

The background of the cover is a photograph of an industrial plant with a complex network of pipes, valves, and machinery. The lighting is dramatic, with strong highlights and deep shadows, creating a sense of depth and scale. The pipes are primarily metallic and have a reflective surface. The overall color palette is dominated by blues, greys, and oranges.

# CIBSE JOURNAL



**CPD SPECIAL**

**SIZING BRAZED PLATE  
HEAT EXCHANGERS  
IMPROVING ENERGY  
EFFICIENCY WITH MVHR**

## **KNOWLEDGE IS POWER**

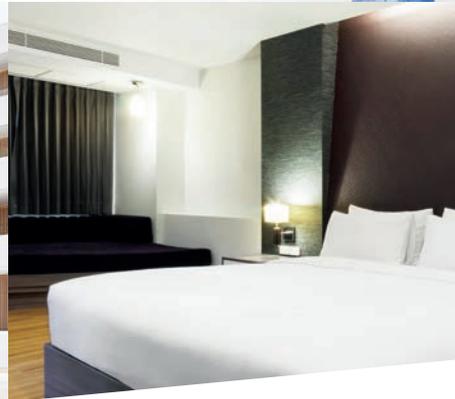
The complete list of organisations  
offering CIBSE-approved CPD courses



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Lindab Solutions  
Build for the future



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Our customised indoor climate solutions comprise all the parts you need to efficiently execute a project. You receive a complete combination of ventilation systems, products, knowledge and support – all in one package.

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porting you throughout the process. We help you to plan, dimension and optimise your project and provide complete documentation about your systems and products. And you can draw on the knowledge we have amassed over years of developing energy-efficient systems that meet future needs. This means you can carry out your project more efficiently, and offer your clients the perfect indoor climate.

Good Thinking  
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## Knowledge exchange



Welcome to our third CPD directory special, featuring not only two additional CPD modules, but also the full list of the 220 companies in the CIBSE CPD directory.

The companies listed in the directory offer courses reviewed and assessed by CIBSE to ensure the technical content is of a high standard. They embrace many different areas, and offer members a valuable resource with which to keep up with their continuing professional development (CPD) requirements.

Professionally registered engineers, whether engineering technicians, incorporated or chartered engineers, are required to undertake CPD each year.

In competitive recruitment situations, companies recognise the investment and commitment that an up-to-date CPD record demonstrates.

The working environment in the UK is evolving rapidly. Emerging technologies and changing regulations may bring improved efficiencies, as well as fresh challenges and demands. These highlight the importance of CPD for all engineers, whether experienced or just starting out. To stay current and relevant, engineers need to continually update knowledge and absorb a wide range of new information.

CIBSE is a professional engineering body that exists to give members and the public first-class knowledge and information. It offers a huge range of training events countrywide, covering electrical services, facilities management, fire safety and lighting to name just a few, many of which are also available as in-house courses.

Over the past year, CIBSE has seen a growing uptake of its online learning courses, and now offers webinars to complement technical publications, providing content through a host of different channels. You can view the full list of courses at

[www.cibse.org/training](http://www.cibse.org/training)

CIBSE offers a diverse range of opportunities to maintain your CPD, as does the *CIBSE Journal*, with the monthly CPD modules – two of which you will find within this supplement – and sponsored webinars, available to view on-demand at [www.cibsejournal.com](http://www.cibsejournal.com)

For more information about the Institution, visit [www.cibse.org](http://www.cibse.org)

■ **BRUCE MCGILL**, interim director of membership, CIBSE

Supplement  
[www.cibsejournal.com](http://www.cibsejournal.com)  
#Build2Perform

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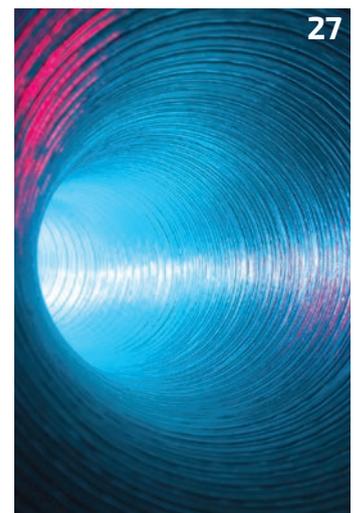
CIBSE's complete CPD course directory

#### 21 Right-sizing brazed plate heat exchangers

Factors involved in the selection of BPHes to ensure the most economic solution

#### 27 Developments in non-residential MVHR

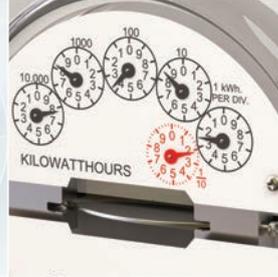
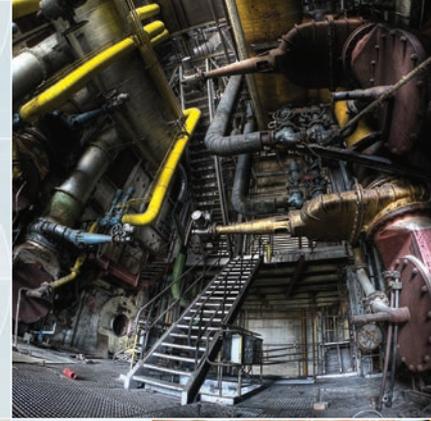
How modern packaged MVHR can deliver multi-mode tempered ventilation with increased efficiency and good air quality



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CIBSE **CPD**  
CIBSE Journal has more than 100 CPD modules available to complete at [www.cibsejournal.com](http://www.cibsejournal.com)  
Our website makes it easier than ever to continue your professional learning online.



# CIBSE CPD DIRECTORY

This directory lists all the accredited organisations offering modules on a range of areas, including electrical, fire, lighting and sustainability

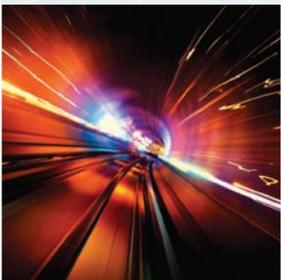
All the CPD courses in this directory have been approved by CIBSE. They are reviewed and assessed to ensure that the technical content is of a high standard and offers valuable CPD to delegates.

The directory of CPD course providers has been compiled to assist members of the Institution in identifying courses suitable for their CPD needs. It embraces many different areas suitable for CPD, and is updated continually to incorporate new entries and revisions.

Members of CIBSE are required by the Code of Professional Conduct to maintain their professional competence, but this should also apply to any professional working in the industry.

The directory will help you find suitable CPDs to assist with your ongoing career development.

For guidance on what constitutes different CPD activities, and how to go about recording your continuing professional development, visit [www.cibse.org/cpd](http://www.cibse.org/cpd)



**A**  
DIRECTORY

	Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
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A O Smith Water Heaters www.aosmith.co.uk													■
A1 Flue Systems www.a1flues.co.uk		■									■		
ABB www.abb.com		■		■	■								■
Ability Projects www.abilityprojects.co.uk											■		■
Access Control Technology (ACT) www.act.eu				■									
ACV UK www.acv-uk.com											■		
ADEY Professional Heating Solutions www.adey.com							■				■		
Adveco www.adveco.co.uk													■
Aermec UK www.aermec.co.uk	■						■				■		
Aico www.aico.co.uk						■							
<b>Airflow Developments</b>		■	■						■		■	■	■



■ **Phone: 01494 525252**  
**Web: www.airflow.com**  
**Email: info@airflow.com**

Ventilation pioneer Airflow Developments offers an on-demand, CIBSE-approved CPD seminar titled Understanding Mechanical Ventilation with Heat Recovery (MVHR) for Commercial Applications. It explains the key aspects to consider when designing any commercial building.

**By the end of the CPD seminar, you will understand:**

- The importance of ventilation in improving indoor air quality
- How MVHR works and its applications
- The reasons for choosing MVHR as your ventilation system
- Current Building Regulations and legislation concerning ventilation, MVHR and new-build commercial premises
- The different types of heat exchangers available within commercial MVHR systems
- How MVHR can reduce the energy bills of a building

Its CIBSE-approved CPD seminars are popular, and slots fill up fast. So contact Airflow today to arrange a free seminar, at a location and a time that is convenient for you.

Altecnic www.altecnic.co.uk		■	■								■		
Aluline Group www.alulinegms.com											■	■	■



# A DIRECTORY

Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
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**AMG Systems**

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■ **Web:** [www.amgsystems.com](http://www.amgsystems.com)  
 ■ **Email:** [Technical@amgsystems.com](mailto:Technical@amgsystems.com)

As a UK-based network switch manufacturer, AMG systems can offer quality and robust networking and transmission products and solutions. CIBSE-approved CPD seminar courses are available on the subjects of 'Networking overview and design', 'Radio systems overview and design' and 'Fibre-optic transmission solutions overview and design'.

On completion of our CPD courses you will have gained an improved understanding of:

- Networking, radio and/or fibre technologies
- Networking, radio and/or fibre system considerations and design
- How effective networking solutions can be integral in supporting and improving overall building design
- How the support of companies such as AMG can assist in ensuring the delivery of functional, effective and robust networking solutions for any building requirement or project application

Its CIBSE-approved CPD courses are designed to fit a lunch-and-learn environment, understanding that making time available for dedicated training sessions can be challenging, and can be delivered by its technical team either at its offices in Biggleswade, Bedfordshire, or at a location convenient for you.

**Anord Control Systems**  
[www.anord.com](http://www.anord.com)

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**Apreco**  
[www.apreco.com](http://www.apreco.com)

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**Armacell UK**

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■ **Web:** [www.armacell.com](http://www.armacell.com)

Armecell UK offers a series of CIBSE-approved, lunchtime learning seminars for mechanical services engineers. Courses are held at engineers' offices, where a buffet lunch is provided. The courses currently available are:

**Mechanical services insulation materials**

A review of the different types of mechanical services insulation available for HVAC-R pipe and ductwork equipment, and the key considerations when specifying materials, including fire performance, energy-saving and thermal-conductivity ratings, condensation control, acoustics and installation methods.

**Environmental insulation standards**

An introduction to the environmental considerations and assessment methods when specifying thermal insulation materials, including: Breeam Green Guide ratings; Environmental Product Declaration (EPD) certificates; life-cycle assessments; global-warming and ozone-depletion potential ratings; the Energy Savings Opportunity Scheme (ESOS); Enhanced Capital Allowance (ECA) scheme; Thermal Insulation Performance (TIP) Checks; payback periods; and CO<sub>2</sub> savings.

**Building Regulations guidance for HVAC-R insulation materials**

A review of the Building Regulations and standards governing pipe and duct insulation, including: BS 5422 (Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C); Part L and the Domestic and Non-Domestic Compliance Guides; water supply regulations; and fire regulations (BS 476 fire tests and Euroclasses).

For more information, or to book one of the courses, contact Anthony Barnett on **0161 287 7015** or email [mark.taylor@armacell.com](mailto:mark.taylor@armacell.com)

# B-C DIRECTORY

	Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
BACnet Interest Group Europe www.big-eu.org		■							■			■	■
Beckhoff Automation www.beckhoff.co.uk/building		■							■				
BEG (UK) www.beg-luxomat.com									■				
Belimo Automation UK www.belimo.co.uk	■					■					■		■
Biddle Air Systems www.biddle-air.co.uk	■	■									■		
BPC Energy www.bpc-ups.com									■				
Bronz-Glow UK www.bronz-glow.co.uk	■										■		■
BT Cables www.btcables.com		■											
Building Controls Industry Association www.bcia.co.uk	■							■			■		
Caice Acoustic Air Movement www.caice.co.uk	■	■									■		■
Calor Gas www.calor.co.uk											■		■
Calor Gas Northern Ireland www.calorgas.ie											■		■
Calorex www.calorex.com							■						
Camfil www.camfil.co.uk			■										
Capitoline www.capitoline.org		■									■		■
Carel UK www.careluk.co.uk											■		
Carlo Gavazzi UK www.carlogavazzi.co.uk		■	■	■	■								
Cassian Compliance www.cassiancompliance.co.uk													■
Chargemaster www.chargemasterplc.com		■									■		
Clivet UK www.clivet.com	■						■					■	■
CNET Training www.cnet-training.com		■											
Colt International www.coltinfo.co.uk						■					■		
Complete Ventilation Solutions www.completeventsolutions.co.uk											■		



# C-E DIRECTORY

	Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
Condair (JS Humidifiers) www.condair.co.uk											■		
Continu www.continu-ups.com		■											
Cool Designs www.cdlweb.info	■	■									■		
C-Suite Consulting www.c-suiteconsulting.co.uk				■									
D C Professional Development www.dc-professional.com	■	■			■	■			■		■	■	■
DAB Pumps http://uk.dabpumps.com											■		
Daikin www.daikin.co.uk/cpd	■										■		
Daikin Applied (UK) www.daikinapplied.uk	■						■				■		
Danfoss www.heating.danfoss.com					■								
DEIF UK www.deif.co.uk		■											
Delabie UK www.delabie.co.uk												■	■
Delmatic Lighting Management www.delmatic.com		■							■				
DencoHappel UK www.dencohappel.com	■										■		
Designplan Lighting www.designplan.co.uk									■				
Dextra Group www.dextragroup.co.uk		■							■				
Dimplex www.dimplexrenewables.co.uk		■									■		■
Durapipe UK www.durapipe.co.uk	■	■									■		
Dutypoint www.dutypoint.com											■	■	
Eastman www.eastman.com	■										■		■
Eaton Security www.touchpoint-online.com		■											
EBM-Papst UK www.ebmpapst.com		■	■				■				■		
Elco UK www.elco.co.uk		■									■		■
Elta Fans www.eltagroup.co.uk			■			■	■				■		

# E-F DIRECTORY

	Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
<b>Emergi-lite Safety Systems</b> www.emergi-lite.co.uk		■				■			■				
<b>Emerson Network Power (Asco Division)</b> www.asco.com		■											
<b>EMS</b> www.emsgroup.co.uk		■											
<b>ENER-G Combined Power</b> www.energ.co.uk		■									■		■
<b>Energy Institute</b> www.energyinst.org			■										
<b>Enocean Alliance</b> www.enocean-alliance.org		■	■		■				■		■		
<b>Envirotec</b> www.envirotec.co.uk											■		
<b>ESG</b> www.esg.co.uk												■	■
<b>Euro-Diesel (UK)</b> www.euro-diesel.com		■											
<b>Evinox Energy</b> www.evinoxenergy.co.uk							■				■		
<b>Excel Networking Solutions</b> www.excel-networking.com		■											
<b>Fabricated Products</b> www.fabricatedproducts.co.uk											■		
<b>Fire Safety Training Group</b> www.fstg.org.uk		■							■				
<b>Fläkt Woods</b>				■							■		



■ **Web:** [www.flaktwoods.co.uk](http://www.flaktwoods.co.uk)

Fläkt Woods UK is a global supplier of air-technology-based solutions for buildings, focusing on air comfort and fire safety. Its passion is to always propose superior solutions to customers with the best energy efficient products.

**It offers CIBSE-approved CPD courses aimed at improving industry knowledge in the following areas:**

- Reducing total emissions using high-efficiency energy recovery
- Study of the effects of fire within residential apartment blocks
- Active chilled beams and demand-controlled ventilation
- Designing a smoke-control car park system
- An introduction to plug fan technology
- Smoke shafts: a practical guide
- Low carbon air handling units

All CPDs are written and presented by its staff, who are experienced experts in these fields. Courses are approximately one hour in length and can be presented at one of Fläkt Woods' UK offices, or within your company building. CPD certificates will be presented to you via email upon completion. To register your interest, please email [marketing.uk@flaktgroup.com](mailto:marketing.uk@flaktgroup.com)



# F-H DIRECTORY

	Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
Flamco www.flamco.co.uk											■		
Fratelli Pettinaroli www.pettinaroli.com												■	
Frenger Systems www.frenger.co.uk	■								■		■		
Fujitsu Air Conditioners www.fujitsu-general.com/uk/		■											■
Furse www.furse.com									■				
Future Designs www.futuredesigns.co.uk									■				
GDL Air System www.grille.co.uk									■		■		
General Environmental Services www.ges-water.co.uk												■	
Gerberit Sales www.gerberit.co.uk		■									■		
Giacomini UK uk.giacomini.com											■		
Gripple www.gripple.com											■		
Halton Foodservice www.halton.com/foodservice											■		
Hamworthy Heating www.hamworthy-heating.com							■				■		■
Havells UK www.havells.com		■											
Helvar www.helvar.com									■				
Herz Valves UK www.herzvalves.com			■		■						■		
Hevasure www.hevasure.com							■						
Hitachi Air Conditioning Europe www.hitachi.com	■										■		
Hochiki Europe (UK) www.hochikieurope.com		■				■			■				
Honeywell Energy and Environmental Solutions www.honeywell.com		■							■			■	
Hoval www.hoval.co.uk				■									
Humidity Solutions www.humiditysolutions.co.uk											■		
Hydrotec www.hydrotec.co.uk											■	■	

# H-M DIRECTORY

	Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
Hygromatik UK www.hygromatik.co.uk											■		
Interflow UK www.interflow.co.uk											■		
Itron Metering Solutions UK www.itron.com											■		
IV Produkt www.ivprodukt.com											■		
Jaeggi Hybrid Technology www.jaeggi-hybrid.ch	■		■								■		■
Jaga Heating Products www.jaga.co.uk											■		
Johnson Controls UK www.johnsoncontrols.com/en_gb		■									■		
JS Air Curtains www.jsaircurtains.com											■		
Kelvion www.kelvion.com											■		
Kingspan Environmental www.kingspanenviro.com											■		■
Kingspan Industrial Insulation www.kingspaninsulation.co.uk		■	■								■		■
KNX UK www.knxuk.org		■							■				
KSB www.ksb.com/ksb_en												■	
LG Electronics, Air Conditioning & Energy Solutions http://partner.lge.com/uk/index.lge	■										■		
Lifescience Products www.lifescience.co.uk												■	
Lindab Comfort Division (UK) www.lindab.co.uk											■		
Lindab Ireland www.lindab.ie						■	■				■		
Link by Lighting www.linkbylighting.co.uk									■				
Lochinvar www.lochinvar.ltd.uk											■	■	■
LPA Lighting www.lpa-lighting.com									■				
Luxonic Lighting www.luxonic.co.uk									■				
Maincor www.maincor.co.uk													■
Mansfield Pollard & Co www.mansfieldpollard.co.uk	■	■											



# M-O DIRECTORY

	Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
Marflow Hydraulics <a href="http://www.marflowhydraulics.co.uk/events">www.marflowhydraulics.co.uk/events</a>											■		
Mark Eire BV <a href="http://www.markgroup.eu">www.markgroup.eu</a>		■									■		
Marley Plumbing and Drainage <a href="http://www.marleypd.co.uk">www.marleypd.co.uk</a>											■		
Medem UK <a href="http://www.medem.co.uk">www.medem.co.uk</a>											■		
Mennekes Electric <a href="http://www.mennekes.co.uk">www.mennekes.co.uk</a>		■											
Mikrofill Systems <a href="http://www.mikrofill.com">www.mikrofill.com</a>											■		
Mitsubishi Electric Hydraulics & IT Cooling Systems <a href="http://www.climaveneta.com">www.climaveneta.com</a>	■	■	■								■		■
Mitsubishi Heavy Industries Air Conditioning Europe <a href="http://www.mhiae.com">www.mhiae.com</a>		■									■		
Mobotix AG <a href="http://www.mobotix.com">www.mobotix.com</a>		■											
<b>Monodraught</b>									■		■		
 <p>■ <b>Web:</b> <a href="http://www.monodraught.com">www.monodraught.com</a></p> <p>Monodraught designs, manufactures, installs and maintains natural ventilation, lighting and cooling systems. It creates low-energy, low carbon and sustainable buildings to help keep occupants healthier and more productive. Through its CPD programme, Monodraught helps architects, consultants and contractors improve, maintain and broaden their knowledge and skills. Sessions can be delivered in-house or at the company's head office in High Wycombe.</p> <p><b>CIBSE-accredited CPDs:</b></p> <ul style="list-style-type: none"> <li>■ <b>Natural cooling and ventilation for improved building sustainability and healthier occupants</b> Explore the use of phase-change materials in ventilation systems to reduce a building's energy consumption and carbon footprint</li> <li>■ <b>Ventilation, thermal comfort and indoor air quality (IAQ) in schools</b> The benefits of natural ventilation to achieve high IAQ in schools. Explains strategies and systems that reliably meet requirements for thermal comfort and energy efficiency. Showcases building simulation tools</li> <li>■ <b>Hybrid lighting, sustainability and wellbeing</b> The impact of hybrid lighting systems on the built environment and energy costs in multiple sectors.</li> </ul> <p>Visit <a href="http://www.monodraught.com/resources/cpds">www.monodraught.com/resources/cpds</a> or call <b>01494 897700</b> to book your session.</p>													
Munters <a href="http://www.munters.co.uk">www.munters.co.uk</a>	■										■		
Nalco <a href="http://www.nalco.com">www.nalco.com</a>											■	■	
Nordeon Group <a href="http://www.wila.com">www.wila.com</a>									■				
Nortek Global HVAC (UK) <a href="http://www.ambirad.co.uk">www.ambirad.co.uk</a>							■						
Oventrop UK <a href="http://www.oventrop.co.uk">www.oventrop.co.uk</a>											■	■	

# O-P DIRECTORY

	Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
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Operational Intelligence www.dc-oi.com		■	■								■		■
P4(P4 Fastel) www.p4fastel.co.uk		■				■					■		
Panasonic UK Heating & Cooling www.aircon.panasonic.eu/GB_en	■										■		
Paxton Access www.paxtonspecifier.co.uk		■									■		
Pegler Yorkshire Group www.pegleyorkshire.co.uk											■		
Pentair Thermal Management www.pentairthermal.co.uk											■		
Plasma Clean www.plasma-clean.com							■				■		
Polypipe Ventilation www.polypipe.com/ventilation											■		
<b>Power and Light Equipment</b>		■											



**■ Phone: 0115 860 2301**  
**■ Web: www.powerandlight.equipment**  
**■ Email: enquiries@powerandlight.equipment**

Power and Light Equipment is a specialist technical sales agency. It imports a range of electrical equipment that includes electric vehicle charging stations. The charging stations comply fully with current standards and offer a range of options that include stainless-steel enclosures, radio-frequency identification readers, Bluetooth operation, wall- and floor- mounting types, and more.

Its CIBSE-approved CPD presentation will offer information about:

- IEC 62916 (connector types)
- IEC 61851 (charging modes and safety)
- Slow, fast and rapid charging
- Electrical connection, including earthing requirements
- Diversity and EV chargers

Power and Light would be pleased to present its CPD at a place, date and time convenient to your business. A service-oriented business, it offers quotations, technical submissions, site surveys, installation, testing and commissioning of its EV chargers, busbar trunking and cast resin/liquid cooled distribution transformer range.

For more information and to arrange your CPD, please get in touch by phone or email.

Price TWA www.pricetwa.co.uk											■		
Prihoda UK www.prihoda.co.uk													■
Priva UK (Building Intelligence) www.priva.co.uk			■	■									
Prolojik www.prolojik.com									■				
Reflex Winklemann www.reflex.co.uk											■		
Reliance Worldwide Corporation (UK) www.rwc.co.uk		■										■	■



# R-S DIRECTORY

	Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
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Remeha Commercial www.remeha.co.uk											■		■
Riello www.rielloburners.co.uk				■							■		■
<b>Rittal</b>		■									■		



■ Braithwell Way, Hellaby Industrial Estate, Hellaby Rotherham, S Yorks S66 8QY  
Web: [www.rittal.co.uk](http://www.rittal.co.uk)  
Email: [information@rittal.co.uk](mailto:information@rittal.co.uk)

Rittal manufactures a range of products that form 'Rittal: the system'. This has been designed to offer clients a complete solution, including modular enclosures, power distribution and climate-control systems, which are rapidly becoming the industry's first choice for protecting critical equipment. Its vast range of high-quality, cutting-edge products can be supplied individually or as complete systems, or adapted to meet the most complex and diverse client needs in the infrastructure, manufacturing, engineering and IT sectors.

Rittal is committed to CPD and has created a series of accredited seminars to keep you up to date with the latest industry and IT infrastructure requirements.

**Seminars available:**

- Building a data centre in the perfect storm
- Data centre energy efficiency
- An introduction to IEC 61439
- Energy-efficient cooling
- Enclosures - equipment protection

Rittal's technical personnel can visit your offices to give a presentation - lasting about one hour - on an agreed topic(s). Alternatively, you can come to its fully equipped demonstration centre in Rotherham.

<b>S&amp;S Northern</b>		■									■		
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■ Phone: 01257 470983  
Web: [www.snsnorthern.com](http://www.snsnorthern.com)  
Email: [info@snsnorthern.com](mailto:info@snsnorthern.com)

S&S Northern is a gas-control specialist in the commercial and educational sectors, manufacturing and supplying a wide range of safety systems.

It offers CIBSE-approved CPD courses - aimed at M&E consultants and contractors - to help improve industry knowledge in the following areas:

- Plantroom gas safety and gas detection
- School science laboratories and food-tech classrooms
- Air-quality monitoring for general teaching spaces
- Commercial kitchen gas safety

S&S Northern explains all the relevant regulations and standards, and advises on simple solutions. It can present the CPD at your office or any suitable location, and provide lunch and refreshments.

S&S Northern, established in 1995, is a friendly, family business. It has built a reputation in the UK that is second to none, by offering not just the highest standard of service in the gas-safety industry, but also the best products available to meet its clients' requirements. S&S Northern has become synonymous with designing, manufacturing and gas-safety systems.

Get in touch to arrange a CPD, or to discuss any projects for which gas-safety systems are required.

**S**  
**DIRECTORY**

	Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
Saint-Gobain Isover www.isover.co.uk	■					■					■		
Sanha UK www.sanha.co.uk											■		
Sauter Automation www.sauterautomation.co.uk													■
SAV Systems www.sav-systems.com							■			■			
Schneider Electric www.schneider-electric.com		■									■		
School of Architecture, Building and Civil Engineering Loughborough University www.bispa.org											■		
Schwank www.schwank.co.uk/en/home.html											■		
Seeley International www.seeleyinternational.com	■						■			■			
SenerTec www.senertec.co.uk													■
<b>Sentinel Performance Solutions</b>											■		
 <p>Without proper water treatment, commercial heating systems will fall foul of corrosion and limescale, which is likely to lead to problems such as reduced efficiency, poor system performance, premature parts replacement, system downtime, unplanned maintenance, and even complete boiler failure.</p> <p>Sentinel Commercial's CPD on Water Treatment in Commercial Heating Systems aims to help participants avoid these issues, with best-practice water treatment forming the crux of the course.</p> <p>Attendees are helped to understand how corrosion and limescale develop in - and affect - heating and hot water systems. Case studies are used to demonstrate the problems, alongside illustrations of the cost implications for the supply chain.</p> <p>After a review of industry guidelines and regulations, the course looks at how lifetime boiler and system protection is achieved. This includes controlling corrosion and the formation of scale and sludge in closed-circuit heating systems, using the best-practice approach of system cleaning, inhibitor dosing and water testing (for analysis and maintenance). Part L-recommended permanent limescale prevention solutions for 'once through' hot water systems are also assessed, within the practical contexts of maintenance, running costs and associated requirements, such as storage and handling. Design needs and simple methodologies are also covered.</p> <p>Contact Sentinel Commercial to find out more about its CPD.</p>													
Shenton Group www.shentongroup.co.uk		■											■
Siemens Building Technologies www.siemens.co.uk/buildingtechnologies			■	■		■	■						



**S**  
DIRECTORY

	Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
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Simmtronic Lighting Controls www.simmtronic.com									■				
Smith Brothers Stores www.sbs.co.uk											■		
SMS Environmental www.sms-environmental.co.uk												■	■
Sodeca Fans UK						■							



■ Phone: 01827 216109  
 Email: sales@sodeca.co.uk  
 Web: www.sodeca.co.uk

Sodeca designs, manufactures and supplies industrial and commercial ventilation products. It has an immense knowledge base in ventilation solutions, including the requirements for smoke-control and hazardous-area fans, and offers CPD presentations in both of these areas:

**Smoke control - an introduction:**

- The hazards of smoke and why it needs to be controlled
- Goals of smoke control for safety and protection
- Relevant documents and standards
- Types of smoke control systems, and where and how they are used
- Types of equipment
- Simulation and report examples, and computational fluid dynamics studies example

**Fans for explosive atmospheres - an introduction:**

- Summary of ATEX regulations and other governing documents
- Types of hazards
- Mechanical and electrical design considerations
- Types of fans available and their safety features
- Summary of other hazardous area specifications in other regions

Contact Sodeca Fans UK to arrange a presentation at your premises, or as part of a group presentation.

Sontay www.sontay.com		■			■						■		■
SPC www.spc-hvac.co.uk			■								■		
Spirax Sarco www.spiraxsarco.com/uk					■						■		
Spirotech UK www.spirotech.co.uk			■								■		
Star Refrigeration www.i-know.com	■										■		■
Stelrad www.stelrad.com											■		
Stokvis Industrial Boilers International www.stokvisboilers.com											■		

# S-T DIRECTORY

Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
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<p><b>Strategic Media Asia</b></p>  <p> <b>Phone: (852) 2117 3893</b>  <b>Web: <a href="http://www.stmedia-asia.com">www.stmedia-asia.com</a></b>  <b>Email: <a href="mailto:info@stmedia-asia.com">info@stmedia-asia.com</a></b> </p>	<p> <b>Redundancy and reliability matter</b>                      Achieve the criteria of best practices and avoid costly downtime for data centres and critical facilities design, by SMA's team of chartered engineers and a series of CIBSE-approved, two-day learning seminars.                 </p> <p> <b>Data centre facilities design and infrastructure engineering</b>                      An introduction to the critical infrastructure system that supports data centres and the main components that facilitate their design and build, including the standards of TIA-942 and Uptime Tier Levels.                 </p> <p> <b>Electrical design for mission-critical supply</b>                      A review of critical-power system design and the components that support data centres and critical facilities, from power components to power requirements and design, testing and commissioning.                 </p> <p> <b>Air conditioning system design for data centre</b>                      Understanding the heating, ventilation and air conditioning design principles for mission-critical purposes, such as psychrometric chart, load calculation/estimation, and considerations such as air distribution, availability and redundancy, and integration with mechanical, electrical and plumbing. You will be able to make informed decisions about HVAC systems, and meet your project goal and service level agreement.                 </p>
<p>Swegon Air Management <a href="http://www.swegonair.co.uk">www.swegonair.co.uk</a></p>	
<p>Swegon Group <a href="http://www.swegon.co.uk">www.swegon.co.uk</a></p>	
<p>SWEP International <a href="http://www.swep.net">www.swep.net</a></p>	
<p><b>Switch2 Energy</b></p>  <p> <b>Web: <a href="http://www.switch2.co.uk">www.switch2.co.uk</a></b> </p>	<p>Switch2 Energy's CPD explains what you need to know about heat metering on community and district heating schemes. Its two-hour course gives an introduction to heat metering and developing metering strategies for heat networks. The CPD is suitable for mechanical engineers and other stakeholders working on district and community heating systems.</p> <p> <b>Course content</b>                      Its CIBSE-accredited, two-hour course includes:                 </p> <ul style="list-style-type: none"> <li>■ An introduction to the Heat Network (Metering &amp; Billing) Regulations</li> <li>■ Key drivers for metering</li> <li>■ Introducing metering strategies to schemes</li> <li>■ Understanding the heat meter</li> <li>■ Getting the meter readings</li> </ul> <p> <b>Key areas</b> </p> <ul style="list-style-type: none"> <li>■ Why is metering so important to heat networks?</li> <li>■ What are the key drivers for metering?</li> <li>■ How does regulation affect the way we operate schemes?</li> <li>■ How to implement an airtight metering strategy</li> <li>■ What equipment should you use and how does it work?</li> </ul> <p>For more information, or to book this free CPD course, email <a href="mailto:advice@switch2.co.uk">advice@switch2.co.uk</a> or call <b>0330 053 5599</b>.</p>
<p>Systemair <a href="http://www.systemair.co.uk">www.systemair.co.uk</a></p>	
<p>Terasaki Electric (Europe) <a href="http://www.terasaki.com">www.terasaki.com</a></p>	
<p>Thermal Integration <a href="http://www.heatweb.co.uk">www.heatweb.co.uk</a></p>	



# T-U DIRECTORY

	Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
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Thorlux Lighting www.thorlux.com									■				
Toshiba Carrier UK www.toshiba-aircon.co.uk	■										■	■	
Trane UK www.trane.com/Index.aspx											■		
Tridonic UK									■				



■ Phone: 01256 374303  
 Email: Richard.raeburn@tridonic.com  
 Web: www.tridonic.com

Tridonic is a global leader in LED lighting control and technology, and supplier of intelligent and efficient lighting solutions. It offers a full range of CIBSE-certified CPD modules to complement Tridonic's portfolio of products. The aim is to help CIBSE members, architects and specifiers maintain, improve and broaden their lighting knowledge and skills, by learning – and putting into practice – new competences year after year.

**Tridonic's CPD modules include:**

- LEDs – module and driver technology, terminology, handling and precautions, and lifetime and lumen depreciation
- Emergency lighting – an overview of emergency lighting and its objectives, relevant directives and standards, and battery technology
- Human-centric lighting – the effect and importance of circadian rhythms, tunable white technology, and how this can be used to improve performance and wellbeing
- Digital lighting protocols – explaining the history of the main digital dimming protocols, including DSI and DALI, their characteristics and commonality, plus DALI specifications, planning and limits
- LED flicker – introduction and definition explained, including the cause and effects for LED, fluorescent and incandescent light sources. This CPD also covers flicker frequency and behaviour, and how it's measured.

Trox UK www.troxuk.co.uk	■												
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Uninterruptible Power Supplies		■											
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■ Phone: 0800 7313269  
 Web: www.upspower.co.uk  
 Email: Sales@upspower.co.uk

Bespoke training on particular topics can be arranged.

Uninterruptible Power Supplies (UPS) was the first company to introduce modular UPS and transformerless technology to the market, and it continues to innovate with new products. It offers a number of CPD-certified, free technical seminars, which can be held at your site over a lunchtime by a specialist trainer.

UPS also runs full-day UPS Training Academy courses across the UK, which are free to attend and also CPD-certified. These are ideal for graduate and newly qualified engineers, and those looking to refresh their knowledge of UPS. The courses are an excellent way to improve your understanding of the most recent power-protection specification and selection requirements, and the latest technology available – while, at the same time, gaining invaluable CPD hours and points.

**Topics include:**

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>■ UPS Systems (general)</li> <li>■ History and evolution of UPS</li> <li>■ Stand-alone v modular UPS</li> <li>■ UPS systems topology/architecture</li> </ul> | <ul style="list-style-type: none"> <li>■ Fault clearance, neutral earth referencing, sizing a UPS</li> <li>■ Producing a technical specification</li> <li>■ Battery systems – sizing/containment/isolation</li> <li>■ History and evolution of UPS – UPS internals: rectifier/inverter/booster/static switch</li> </ul> |
|---|---|

Unitrunk (UK) www.unitrunk.co.uk		■											
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Uponor UK www.uponor.co.uk											■	■	
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# U-Z DIRECTORY

	Air conditioning	Electrical	Energy efficiency	Energy management & controls	Energy metering	Fire	HVAC solutions	Lifts & transportation	Lighting	Low carbon solutions	Mechanical	Public health	Sustainability
UTC Fire & Security UK www.utcssecurityproducts.co.uk		■											
Valves Instruments Plus www.vip-ltd.co.uk											■		
Vector Air & Water www.vector-airandwater.co.uk												■	
Vertiv www.vertivco.com/en-emea		■							■				
Victaulic www.victaulic.com	■					■					■		■
Viessmann www.viessmann.co.uk											■		■
Vipond Fire Protection www.vipondfire.co.uk						■							
Wagner UK www.wagner-uk.com						■							
Warmup www.warmup.co.uk		■									■		
Waterloo Air Products www.waterloo.co.uk	■						■				■		
Wavin www.wavin.co.uk			■									■	
Weidmüller www.weidmuller.co.uk		■	■		■				■		■		■
Wieland Electric www.wielandmetalyx.co.uk		■									■		
Wilo UK www.wilo.co.uk		■									■		
Wolf http://en.wolf-heiztechnik.de/			■				■				■		
Wolter Asia www.wolter.com.hk/HongKong/en/index.asp	■						■				■		■
Xicato www.xicato.com		■							■				
Xtralis (UK) www.xtralis.com		■				■							
Xylem Water Solutions UK www.lowara.co.uk			■				■						
Yorkshire Water www.yorkshirewater.com											■	■	
Zehnder www.zehnder.co.uk			■								■		
Zeta Compliance Services www.zetaservices.co.uk											■	■	
Ziehl-Abegg UK www.ziehl-abegg.com/en	■	■		■							■		■

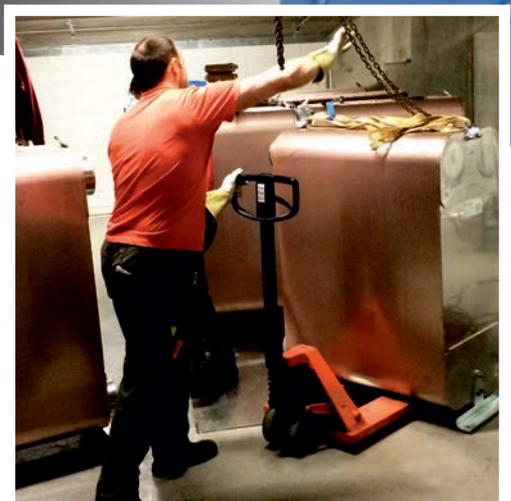


# THE WIDEST RANGE OF BRAZED PLATE HEAT EXCHANGERS

**SWEP**

SWEP offers the largest brazed plate heat exchangers with capacities up to 10MW. Our gasket-free heat exchangers have low maintenance costs and an optimal LCC (Life Cycle Cost).

With significantly lower weight and compact design, they require about 50% less floor space than traditional solutions. The units can easily be transported through a standard doorway. And if you need higher capacity, simply add more units.



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This *Journal* CPD programme can be used to meet your CPD requirements. Study the module and answer the questions on the final page. Each successfully completed module is equivalent to 1.5 hours of CPD.

Modules are also available at [www.cibsejournal.com/cpd](http://www.cibsejournal.com/cpd)



## Right-sizing brazed plate heat exchangers

This module considers the factors involved in the selection of brazed plate heat exchangers to ensure the most economic solution for a variety of applications

The application of brazed plate heat exchangers (BPHE) has developed over the past 40 years. In many cases they have replaced the position once held by shell - and tube - format heat exchangers, and are often used in place of the earlier gasketed (demountable) plate heat exchangers (PHEs).

BPHEs were originally developed to allow high operational pressures and temperatures, but are now commonly applied across numerous applications. Typically, in building systems they will be used to transfer heat between primary and secondary water (or glycol) systems. They are available in a range of sizes, capable of transferring from only a few kilowatts up to several megawatts, and by virtue of their relatively small dimensions have enabled the development of products and applications that would have hitherto been less practical or even impossible.

Brazed plate heat exchangers are normally manufactured from pressed, stainless steel plates sandwiched, and brazed, together to form a compact heat transfer device. The manufacturing process presses the thin steel plates together with a copper foil, creating a plate embossed with a 'herringbone' type pattern. The pattern's orientation is alternated for each successive plate, creating a 'package' of plates with channels through which the fluid can flow. The end plate in the package is either plain or has four holes to allow the connection of pipework for the two fluid streams. (Examples of packages are shown in Figure 1.)

After the packages of plates have been gathered, they are stacked in batches and placed in a furnace where they are heated in a partial vacuum. A brazed joint is formed at every contact point between the channel plates (where the copper has melted). Copper is the standard brazing material used in BPHEs and applied across a wide range of sizes and models. Copper has a melting point of 1,083°C and a normal maximum

operating temperature of 225°C. Nickel, with a melting point of 1,453°C, can be used for specialist applications requiring higher temperatures and fluids aggressive to copper, with a maximum operating temperature of 350°C.

Following brazing, the units are tested for leaks, using inert gas, ensuring that there is no external or internal leakage. They are pressure-tested typically at a pressure 50% higher than the normal maximum operating pressure.

### BPHE operation

The operating principle of a BPHE is based on the simple transfer of heat energy from the warmer media to the cooler one. The secondary side always has one more flow channel than the primary side - provided by the first and last channels - and contains the secondary fluid surrounding the primary >>



Figure 1: Examples of flow configurations of BPHEs - single pass and multi-pass (Source: SWEP)

» channel. The secondary circuit also has a lower pressure drop because it contains one more (parallel) channel.

The flow arrangement can be either counter flow or parallel flow (Figure 2).

Counter flow is preferred, since it enables a closer approach temperature (this is the temperature difference between the inlet of the primary and the outlet of the secondary flows), as well as a greater total heat exchange. As with any heat exchanger, the heat transfer from one flow to the other through a BPHE can be determined from  $U A \Delta T_{LM}$ , where  $U$  is the average thermal transmittance from one flow to the other ( $W \cdot m^{-2} \cdot K^{-1}$ );  $A$  is the overall heat transfer area ( $m^2$ ); and  $\Delta T_{LM}$  is the log mean temperature difference between the two flows.

$\Delta T_{LM}$  - often referred to as LMTD - is determined from the entering and leaving primary and secondary temperatures:

$$\Delta T_{LM} = \frac{\Delta T_A - \Delta T_B}{\ln \left( \frac{\Delta T_A}{\Delta T_B} \right)} = \frac{\Delta T_A - \Delta T_B}{\ln \Delta T_A - \ln \Delta T_B}$$

So, for example, referring to the recommended system temperatures in Table 2 of COP1 *Heat networks: Code of Practice for the UK*<sup>1</sup>, considering a (secondary side) radiator system that has a flow temperature of 70°C and a return of 40°C, supplied through a counter flow BPHE from a heat network (primary side) with a flow temperature of 80°C and a return of 44°C:

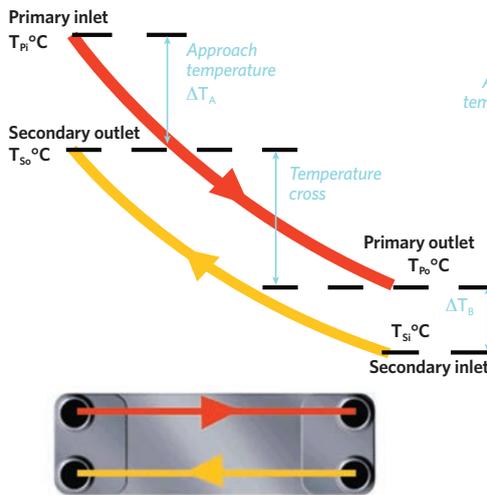
$$\Delta T_{LM} = \frac{\Delta T_A - \Delta T_B}{\ln \Delta T_A - \ln \Delta T_B} = \frac{10 - 4}{2.303 - 1.386} = 6.55K$$

A small change in the primary or secondary flow temperatures can make a substantial difference to  $\Delta T_{LM}$ , and so can have a significant effect on the sizing of the BPHE. In the previous example, if the primary flow temperature is increased by 2K, then  $\Delta T_{LM}$  will increase by 11%.

The overall sensible (single-phase) heat transfer in kW can also be determined from  $m \cdot C_p \cdot \Delta T$ , where  $m$  is the mass flow rate ( $kg \cdot s^{-1}$ ) of either one of the flows (most usefully, the secondary flow),  $C_p$  is the specific heat capacity ( $kJ \cdot kg^{-1} \cdot K^{-1}$ ) of the flowing liquid, and  $\Delta T$  is the difference between the inlet and outlet temperatures for that flow (K).

The thermal transmittance,  $U$ , is a function of the thermal resistance of the plate material, the surface heat transfer coefficient on both sides of the plates, and an allowance for 'fouling'. The thin - circa 0.4mm - stainless steel plates have a very low thermal

Counter flow heat exchanger



Parallel flow heat exchanger

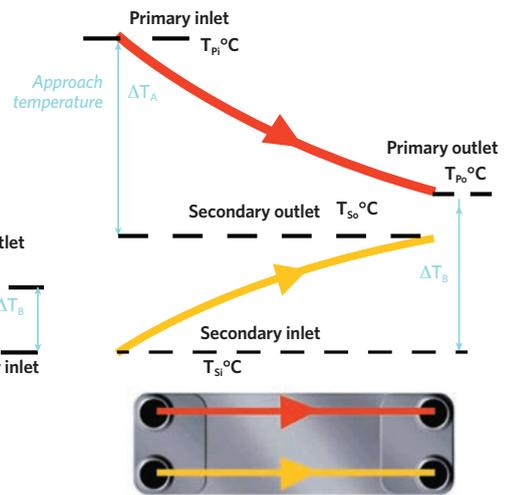
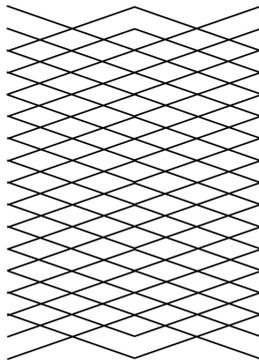
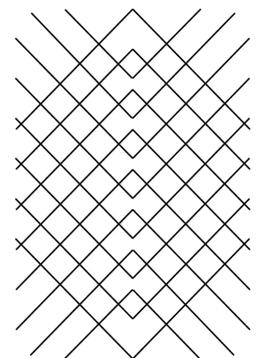


Figure 2: Temperature profiles for counter flow and parallel flow BPHE

High theta



Low theta



Medium theta - where a high theta plate faces a low theta plate

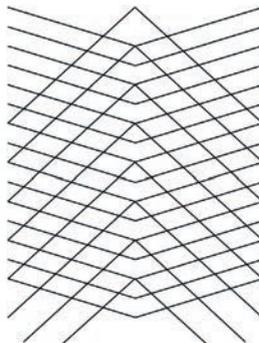


Figure 3: Examples of high, low and medium theta plate configurations

resistance and, because of the turbulent flow through the heat exchanger, there is very little deposition and accumulation of unwanted materials - such as scale, algae, suspended solids and insoluble salts - on the surfaces, so fouling factors are low. The surface heat transfers are dependent on the fluid characteristics and the flow, and so are set by the application. Turbulence creates increased heat transfer and reduces the boundary layer thickness but at a higher pressure drop, and so with greater pumping costs.

The basic performance of the heat exchanger is determined by the patterns in the plates and the channel sizes in the BPHE. This is characterised by the so called 'theta value' of the plates, used by manufacturers to represent the 'number of transfer units' (NTU) given (for a particular flow) by  $\frac{U A}{m \cdot C_p}$ .

The NTU method is used to predict outlet temperatures of heat exchangers using simple calculations, and does not require a knowledge of the log mean temperature difference as this would not necessarily be known. A high theta value would be 3 or above and a low theta would be close to 1.

Using high theta plates will provide 'high thermal length', so offering very effective heat exchangers. The thermal length of a particular flow channel is a function of the channel hydraulic diameter, plate length, and the angle of the corrugations, along with the physical properties of the flowing fluids. Increased turbulence will also reduce fouling.

The choice and configuration of plates will allow the BPHE to provide the required heat exchange characteristic and so deliver the desired secondary outlet temperature. The examples in Figure 4 give an indication of the exchanges from three arrangements with the same primary and secondary input temperatures.

High theta plates typically have a highly angled chevron pattern, whereas low theta plates typically have less acute angles. A mixture of patterns is used when an intermediate thermal effectiveness is required. Manufacturers have developed novel arrangements, such as an asymmetrical design, that has an improved heat transfer, so increasing the system's thermal performance. It also has a lower pressure loss, reducing pump work and improving the mechanical strength, which creates a physically stronger unit.

For any particular application, the channel geometry

should be designed to provide the required thermal length for each of the fluids for the most economical BPHE. If thermally oversized (that is, if the thermal length is too long) the pressure drop is likely to be acceptable, but there is a risk of excessive surface, which leads to bad performance. For thermally short applications, there is often a good fit in terms of the heat transfer surface, but it may not take advantage of the maximum allowable pressure drop, which again can lead to inferior performance.

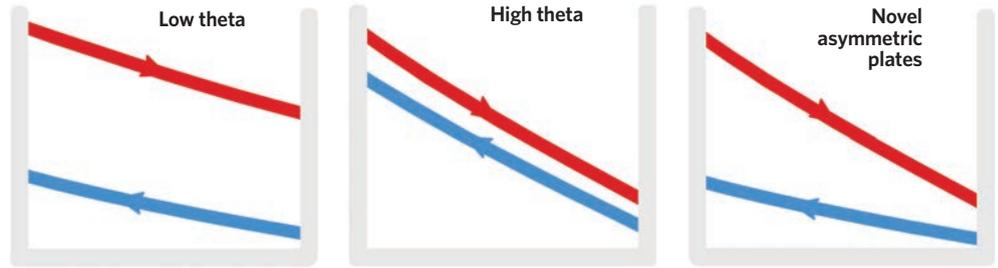


Figure 4: Indicative examples of the temperature profiles that would typically be delivered using low and high theta, and novel asymmetrical design plates

For an appropriate design, and to avoid an excessively large heat transfer surface, the annual profile of the load requirements should be assessed. As an example - and in the absence of project-specific data - the weightings and temperature profiles as applied in the European Seasonal Energy Efficiency Rating (ESEER), as shown in Figure 5, can be used to indicate the annual working profile of a BPHE that is supplying a heating system.

As seen in Figure 5, 100% load is only required (in this scenario) for approximately 11 days per year (3% of the year). So, when establishing the appropriate size of BPHE, it could be beneficial to consider making a small increase to the primary flow temperature at times of peak load, as shown in the earlier example of the determination of  $\Delta T_{LM}$ .

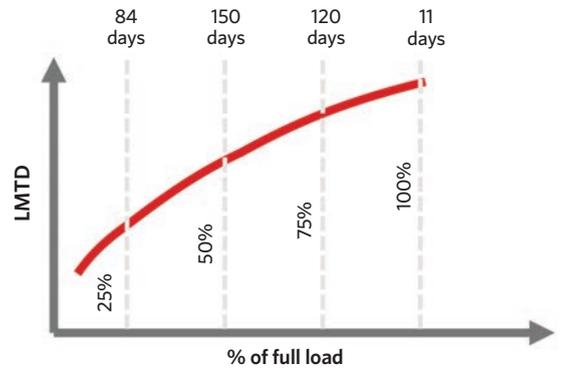


Figure 5: Relationship between required LMTD and load, together with frequency of heat demand, based on ESEER weighting factors

### Example applications of BPHE

Systems employing a single BPHE between the primary system, such as a heat network, and a second system, such as a heating system in an apartment, are increasingly common. The BPHE provides a hydraulic break between the primary and secondary side, so not only can it exchange heat, but it also allows a higher-pressure primary system to deliver heat safely to a lower pressure heating system, and can potentially use different liquids on each side of the BPHE.

The system, as shown in Figure 6 (taken from COP 21), uses separate heat exchangers for the space heating and the domestic hot water system, with the separate BPHE designed to deliver the required approach. This same concept is employed in district heating substations, where this arrangement is categorised as a one-stage configuration. This layout is simpler than the alternative two-stage layout, which employs a pair of cascading (series-connected) BPHEs.

Large-scale BPHEs, such as that shown in Figure 7, have been developed specifically for heat networks, as well as for cooling and industrial applications that require close temperature approaches at high operating pressure. With

heating capacities up to 10MW, the single high-capacity BPHE can offer an economic solution for distributed heating and cooling. As with all building services applications, this requires careful, holistic selection that should include not only an examination of the secondary load requirements, but also a careful consideration of the primary temperature profiles, to ensure delivery of energy at the lowest overall cost and environmental impact.

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■ With thanks to Christer Frennfelt, of SWEP, for supplying core information for this article.

■ Turn to page 24 for references.

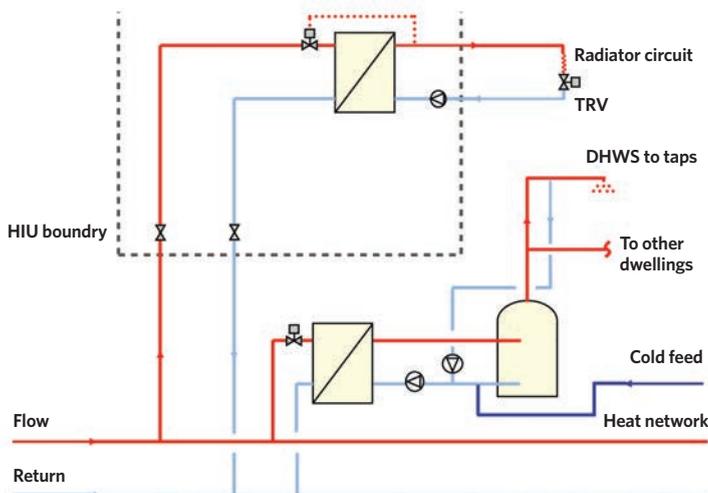


Figure 6: An example of a heating system and domestic hot water service served by two separate BPHEs selected to meet the secondary flow temperature and pressure requirements with a common primary flow (Source: COP21)



Figure 7: A BPHE capable of supplying 10MW heating (Source: SWEP)

# » Module 118

November 2017

**1. What material is typically used to braze the plates in a BPHE?**

- A Bronze
- B Copper
- C Hard solder
- D Nickel
- E Steel

**2. What is the term used to describe the temperature difference between the primary inlet and secondary outlet?**

- A Approach temperature
- B Average operating temperature
- C LMTD
- D NTU
- E Temperature cross

**3. In the example, what was the increase in  $\Delta T_{LM}$  when the primary flow temperature was increased by 2K?**

- A 11%
- B 2K
- C 44%
- D 6.55K
- E 80%

**4. In the frequency data, for example heating loads, what proportion of the year was there likely to be 75% full load?**

- A 11 days
- B 120 days
- C 150 days
- D 75 days
- E 84 days

**5. What approximate capacity was quoted for the BPHE in Figure 7?**

- A 1MW
- B 2MW
- C 5MW
- D 10MW
- E 20MW

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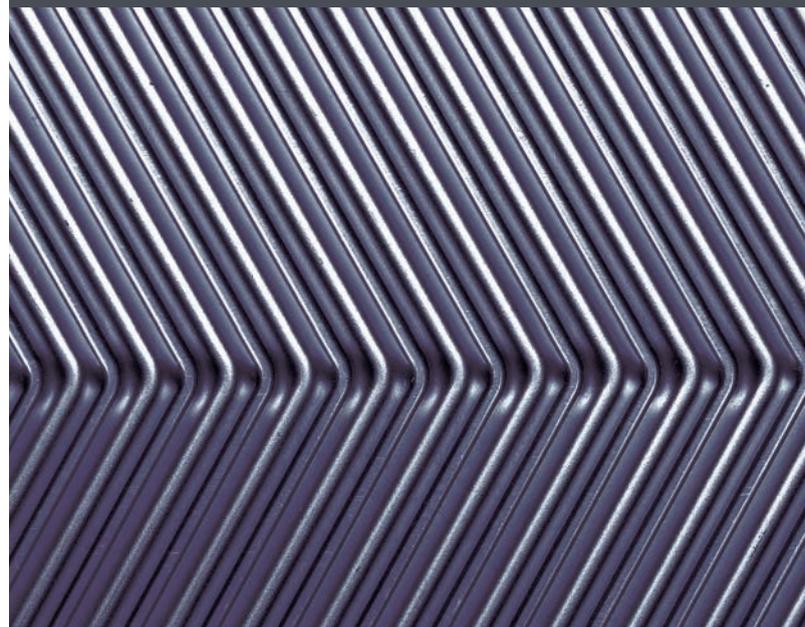
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#### References:

- 1 COP1 Heat networks: Code of Practice for the UK, CIBSE/ADE 2015.



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## Developments in non-residential mechanical ventilation and heat recovery

This module explores how modern packaged MVHR can deliver multi-mode tempered ventilation with increased efficiency and good air quality

The development and application of increasingly efficient mechanical ventilation units with integral heat recovery has been boosted by the Ecodesign directives, so that today's systems are a world away from the simple, inefficient and poorly controlled 'unit ventilators' of yesteryear. This CPD will explore how modern packaged non-residential mechanical ventilation and heat recovery (MVHR) can deliver multi-mode tempered ventilation, and cope with the challenges of increased efficiency and good air quality. The article will also consider the inclusion of thermal wheels into MVHR as a means of providing effective heat recovery.

The MVHR unit, as shown in the photograph in Figure 1, is designed to fit above a false ceiling in the ceiling void. These units tend to be as compact in height as possible, and the access to service filters and heat exchangers is usually from the side, as ceiling access panels are unlikely to be large enough to allow bottom panels to be removed. An unanticipated effect of the Ecodesign directive<sup>1</sup> on such non-residential MVHR units – classified in the regulations as 'bidirectional ventilation units with heat recovery' – is that the unit size has increased relative to the air flowrate. This is to meet the combination of:

- More stringent specific fan power (SFP) requirements. Larger, typically backward-curved centrifugal or plug fans, operated at slower speeds, normally perform better than smaller fans
- Higher required heat recovery efficiencies. The smaller compact cross-flow heat exchanger is likely unable to meet the minimum 67% effectiveness requirement (rising to 73% in January 2018)
- Lower permitted sound power levels – so requiring motors with lower sound output and increased sound insulation.

Larger sizes of electro-commutated (EC) fans have been developed to suit higher airflows and duties, but are still able to fit into the restricted space available in these limited height units.

The other commonly employed MVHR configuration, as shown in the unit in Figure 2, is free-standing. The unit is assembled on a more robust chassis and is likely to be installed outside, with a weatherproof cover or in a dedicated plant room.

Both construction types usually have insulated panels that allow a certain degree of flexibility, so that ducting connections can be swapped between side and end panels for convenience.

Controls and heating options are commonly integrated for ease of installation. Other modular elements can also be added to standard configurations to integrate heat pumps and more specialist filters, to deliver higher standards of indoor air quality (IAQ).

The units typically incorporate additional heating capacity to make up the difference between the recovered heat and the required supply air temperature.

There are numerous heater options available, including electric heater batteries, LPHW heating coils and refrigerant condensers, as well as reversible coil options to provide a capability for chilling and heating, plus heat recovery. Heat pumps may be used by employing a refrigerant coil >>



Figure 1: MVHR unit designed for installation in ceiling void (Source: S&P)

that could be used for cooling or heating - in these cases, the control of the refrigerant section is normally supervised by the heat pump unit, with the MVHR coil control acting as a slave. This can be integrated with other variable refrigerant flow systems in the building, creating high operating efficiencies by effectively using otherwise rejected heat.

Since these units are designed to provide ventilation, air filters are included - not only to protect the equipment, but also to ensure that a reasonable quality of air is supplied to the room. Aside from the larger particulate contaminants in the outdoor air, buildings that are located in urban areas are also likely to be subject to higher levels of PM<sub>1</sub>, PM<sub>2.5</sub> and nitrogen dioxide (NO<sub>2</sub>), resulting particularly from vehicle emissions and combustion in heating appliances.

A standard 'F7 grade' filter (approximately equivalent to ISO 16890 ePM<sub>2.5</sub> 80%) will reduce<sup>2</sup> PM<sub>2.5</sub> particulates by approximately 80%, and PM<sub>1</sub> by 50%, but upgrading to an 'F9 grade' (approximately equivalent to ISO 16890 ePM<sub>1</sub> 80%) will eliminate greater than 90% of PM<sub>2.5</sub> and 80% of PM<sub>1</sub> particulates cost effectively. However, it will increase the pressure drop and resulting fan power and these filters will not filter out NO<sub>2</sub>. This requires an additional filter - such as an active carbon filter - as an effective means of reducing high NO<sub>2</sub> to an acceptable mean annual concentration level of 40µg·m<sup>-3</sup>. These filters are typically fitted adjacent to the heat recovery unit and, as a dividend, also offer additional acoustic attenuation. They will significantly add to the weight of the unit and to the required fan power.

**Integration of thermal wheels into MVHR**

The thermal wheel (variously known as heat wheel, rotary heat exchanger, energy or enthalpy wheel) is based around a rotating cylinder that is packed with an air permeable material. The packing is designed

to provide a large surface area for the transfer of heat between the airstream and the material. The wheel is positioned in a casing, so that one half of the wheel sits in the airstream carrying outdoor air, while the other half is in the air being discharged from the conditioned space. As the wheel is driven around by a small motor, it first transfers energy between the discharge airstream and the packing - for example, as the air is extracted from a room, its temperature reduces as it passes through the packing - and then as the wheel rotates into the supply airstream, the energy is exchanged to or from this air - for example, incoming outdoor air is heated.

The heat transferred between the two airstreams may be sensible heat, leading to a change in the dry bulb temperature in the two streams or - more effectively - when the wheels are hygroscopic, include both latent heat and sensible heat, so affecting both the dry bulb temperature and the air moisture content as shown in Figure 3.

Thermal wheels are able to provide high-efficiency heat recovery in a compact form. Despite the relatively short time that the air takes to pass through the wheel and the relatively low pressure drop across the wheel, the heat recovery efficiency can still be more than 80%. Wheel diameters can be as big as 4m without compromising performance and efficiency, so can be used with high airflow rates. Since thermal wheels can be designed to transfer latent energy between airflows, this can negate the need for humidification of the incoming dry winter air and also eliminate the need for condensate drains. The amount of heat transferred may be readily regulated by varying the speed of the rotating wheel.

Wheels can also be coated in silver or gold for sterile environments, such

Figure 2: AHU suitable for plant room or rooftop installation (Source: S&P)



as hospitals. Cross-contamination can occur by carryover, as air entrained within the wheel is transferred to the other airstream, and leakage. A purge section would normally be installed to reduce carryover, and this can also be minimised by avoiding large pressure differences between the two airstreams. Hygroscopic media may transfer toxic gases or vapours from a contaminated exhaust to a clean air supply.<sup>3</sup>

Under the Ecodesign directive, a thermal bypass is required for MVHR units. When employing a thermal wheel, the thermal bypass is achieved by simply stopping the rotation of the wheel. Dependent on the application, a small 'ducted' bypass around the wheel can provide reductions in fan energy for when the wheel is stopped. In some applications – for example, where there is some room cooling – it may be advantageous to operate the wheel (without using a ducted bypass) for the majority of the year.

**Multi-mode control**

Modern packaged MVHR systems would normally be supplied with manufacturer-installed controls that can be used to set up different ventilation modes relatively quickly. The majority of current designs have inbuilt pressure, airflow and temperature sensors, and are able to connect with external sensors to provide control regimes according to the particular requirements of the building.

So, for example, a constant air volume configuration would allow a single zone or area, such as an office, to have a continuous volume supply regardless of the cleanliness of filters, damper settings and outside air pressure. (It would be normal for the unit to provide feedback to the user if, for example, the filters required attention.) Demand-led control can be applied for zones or rooms – such as meeting rooms – that have variable occupancy, where volume flows are linked to air quality sensors or occupant counters.

Such systems are increasingly being applied to supply multi-zone systems that include a combination of constant and variable air volume requirements. These can be delivered with a single unit that will provide a constant pressure and variable airflow to the ventilation system – based on feedback from zone sensors and control – by variable geometry air diffusers and dampers. Before the advent of EC fans and low-cost integrated controls, such systems would have taken a considerable period to commission and set up. Having designed and installed the system, it can provide multi-zone mixed-mode control with a simple selection of the appropriate control scheme to suit the building or space to be ventilated.

The integral controller would normally be capable of interfacing to the building management system (BMS) through a standard protocol (such as BACNet, Modbus or LonWorks) to allow commissioning and operation, as well as communication with other building systems, and to provide ongoing adjustment, monitoring and reporting.

**Enhanced Capital Allowance**

Under the UK government's Enhanced Capital Allowance Scheme<sup>4</sup> (ECA), energy-saving products that are approved and listed on the Energy Technology List<sup>5</sup> offer businesses the opportunity to write off the whole cost of the equipment against taxable profits in the year of purchase. The ECA scheme is surrounded by myths and misconceptions that date back to the early 2000s, when inverters and more efficient motors were the first eligible technologies. In those early days, only the costs of the approved component to a system could be claimed, but because these costs were not readily isolated by equipment manufacturers it was rare that claims were made. In addition, the paperwork accompanying a claim was onerous and time-consuming to complete. Now, most companies fill in a self-assessment corporation tax return on a quarterly basis and the process of claiming ECAs is simply a matter of deducting the eligible amount from the calculated corporation tax due figure.

In the category of air-to-air energy recovery products, those approved using thermal wheel rotating heat exchangers are eligible to offset the full purchase value against corporation tax in year one – that includes the invoiced price of

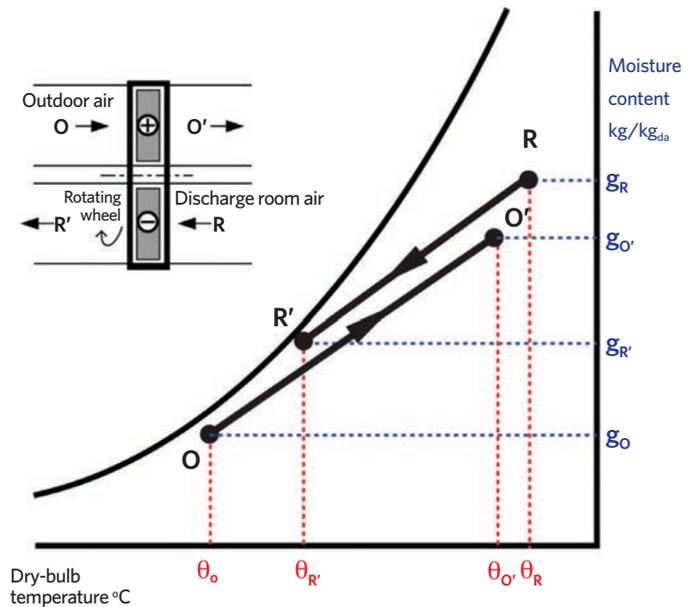


Figure 3: The psychrometry of the total thermal wheel

the product, delivery, installation and commissioning costs.<sup>6</sup> This contrasts with other heat-recovery technologies, such as plate heat exchangers, where only the cost of the exchanger itself can be claimed.

To ease the integration of all the elements into the MVHR unit, several manufacturers will offer online tools that allow selections to be made quickly. These are often linked to quotations, technical datasheets, compliance information – such as specific fan power (SFP) data – graphical and BIM-related files.

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- With thanks to Alasdair Howie of S&P for providing core information for this article.
- Turn to page 30 for references.



Figure 4: Example of thermal wheel (Source: S&P)



# » Module 119

November 2017

**1. Which of these is least likely to have caused an increase in unit size relative to the air flowrate?**

- A Ecodesign requirements
- B Higher required heat recovery efficiencies
- C Inclusion of EC fans
- D Lower required sound power levels
- E More stringent specific fan power requirements

**2. What is the reason given for the units typically incorporating additional heating capacity?**

- A To allow concurrent heating and cooling
- B To allow increased humidification
- C To ensure an appropriate supply air temperature (when heating)
- D To ensure that the air is dry
- E To ensure that the filters do not suffer from icing

**3. Approximately what percentage of PM<sub>2.5</sub> particles could a new F9 grade filter be expected to remove?**

- A At least 50%
- B At least 60%
- C At least 70%
- D At least 80%
- E At least 90%

**4. What is proposed in the article as meeting the requirement for thermal bypass for the thermal wheel?**

- A Add a duct to bypass around the wheel
- B Add hygroscopic coating to the wheel
- C Increase wheel size (no greater than 4m)
- D Reverse the wheel
- E Stop the wheel

**5. What list holds the technologies eligible for Enhanced Capital Allowance scheme?**

- A BIM
- B ECA
- C ETL
- D MVHR
- E SFP

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### References:

- 1 Commission Regulation (EU) No 1253/2014 of 7 July 2014 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for ventilation units.
- 2 PM1 - Fine dust hazard to health, Camfil, [www.camfil.com](http://www.camfil.com)
- 3 CIBSE Guide B2, *Ventilation and Ductwork*, Section 2.3.4.3, CIBSE 2016.
- 4 [www.gov.uk/government/publications/enhanced-capital-allowance-scheme-for-energy-saving-technologies](http://www.gov.uk/government/publications/enhanced-capital-allowance-scheme-for-energy-saving-technologies) - accessed 9 October 2017.
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## Rinnai CPD courses – full programme on hot water-heating systems and delivery

Rinnai, UK supplier of hot-water heating products and systems, has announced its full programme of approved CPD courses which are now freely available to all sectors of the industry, including contractors, engineers, specifiers, building services consultants and interior designers.

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## Hamworthy launches new CIBSE-accredited CPD seminar

Hamworthy Heating is expanding its offer of CIBSE-accredited continuing professional development (CPD) seminars. Aimed primarily at consultants and building services engineers, the new course covers the topic of new boilers on old heating systems with a focus on hydraulic separation.

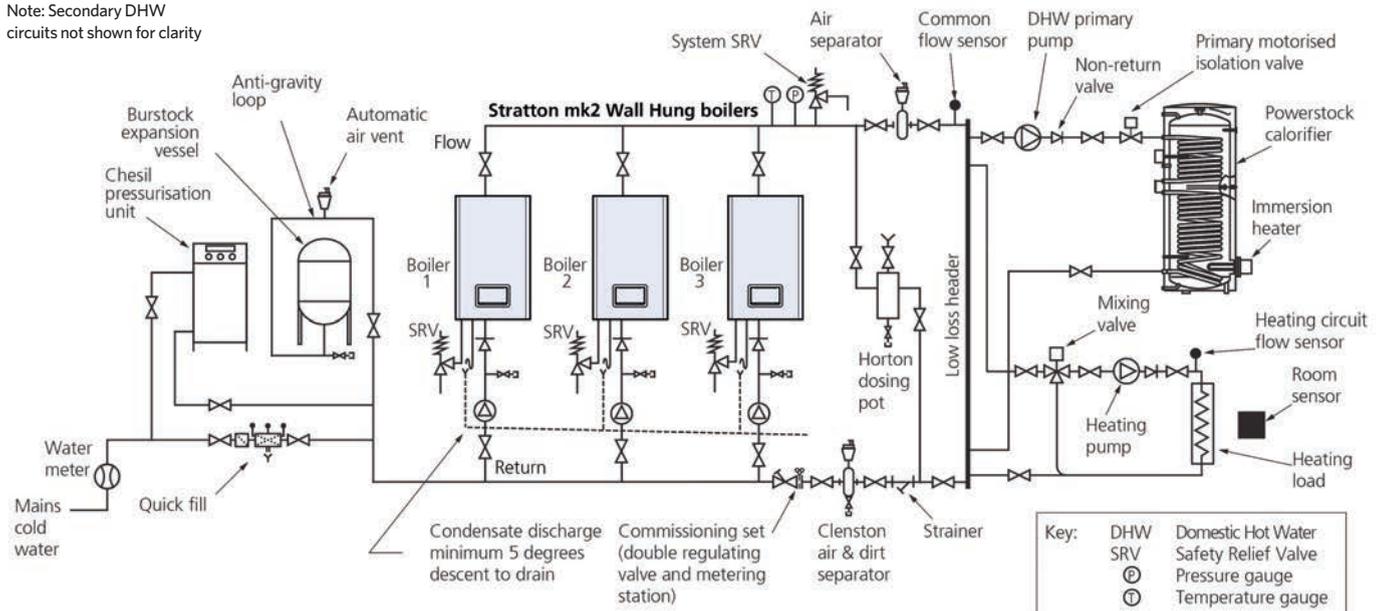
The new seminar explores the challenges when refurbishing old heating systems by looking at open vs closed heating systems, and how to overcome these challenges with methods such as hydraulic separation. Attendees can learn about different approaches to connect new boilers to the secondary

circuit, the old heating system. Methods, such as installing a low loss header, a plate heat exchanger or using a no-flow boiler and buffer vessel, are explored including the pros and cons for each.

The CIBSE judges' feedback on the presentation was: 'It is well structured, contains some very useful technical content and will be of benefit to our members.'

■ Email [sales@hamworthy-heating.com](mailto:sales@hamworthy-heating.com) or visit [www.hamworthy-heating.com](http://www.hamworthy-heating.com)

Note: Secondary DHW circuits not shown for clarity



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