising a modulating 24VDC actuated valve.

The HTM FS-C has a LTHW coil and integral condense pump encased within the HTMs casing and is installed directly over the supply opening of the system to provide up to 6kW of heating or 3kW of cooling to a space. Able to provide 130l/s (SFP 0.17) of daytime ventilation and 250l/s (SFP 0.4) for night purge ventilation when required. The system is supplied as standard with full data logging facility, temperature and CO₂ controls. With an optional BACnet or Modbus module, each unit has the ability to output key performance data to a central BMS.

A composite panel body provide high levels of acoustic attenuation.

An integrated exhaust path within the system’s body removes the need for additional exhaust paths, therefore reducing the required number of façade openings.

The HTM FS-C has been specially designed to meet and exceed BB93, PSBP and Annex F facility output specification requirements.

The HTM is designed to provide single sided and cross flow ventilation strategies, bringing fresh air into the room and reducing the CO₂ level to create an ideal environment for school classrooms/areas.

The system is designed to provide mixed tempered air during winter, boosted levels of ventilation during summer and secure night time cooling.

The system works in conjunction with natural ventilation provided by manual or automatic windows and VENTSAIR louvres.
TECHNICAL SPECIFICATIONS

**Fascia/Below Ceiling**

**Materials**
- Unit: Powder coated mild steel frame
- Specialist acoustic panels
- ABS low maintenance panels

**Dimensions**
- 900(w) x 300(h) x 1200 (l)
- 960(w) with electronics tray

**Coil**
- Copper piping
- Galvanised steel casing
- Aluminium fins

**Weight**
- 50kg

**Installation**
- Units supported via a minimum of 3 No. fixings
- Minimum ceiling void of 350mm - if required

**System Requirements**
- External weather louvre with minimum free area of 0.14m²
- Louvre panel to be supplied-fitted with anti-bird mesh
- Suitable water supply for required heat and cooling output
- Actuated valve with 24V DC (0-10V modulation) actuator

**Electrical Requirement**
- 230V AC mains with switched fused 3A Spur

**Guarantee**
- 5 year warranty / Mechanical and electrical components have a 1 year warranty

**Flowrates/SFP**
- Max Day - 130 l/s - SFP: 0.17
- Max Night - 250 l/s - SFP: 0.4

**Coil Performance**
- Up to 6kW of heat and 3kW of cooling

**Sensors**
- External temp. sensor -20°C to +90°C
- Recirculation temp. sensor -20°C to +90°C
- Mixed air supply temp. sensor -20°C to +90°C
- Room temp. sensor within wall controller -20°C to +90°C
- Room CO₂ sensor within wall controller 0-2000 ppm

**Data Monitoring**
- Data logging functionality as standard: all system operations, sensor readings and damper positions logged every 1 minute

**Additional Functions**
- Self-Test Mode via wall controller
- Condensation pump with 10m head
- BACnet / Modbus
- Filter module EU-G4 bag filter / Filter module EU-F7 bag filter
- Attenuation module

**Options**
- System enable input - NC volt-free contact to activate and deactivate the system
- Fault output - NC relay output for fault indication
- CATSe Slave Connection - 2-4 No. HTM units synchronised to work in a Master/Slave configuration in a single zone
- VENTS AIR systems acting as automatic natural ventilation opening

The information above corresponds to a single HTM FS-C unit.
Controls Strategy

- The HTM incorporates a fully automatic control system based on seasonal control strategy which is determined by the system's internal time, date and weather compensation algorithm to pick up unseasonal conditions.

- The system provides natural ventilation as the default method of ventilation indicating when manual windows or automatically opening dampers should be utilised to maximise the IAQ and maintain the comfort levels.

- The control system incorporates a number of temperature sensors integral to the unit to monitor external temperature, mixed air temperature and supply air temperature.

- In addition, a wall mounted controller fitted with an internal temperature, CO₂ sensor and user override controls are included as standard.

- Data is stored per minute on an integral data card for data analysis and compliance requirements.

### Seasonal Controls

<table>
<thead>
<tr>
<th>Season</th>
<th>Occupied hours 08:00 - 17:00</th>
<th>Night time cooling 22:00 - 07:00</th>
<th>Heating</th>
<th>Adaptive Pre-heat</th>
<th>Cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Date</td>
<td>01 Mar</td>
<td>N/A</td>
<td>19°C</td>
<td>Up to 1 hour before occupied hours</td>
<td>25°C</td>
</tr>
<tr>
<td>Finish Date</td>
<td>30 Apr</td>
<td>N/A</td>
<td>18°C</td>
<td>N/A</td>
<td>26°C</td>
</tr>
<tr>
<td>Nat Vent</td>
<td>18°C</td>
<td>N/A</td>
<td>16°C</td>
<td>N/A</td>
<td>26°C</td>
</tr>
<tr>
<td>Nat Vent + Windows</td>
<td>23°C</td>
<td>N/A</td>
<td>19°C</td>
<td>N/A</td>
<td>26°C</td>
</tr>
<tr>
<td>Boost</td>
<td>24°C</td>
<td>N/A</td>
<td>20°C</td>
<td>N/A</td>
<td>26°C</td>
</tr>
<tr>
<td>Mixed Mode</td>
<td>23°C</td>
<td>N/A</td>
<td>23°C</td>
<td>N/A</td>
<td>27°C</td>
</tr>
</tbody>
</table>

### CO₂ Levels

<table>
<thead>
<tr>
<th>Season</th>
<th>Start Date</th>
<th>Finish Date</th>
<th>Nat Vent</th>
<th>Nat Vent + Windows</th>
<th>Boost</th>
<th>Mixed Mode</th>
<th>Night time cooling 22:00 - 07:00</th>
<th>Heating</th>
<th>Adaptive Pre-heat</th>
<th>Cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>01 Mar</td>
<td>30 Apr</td>
<td>21°C</td>
<td>23°C</td>
<td>24°C</td>
<td>23°C</td>
<td>N/A</td>
<td>19°C</td>
<td>Up to 1 hour before occupied hours</td>
<td>25°C</td>
</tr>
<tr>
<td>Summer</td>
<td>01 May</td>
<td>31 Sept</td>
<td>18°C</td>
<td>20°C</td>
<td>22°C</td>
<td>22°C</td>
<td>N/A</td>
<td>18°C</td>
<td>N/A</td>
<td>26°C</td>
</tr>
<tr>
<td>Autumn</td>
<td>01 Oct</td>
<td>30 Nov</td>
<td>21°C</td>
<td>23°C</td>
<td>24°C</td>
<td>23°C</td>
<td>N/A</td>
<td>16°C</td>
<td>N/A</td>
<td>26°C</td>
</tr>
<tr>
<td>Winter</td>
<td>01 Dec</td>
<td>End of Feb</td>
<td>22°C</td>
<td>24°C</td>
<td>25°C</td>
<td>24°C</td>
<td>N/A</td>
<td>19°C</td>
<td>N/A</td>
<td>27°C</td>
</tr>
</tbody>
</table>

### CO₂ Levels

<table>
<thead>
<tr>
<th>Season</th>
<th>Start Date</th>
<th>Finish Date</th>
<th>Nat Vent</th>
<th>Nat Vent + Windows</th>
<th>Boost</th>
<th>Mixed Mode</th>
<th>Night time cooling 22:00 - 07:00</th>
<th>Heating</th>
<th>Adaptive Pre-heat</th>
<th>Cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>01 Mar</td>
<td>30 Apr</td>
<td>21°C</td>
<td>23°C</td>
<td>24°C</td>
<td>23°C</td>
<td>N/A</td>
<td>19°C</td>
<td>Up to 1 hour before occupied hours</td>
<td>25°C</td>
</tr>
<tr>
<td>Summer</td>
<td>01 May</td>
<td>31 Sept</td>
<td>18°C</td>
<td>20°C</td>
<td>22°C</td>
<td>22°C</td>
<td>N/A</td>
<td>18°C</td>
<td>N/A</td>
<td>26°C</td>
</tr>
<tr>
<td>Autumn</td>
<td>01 Oct</td>
<td>30 Nov</td>
<td>21°C</td>
<td>23°C</td>
<td>24°C</td>
<td>23°C</td>
<td>N/A</td>
<td>16°C</td>
<td>N/A</td>
<td>26°C</td>
</tr>
<tr>
<td>Winter</td>
<td>01 Dec</td>
<td>End of Feb</td>
<td>22°C</td>
<td>24°C</td>
<td>25°C</td>
<td>24°C</td>
<td>N/A</td>
<td>19°C</td>
<td>N/A</td>
<td>27°C</td>
</tr>
</tbody>
</table>

### Acoustic Information

Full acoustic testing has been conducted at SRL (Sound Research Laboratories) and the system was tested with a standard 50mm external louvre arrangement.

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Sound Power Level at 130 l/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 Hz</td>
<td>58.1</td>
</tr>
<tr>
<td>125 Hz</td>
<td>59.1</td>
</tr>
<tr>
<td>250 Hz</td>
<td>57.2</td>
</tr>
<tr>
<td>500 Hz</td>
<td>51.7</td>
</tr>
<tr>
<td>1000 Hz</td>
<td>42.9</td>
</tr>
<tr>
<td>2000 Hz</td>
<td>34.1</td>
</tr>
<tr>
<td>4000 Hz</td>
<td>27.1</td>
</tr>
<tr>
<td>8000 Hz</td>
<td>25.5</td>
</tr>
</tbody>
</table>

\[ \text{Sound Reduction Index } \text{R}_w (\text{C:Ctr}) = 29 \text{ dB} \]
HTM systems have eight operational fan speeds, at which a minimum air flow rate is supplied if installed in accordance with Monodraught recommendations.

During normal occupied operation, the system will automatically operate between Fan Speeds 1-5 to provide fresh air ventilation and cooling (if conditions permit). The system is limited to a maximum of Fan Speed 5 (maximum AUTO daytime).

The user is able to Boost the system’s level of ventilation via the wall controller, increasing the system’s operating fan speed by two fan speeds and in doing so the user is allowing the system to operate at an increased sound level.

The system will time out and revert to its automatic operating fan speed after a default time period of 60 minutes. This time out is set via the wall controller with options of 20, 60 or 180 minutes.

Fan speed 8 is reserved for night time cooling. During summer periods, when the building is unoccupied and when the internal temperature is above 18°C the system will provide peak ventilation.

### LTHW Coil Operation

<table>
<thead>
<tr>
<th>Fan Speed Description</th>
<th>Max Air Flow (l/s)</th>
<th>SFP</th>
<th>Heating Mode</th>
<th>Air O/F Temp (°C)</th>
<th>Output (kW)</th>
<th>Rated Water Flow Rate (l/s)</th>
<th>Max Water Flow Rate (l/s)</th>
<th>Coil Water Capacity (l)</th>
<th>Water Pressure Loss at Rated Flow Rate (kPa)</th>
<th>Max Working Pressure (MPa)</th>
<th>Pipe Connections</th>
<th>Valve and Actuator Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Daytime</td>
<td>130</td>
<td>0.17</td>
<td>Occupied Heating</td>
<td>30</td>
<td>6.0</td>
<td>0.086</td>
<td>0.14</td>
<td>0.7</td>
<td>5.24</td>
<td>1.6</td>
<td>2 No. 3/4&quot; BSP</td>
<td>Valve required to client requirement with 24VDC actuator with 0-10VDC modulating control</td>
</tr>
<tr>
<td>Preheating</td>
<td>180</td>
<td>0.25</td>
<td>Preheating</td>
<td>40</td>
<td>3.0</td>
<td>0.086</td>
<td>0.14</td>
<td>0.7</td>
<td>5.24</td>
<td>1.6</td>
<td>2 No. 3/4&quot; BSP</td>
<td>Valve required to client requirement with 24VDC actuator with 0-10VDC modulating control</td>
</tr>
<tr>
<td>Max Daytime</td>
<td>130</td>
<td>0.17</td>
<td>Cooling</td>
<td>10</td>
<td>3.0</td>
<td>0.086</td>
<td>0.14</td>
<td>0.7</td>
<td>5.24</td>
<td>1.6</td>
<td>2 No. 3/4&quot; BSP</td>
<td>Valve required to client requirement with 24VDC actuator with 0-10VDC modulating control</td>
</tr>
</tbody>
</table>

**Occupied heating** capacity of 5kW based on 80°C/60°C water temperature, 0.08 l/s water flow rate, 130 l/s of ventilation flow rate, air on coil temperature of -3°C and air off coil temperature of 30°C.

**Pre-heating** capacity of 6kW based on 80°C/60°C water temperature, 0.08 l/s flow rate, 180 l/s of ventilation flow rate, air on coil temperature of 12°C and air off coil temperature of 40°C.

**Cooling** capacity of 3kW based on 10°C/18°C water temperature, 0.08 l/s water flow rate, 130 l/s of ventilation flow rate, air on coil temperature of 30°C and air off coil temperature of 10°C.
**Typical Wiring Detail**
System working in conjunction with Air Source Heat Pump

**Pipe Schematic Detail**
System working in conjunction with Air Source Heat Pump

---

**Key**
- **Actuated Valve**
- **Calibrating Valve**
- **Commissioning Station**
- **Expansion Vessels**
- **Hand Valve**
- **Flexible Joint**
- **Drain Cock**
- **Air Release Valve**
- **Secondary Pump**
- **T-Filer**
- **Pressure Gauge**
- **Directional Flow Sensor**

**LTHW Coils Located within HTM FS-C Unit**
(Below Water Flow in Coil to be 0.440k)

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**Monodraught to Heat Pump Interface Box**
Supplied by Monodraught, connections by others.

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**Interface Box Connection**
- 6-Core LSZH cable, 0.75mm², by others.
- 4-Core LSZH cable, 0.50mm², supplied by Monodraught, connections by others.

---

**Power Supply**
- Requires a 3-core mains cable to be wired to a switched fused spur (1A) by others.

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**Secondary Supply Connection**
- 8-Core LSZH cable, 0.50mm², by others.
- 3-core mains cable (0.75 - 2.5mm²), by others.
- Main Power

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**HTM FS-C (MPk)**
Master Primary

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**HTM FS-C (MSk)**
Master Secondary

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**R410A Wall Controller**
Supplied and installed by others.

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**HTM FS-C (Mpk)**
Smart Screen Wall Controller

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**Sensor Module**

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**Key**
- **Buffer Tank**
  - Only required should the volume in the system be less than the recommended.
  - Please contact Monodraught for further details.

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**HTM FS-C (Msk)**
Monodraught to Heat Pump Interface Box

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**Key**
- **Actuated Valve**
- **Calibrating Valve**
- **Commissioning Station**
- **Expansion Vessels**
- **Hand Valve**
- **Flexible Joint**
- **Drain Cock**
- **Air Release Valve**
- **Secondary Pump**
- **T-Filer**
- **Pressure Gauge**
- **Directional Flow Sensor**

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**LTHW Coils Located within HTM FS-C Unit**
(Below Water Flow in Coil to be 0.440k)

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**Interface Box Connection**
- 6-Core LSZH cable, 0.75mm², by others.
- 4-Core LSZH cable, 0.50mm², supplied by Monodraught, connections by others.
**Typical Wiring Detail**
System working in conjunction with central heating/cooling system

- **Secondary Signal Connection**
  - 8-Core LSZH cable, 0.35mm², by others.

- **Secondary Fan Power Connection**
  - 3-core mains cable (0.75 - 2.5mm²), by others.

- **Primary Heating Control Connection**
  - 4-Core LSZH cable, 0.35mm², by others.

- **POWER SUPPLY**
  - System is supplied with 1.5m 3-core mains cable to be wired to a switched fused spur (EA typical, SA heater system), by others.

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* Valve and Actuator to be supplied and installed by others unless stated at time of order. Actuator must use a 0-10V control signal and be powered by 24VDC to be compatible with Monodraught system.*
Controls and User Interface

Monodraught offer three wall controller options, each dependant on the room design, layout and the user’s requirements. One wall controller is required to be mounted within each room and will give the user certain functionality over the systems.

The HTM systems have the ability to perform a Self-test operation which is delivered via the system’s wall controller. The HTM runs an automatic diagnostics test, operating and monitoring each element to search for any faults. If any faults are found, they will be indicated to the user by the wall controller.

Self-test Mode

All Monodraught’s HTM systems have the ability to perform a Self-test operation which is operated via the system’s wall controller. The HTM runs an automatic diagnostics test, operating and monitoring each element to search for any faults. If any faults are found, they will be indicated to the user by the wall controller. This test can be initiated by either a Monodraught engineer or a facility manager.

Openable Window Option
(Available for HTM F, FS and FT types)

Allows the user to control the fan speed but will also indicate when they need to open windows to aid the system in providing ventilation.

1. **Boost mode**: Will provide a boosted level of ventilation.
2. **Auto mode**: Allows the HTM system to operate within its 3 automatic modes.
3. **Off mode**: Closes the high level exhaust damper and stops the fan from operating.
4. **LED**: Illuminates to notify users when it is necessary to open a window.

Left hand side provides control and indication of the current operation mode of the HTM system.

Right hand side provides indication for the openable windows.

Louvre Override Option
(Available for HTM F, FS and FT types)

Allows the user to not only control the fan speed of the units, but also regulate the amount that the VENTSAIR Façade system opens by if fitted.

1. **Louvre LED’s**: No LED = Closed / 1 LED = 10% open / 2 LED = 25% / 3 LED = 60% / 4 LED = Fully open.
2. **Plus**: Opens the Ventsair louvre by 1 setting.
3. **Minus**: Closes the Ventsair louvre by 1 setting.
4. **Sensor**: Temperature and air quality sensor.

Left hand side provides control and indication of the current operation mode of the HTM system.

Right hand side provides control and indication for the opening level of the Ventsair wall louvres.
**Temperature Set Point Option**  

1. **Boost Mode**: will provide a boosted level of ventilation via the low energy fan.
2. **Auto Mode**: Allows the ventilation system to operate within its automatic modes.
3. **Off Mode**: Closes the high level exhaust damper and stops the fan from operating.
4. **Temperature Set Point Adjust**: 1 LED = -2°C / 2 LED = -1°C / 3 LED = Set Point / 4 LED = +1°C / 5 LED = +2°C.
5. **Plus**: Adjusts the temperature set point +1.
6. **Minus**: Adjusts the temperature set point -1.
7. **Sensor**: Temperature and air quality sensor.

Left hand side provides control and indication of the current operation mode of the HTM system.  
Right hand side provides control and indication for temperature set point adjust.

**Smart Screen Option**  
(Available for all HTM types)

The controller displays the room temperature, air quality (IAQ) and fan speed via a capacitive touch LCD screen. The user is also able to explore how the system works and adjust the settings in order to maintain a comfortable environment with minimal energy usage.

A. View system information  
B. Change fan speed  
C. Return to Home Page  
D. Time and date  
E. CO₂ level indicator  
   - Red: High / Yellow: Medium / Green: Low  
F. Current fan speed  
G. Room temperature  
H. If additional ventilation is required, it will display the “windows opening” icon.

**The Smart Screen works in conjunction with a modular combined CO₂ & Temperature sensor with a CO₂ range of 400 - 2000 ppm and a temperature range of 0 - 50°C.**

The CO₂ sensor features an automatic background calibration which will recalibrate the sensor back to a background level during unoccupied periods to cancel sensor drift and maintain accuracy over the typical product lifespan.
Fixing Rail
(Available for all HTM types)

Corner Brackets
(Available only for HTM F, FS, F-H, FS-H and FS-C types)

Fixing Bar
(Available only for HTM F and F-H types)

*Note:* Fixing rail to be located no less than 700mm from the front face for standard systems, and no less than 900mm for LTHW type systems.
Monodraught’s HTM is designed to work with and control a range of Ventsair Façade Ventilation systems (VAF) which are often used in lieu of a manual window. These systems typically comprise of an external aluminium louvre, a high specification volume control damper and an internal grille, and are used to provide controlled fresh air during the day and secure night time cooling via cross flow and stack ventilation principles.

Depending on their location within a room, they can assist in stack, cross flow and single sided flow ventilation. The HTM will automatically control these additional vents and the vents can also be opened and closed manually via the system’s control panel.

The system can be specified to suit glazed frames or fitted with a flange to suit wall openings.

HTM F systems are available with a 1kW Electric Heater Module. The module is installed within the system’s air path and is designed to warm the incoming fresh air to ensure a minimum supply temperature is achieved when external temperatures drop below -3 °C. The module is installed in conjunction with a relay linked flow switch and twin thermal cut outs.
Monodraught’s HTM systems are available with an additional BACnet module that allows the system to be installed on to a BACnet/IP network and display a number of systems variables.

The BACnet module plugs into the Control Board and interfaces with the on-board micro-controller to provide BACnet visibility of the HTM system.

The BACnet module requires an RJ45 Ethernet connection (by others) from the BACnet/IP network to each Primary HTM unit.

• HTM F, FT, F-H and FT-H types
  BACnet/IP

• HTM FS, FS-H and FS-C types
  BACnet/IP

The MODBUS module allows an HTM system to be installed on to a MODBUS RTU network and make visible a number of system variables to the master MODBUS device.

Each system has its own unique MODBUS number allocated 1 to 247 within the configuration header of the HTM.

The MODBUS module requires a 1.5 or 2 pair shielded cable daisy chained between each of the Modbus modules located in the Master units. Cable is to be supplied and installed by others.

• HTM F, FT, F-H and FT-H types
  MODBUS RTU
  (Half-duplex RS485)

• HTM FS, FS-H and FS-C types
  MODBUS RTU
  (Half-duplex RS485)
Monodraught’s HTM systems are available with an additional Filter module. The module is installed between the HTM system and the external façade. The filter module is available with either an EU-G4 or EU-F7 bag filter. It is constructed from a powder coated mild steel frame and specialist acoustic panelling.

<table>
<thead>
<tr>
<th>Filter Module Sizes</th>
<th>Width (mm)</th>
<th>Height (mm)</th>
<th>Depth (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>900</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>FS</td>
<td>900</td>
<td>300</td>
<td>500</td>
</tr>
<tr>
<td>FT</td>
<td>1800</td>
<td>300</td>
<td>500</td>
</tr>
<tr>
<td>F-H</td>
<td>900</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>FS-H</td>
<td>900</td>
<td>300</td>
<td>500</td>
</tr>
<tr>
<td>FT-H</td>
<td>1800</td>
<td>300</td>
<td>500</td>
</tr>
<tr>
<td>FS-C</td>
<td>900</td>
<td>300</td>
<td>500</td>
</tr>
</tbody>
</table>

Attenuation Module

HTM systems are available with an additional Attenuation module. The module is installed between the HTM system and the external façade to reduce noise break-in and noise break-out. This is especially useful when installing a system to a façade close to a very busy road or in a residential area.

<table>
<thead>
<tr>
<th>2 Internal Splitters</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 Hz</td>
</tr>
<tr>
<td>6</td>
</tr>
</tbody>
</table>

Weighted Sound Reduction Index Rw (C:Ctr) = 19dB

<table>
<thead>
<tr>
<th>Attenuation Module Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width (mm)</td>
</tr>
<tr>
<td>F</td>
</tr>
<tr>
<td>FS</td>
</tr>
<tr>
<td>FT</td>
</tr>
<tr>
<td>F-H</td>
</tr>
<tr>
<td>FS-H</td>
</tr>
<tr>
<td>FT-H</td>
</tr>
<tr>
<td>FS-C</td>
</tr>
</tbody>
</table>
Within the IES-VE software, Monodraught has developed a performance model of the HTM, utilising data that has been collected from component tests and on site monitoring, to produce an accurate representation for modelling.

A typical school has been prepared, considering all aspects of occupancy, solar gain, and sensible and latent heat gains, based around the design requirements stated within the Facilities Output Specification.

Monodraught’s standard approach is to consider the total heat gains in the area and provide a natural ventilation strategy to dissipate this heat gain. Furthermore, the aim is to provide sufficient fresh air to the occupants of the area so that indoor air quality and thermal comfort are maintained.

The suitable CIBSE DSY weather file for the project location is utilised to provide the expected local environmental conditions to the building being modelled.

### Building Construction Inputs

<table>
<thead>
<tr>
<th>Item</th>
<th>Construction Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction U Values &amp; Thermal Mass (Cm)</td>
<td></td>
</tr>
<tr>
<td>Walls</td>
<td>0.26 W/m².K, 180 kJ/(m².K)</td>
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<tr>
<td>Floor</td>
<td>0.22 W/m².K, 100 kJ/(m².K)</td>
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<tr>
<td>Roof</td>
<td>0.18 W/m².K, 180 kJ/(m².K)</td>
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<tr>
<td>Glazing</td>
<td>0.16 W/m².K</td>
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<tr>
<td>Glazing g-Value</td>
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<tr>
<td>Infiltration Rate</td>
<td>0.25 Air Changes per Hour</td>
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<tr>
<td>Floor Area</td>
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<tr>
<td>Internal Room Height</td>
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<tr>
<td>Glazing Area</td>
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<tr>
<td>Effective Low Level Opening</td>
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<tr>
<td>Heating Set Point</td>
<td>18.0 °C</td>
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<tr>
<td>Occupancy (people)</td>
<td>34 No.</td>
</tr>
<tr>
<td>Occupancy Heat Gain</td>
<td>75 W (sensible), 55 W (latent)</td>
</tr>
<tr>
<td>Occupied Hours</td>
<td>08:30 - 12:30, 13:30 - 16:00</td>
</tr>
<tr>
<td>Lighting</td>
<td>10.0 W/m²</td>
</tr>
<tr>
<td>Equipment</td>
<td>15.0 W/m²</td>
</tr>
</tbody>
</table>

### Natural Ventilation Performance

With a combination of the ModellIT Building Modeller and MacroFlo Air Movement modules of IES-VE, Monodraught can demonstrate the natural ventilation performance of the system within the modelled room, during the non-heating season.

Monodraught’s HTM fully automatic control strategy is replicated within the MacroFlo module of IES, to provide a continuously regulated flow of natural ventilation through the system, dependant on the conditions of the internal classroom. During occupied periods of the non-heating season, the HTM system will also work in conjunction with additional openings to the external façade of the room, to provide greater level of ventilation.
3 Hybrid Ventilation Performance

The HTM system is designed to operate in a Hybrid mode, utilising the internal low energy fan, during peak summer day time periods and summer night periods.

Working within the ApacheHVAC System Simulation Interface module of IES-VE and utilising test data of Monodraught’s low energy fan, Monodraught have developed an accurate modulating profile for the fan assisted natural ventilation strategy, to provide a boost of external fresh air through the HTM system and into the classroom.

4 Analysis of Winter Performance

For the HTM operation during the heating season, Monodraught are able to utilise the ApachePro module to demonstrate tempering of the incoming fresh air. The detailed design of Monodraught’s system, allowing for the mixing of external air and re-circulated room air, ensures that even with an external air temperature of 0 °C, the HTM system is able to provide a supply air temperature into the room at approximately 13 °C.

By locating the HTM system at high level within the room, the supply air benefits from further air mixing. Mixed air supply is directed towards the ceiling through angled louvres, entraining additional room air within the air flow and allowing further mixing to take place.

Climate Testing

During December 2013 an HTM system was installed within a climatic test chamber and a special heat sensitive membrane was fitted running through the centre of the system. An insulated chamber fitted below the HTM system was heated to 23 °C to represent an internal room condition.

Thermal imaging video cameras were used to record the temperature profile of the mixing of air in real time. The cameras were set to record three zones with averaged temperature readings within each zone: external air temp., internal room air temp. and mixed supply air temp. The system was then set to provide 200 l/s of mixed ventilation air to represent maximum daytime variation rates.

Zone 1 is recording the external air temperature with an average temp. of 11.7 °C
Zone 2 is recording an internal room temperature with an average temp. of 22.7 °C
Zone 3 is recording the mixed air supply temperature with an average temp. of 16.4 °C
NOTE: The HTM units can weigh up to 70 kg and therefore should always be lifted by a suitable number of people. The unit will be delivered within a protective cardboard box, complete with nylon straps. The box is designed to be lifted with these handles positioned toward the bottom on the box. It is recommended that the unit and its components are positioned close to their final install point to avoid damage.

1. Ensure external louvres and external connection spigot are positioned and installed correctly to Monodraught specifications. Using the correct detail, mark the location for the support fixings and fasten the correct support fixings for the ceiling construction. Note: the external spigot will protrude by 30 mm into the rear of the system.
2. HTM F units: Two Internal Front Fixings must be installed along with 1 or 2 Internal Rear Fixings to ensure the system is suitably balance and supported. HTM FS units: Standard Fixing method is via the 4No. 90° External Fixings, if these are used all four must be utilised. Note: It is also possible to install the HTM FS units using the Additional Front & Rear Fixings, as per the HTM F unit. Should these fixing point be required this must be stipulated at point of order.
3. Cut the required number of M8 drop rods to length for supporting the unit.
4. Position the system as close to the final position as possible and tear the box away from the unit and remove the front grille if installed.
5. Ensure all of the required fixing points are clear of debris.
6. Only if using Internal Rear Fixings: Insert drop rod lengths, into the pre-tapped rear fixing points of the system as required. Wind the length into the system until approximately 20 mm of thread is left protruding. Run 2No. nuts down this length until they are flush with the system.
7. Using a suitable mechanical lift raise the system into position so that the system is clear of the spigot. Once level with the spigot move the system so that the spigot protrudes into the system by 30 mm making sure that the gap is consistent on all edge and that no weight is being exerted onto the spigot. The support fixings should now align with the fixing points.
8. Only if using Internal Rear Fixings: Wind the rear drop rod out of the system and fully into the support fixings until tight. Use the two nuts to lock the drop rod in place.
9. Insert a drop rod through each fixing point being used and attach a washer and followed by two M8 nuts. Wind the drop rods fully into the support fixings until tight and lock with the top nut.
10. Feed a washer and nut onto the bottom of each of the drop rods and wind up until flush with the system. These nuts are then to be wound further to level out the system. Once the system is level, tighten the remaining nut and washer on top of the system to lock it in place.
Ducting Install

1. Connect the Duct Spigot Plate to the HTM FS Supply Spigot.
2. Ensure correct duct length have been supplied and trim to length as necessary.
3. Using the detail mark the location for the support fixings for the Diffuser Box and Ducting and fasten the correct support fixings for the ceiling construction. Ensure the Diffuser will align with the ceiling grid and HTM FS unit.
4. Cut four M8 drop rod lengths to a suitable length that will allow the Diffuser Box to sit flush with the ceiling raft. Wind a nut onto the end of each drop rod length then wind the drop rods fully into the support fixings until tight and lock into place with the nut.
5. Feed another nut onto the bottom end of each drop rod and wind up by approximately 50 mm.
6. Offer the Diffuser Box up to the drop rods and wind a washer and nut onto each drop rod to support and then level the box. Once the box is level, wind down and tighten the top nuts on top of the Diffuser Box to lock the box in place.
7. Attach flexible ducting to the end of spiral duct length and secure in place with band-clamp.
8. Secure the ducting to the ceiling via a suitable fixing method and adjust the ducting to correct height. Slip the duct ends fully over the HTM spigots and draw flexi ducting over the Diffuser Box Spigots, securing at both end with a band clamp.
9. Attached 4-way diffuser.

System Connections
For Monodraught’s HTM wiring details, please refer to document "Wiring Details" section. To obtain the correct document, please contact us at: info@monodraught.com
A £37.5m school development was recently opened in Ely, Cambridgeshire. Morgan Sindall were appointed to build Littleport Academy in 2016. Littleport Academy includes a primary school, a 3 storey secondary school and a SEN School. It currently accommodates over 650 pupils with room for further growth.

Morgan Sindall and their M&E partner Imtech have successfully achieved their targeted BREEAM “very good” rating for the building, which includes structural insulated panels for thermal efficiency.
Monodraught were specified to provide hybrid and natural ventilation across all three schools and the onsite sport centre including our HTM F and FS systems. These systems were designed specifically to meet the needs of the Priority School Building Programme and EFA regulations.

In addition, our well-established Windcatcher solution provides low energy natural ventilation in spaces such as Sports Halls, dining rooms, staff rooms or reception areas.

We take great pride in the quality of our engineering. Our systems are designed in accordance with our company ethos: innovation, sustainability, reliability and performance. Systems are tested extensively in house and by third party academic and research organisations to ensure that our solutions deliver the best possible results in buildings were the Windcatchers are installed.

The HTM F and FS systems are designed to provide natural ventilation and hybrid ventilation (incorporating mixed tempered air for winter periods), with secure night time cooling and boosted levels of ventilation during summer.

Our experienced team were able to install these solutions and are on-hand to provide ongoing maintenance and support.
Our data monitoring over the initial period has showed that temperatures and CO₂ levels have remained consistent at an average of 584ppm during occupied hours, with an average mixed supply temperature of 17.7°C.

Performance is continually monitored to allow for improvements in performance and product development.

**TEMPERATURE AND CO₂ ANALYSIS**

- **AVERAGE EXTERNAL TEMPERATURE**
  - Avg. Temp. (Ext): 13°C
  - Max. Temp. (Ext): 32°C
  - Min. Temp. (Ext): 5°C

- **MIXED SUPPLY TEMPERATURE**
  - Avg. Temp. (Mixed): 17°C
  - Max. Temp. (Mixed): 31°C
  - Min. Temp. (Mixed): 12°C

- **ROOM TEMPERATURE**
  - Avg. UI Temp.: 22°C
  - Max. UI Temp.: 28°C
  - Min. UI Temp.: 17°C

- **ROOM AIR QUALITY**
  - Avg. UI CO₂: 1000 ppm
Our large R&D team are continually challenging the boundaries developing new products to ensure customers continue to receive market leading products for which Monodraught are renowned. These products are all manufactured within our High Wycombe factory and as R&D is in the same location as production, then the highest levels of quality can be ensured.

We have a team of contract managers who will work with you and your clients from order creation through to delivery and maintenance if required. Our own team of installers work across England and Wales with partner agencies installing in Scotland, Ireland and worldwide. We will visit your site ahead of installation to ensure that everything goes smoothly.

To help architects and consultants deliver ultra low energy efficient designs, Monodraught and building performance analysis specialist IES have developed Performance Components. Our Project Design Engineers are able to work with you to create the right design for your building.

We can provide on-going service and maintenance of our installed products. This helps provide performance data for our customers and structured feedback that can assist product development, resulting in a system running at optimum performance whilst keeping costs to a minimum.
Copperbox Arena - Olympics Handball Stadium