Pre-insulated pipe systems for district heating and cooling networks

Hiline

www.cpv.co.uk
**Introduction**

The result of many decades of research and development, CPV’s Hiline range of bonded pre-insulated pipe systems offers a safe, secure and efficient means of conveying temperature-dependent fluids — for heating and cooling applications. Proven at countless sites throughout the world, each system has been carefully designed and manufactured to deliver outstanding performance and exceptional levels of reliability.

CPV is a true British success story - having been established in the late 1940s, the company has been one of the pioneers in the development and manufacture of thermoplastic pipe systems and this expertise has been put to great use in the evolution of the company’s current Hiline range of pre-insulated pipe systems.

**Environmental Issues**

Climate change is here. With the ever-present threat of extreme weather events, flooding and unseasonable weather patterns, few could honestly deny that change is afoot. In the UK, around half of our energy demands come from the need for heat — whether it’s domestic, commercial or industrial. Governments are now waking up to the fact that by tackling the carbon emissions from this demand, we can make a sizeable contribution to the reduction of global greenhouse gases.

District heating has been identified as a technology that can play a leading role in helping lower carbon emissions. The Hiline range of pre-insulated pipes has been developed with this application in mind and, as such, offer exceptional performance and reliability when distributing low-carbon heating and hot water.

**Applications**

The Hiline range of pre-insulated pipe systems is perfect for all sizes of buried district heating and cooling networks. From large-scale transmission and arterial pipelines down to individual domestic-sized branch connections, the range is complete.

**Efficient Insulation**

A key component in the efficiency of the Hiline pipe systems is the CFC-free polyurethane foam which provides excellent levels of insulation — in accordance with the demands of the EN 253 standard. This produces very-low lambda levels — which results in much-reduced energy losses to the media being conveyed by the service pipe.
The effects of using a more efficient insulation don’t appear to be much at face value, but factor in a minimum 30-year life-cycle cost of operating the system and the savings – both financial and environmental – mount up significantly. The Hiline range of pre-insulated pipe systems are available with increased levels of insulation thickness – which for a relatively small additional investment at the time of installation – will yield significant savings during the lifetime of the system.

To illustrate this point, take an example scenario in which a 5,000-metre long network (flow and return) consisting of DN150mm steel pre-insulated pipes circulating hot water at a flow temperature of 100°C. If fuelled by a natural-gas-fired boiler, constantly operating all-year-round, the system with standard insulation – over its nominal 30-year life – will lose heat to the equivalent of around £3.65 million’s-worth of gas(*) and emit 15,250 tonnes of CO₂. By making a small additional investment – equivalent to around 10 percent of the material cost at the time of installation – in order to upgrade the Hiline pipe system’s insulation thickness to Series Two, the cost of the heat lost would be reduced by some £1.2 million – also saving 5,091 tonnes of CO₂ from being emitted. The graphs shown above (figures 1 and 2) demonstrate the effects that this can have.

(*) Basis of Calculations used for example costs:
- Gas supply tariff 3p/kWh
- Gas costs increase by 2.5% per annum for the 30-year calculation
- Gas boiler efficiency 80%
- Carbon factor for natural gas = 0.1836 kgCO2/kWh (source: Ofgem)

Quality Assured
Hiline systems are manufactured in modern, EN ISO 9001-approved production facilities, using quality-assured materials that comply with all relevant industry standards for district heating and cooling – including EN 253, as well as customers’ bespoke specifications. CPV also works to the requirements of the requirements of the ISO 14001 Environmental Management System.

Research & Development
CPV has been at the forefront of the design and development of specialist pipe systems and its Hiline range is no exception. Not content with merely accepting current industry best practice, the company is constantly looking into ways in which it can improve a system’s performance, life expectancy and capital cost – including innovation in developing the next generation of materials for its composite systems.
A SERVICE PIPE FOR EVERY APPLICATION …

RIGID SYSTEMS
1. Hiline Steel - a range of bonded pre-insulated pipe systems with steel service pipes that conform to European and International specifications – suitable for district heating and cooling applications
2. Hiline Copper - a bonded pre-insulated copper pipe system for district heating and cooling along with hot and cold water applications
3. Hiline GRE - a bonded pre-insulated glass-reinforced epoxy (GRE) service pipe that’s suitable for district heating and cooling networks
4. Hiline Aqua - a bonded rigid-polypropylene pre-insulated pipe system for use in district heating and cooling along with hot and cold water applications
5. Hiline Aqua Cool - a bonded rigid-polypropylene pre-insulated pipe system for use in cooling applications

FLEXIBLE SYSTEMS
6. Hiline e-Flex - a flexible, pre-insulated PE-Xa pipe system for use in district heating and cooling applications
7. Hiline FibreFlex - a flexible, pre-insulated pipe system with a PE-Xa service pipe reinforced with aramid fibres to withstand working pressures of up to 10 bar at continuous operating temperatures of 80°C
8. Hiline FibreFlex Pro - a flexible, pre-insulated pipe system with a PE-Xa service pipe reinforced with aramid fibres to withstand working pressures of up to 16 bar and temperatures of 115°C
9. Hiline S-Flex - a flexible, pre-insulated pipe system with an AISI 316 stainless steel service pipe to withstand working pressures of up to 16 bar at continuous operating temperatures of 120°C

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Surveillance System
- Compatible with a range of surveillance systems for use with both metallic and polymer service pipes
- Nordic pulse, Brandes resistance or customer-specified systems catered for

Efficient insulation
- High-efficiency CFC-free, rigid polyurethane foam insulation
- Different thicknesses available (Series 1, 2 and 3)
- Low global warming potential: <0.6
- Ozone depletion: Zero

Casing Joints
- Range of secure joints and fittings available
- HDPE electro-fusion and heat-shrinkable case jointing options
- Two-part, snap-fit shell sleeve system

Outer Casing
- High Density Polyethylene (HDPE) casing on standard systems
- Foil vapour barrier available on certain systems
- Barrier-pipe casing available for use in contaminated ground
- UV-stable and fire-resistant HDPE above-ground options available
- Metallic spiral-wound casings also available

RIGID SYSTEMS
1. Hiline Steel
2. Hiline Copper
3. Hiline GRE
4. Hiline Aqua
5. Hiline Aqua Cool

FLEXIBLE SYSTEMS
6. Hiline e-Flex
7. Hiline FibreFlex
8. Hiline FibreFlex Pro
9. Hiline S-Flex

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World-class support

CPV prides itself by the way in which it supports its clients - from initial contact, through the design and installation stages and then in offering lifelong operational and maintenance support services for the pre-insulated pipe network. As manufacturer, it is important to ensure that CPV’s systems deliver exceptional performance throughout their working life. Therefore, the company has established an array of world-class support services that help its clients every step of the way.

Design and Stress Analysis

There are many factors that will affect the long-term integrity of a pre-insulated pipe system. Correctly identifying and dealing with the potential for thermal expansion of the pipe system is a critical element of the design process and CPV is a licenced operator of the state-of-the-art sisKMR specialist stress analysis software.

This package enables the configuration of pipe routes to keep thermal expansion within safe limits and conform to the requirements of the EN 13941 standard for Design and installation of pre-insulated bonded pipe systems for district heating.

To illustrate the importance of stress analysis, a 200-metre length of buried DN250mm pre-insulated steel pipe, heated to an operating temperature of 120°C will expand by around 150mm – the equivalent of 52 tonnes. CPV’s design team can provide full advice and support to ensure a system operates within acceptable operational parameters and provide a long working life.

Drawings

CPV’s design team can provide district heating pipe network drawings for every stage of a project – from initial conceptual design through to the as-installed drawings that accurately record pipe routes and the details of electronic surveillance systems.

Electronic surveillance systems support

When installing Hiline Steel systems, it is recommended that an electronic surveillance system is included in order to constantly monitor the insulation for the ingress of moisture.

Training

Training installers, supervisors and maintenance operatives, CPV’s brand new training centre allows for not only the theory, but hands-on practical experience in the correct method for installing the Hiline pipe systems.

In addition to this, certified training courses are offered in the installation, commissioning and maintenance of electronic surveillance systems – including the use of a purpose-built buried Hiline pipe network, on which moisture faults can be simulated as part of the practical training.

Tool sales and hire

CPV offers both the sale and short-term hire of all the specialist tools required to install the Hiline pipe system.

On-site support services

Whether it’s on-site training, site supervision or specialist advice, support and maintenance – CPV’s engineers are at hand to provide customer support as and when required.

Off-site fabrication service

CPV offers a comprehensive off-site fabrication service for the entire Hiline range of pipe systems. This can help lower costs, save time on site, improve quality and reduce waste.
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
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<tbody>
<tr>
<td><strong>PRODUCT SELECTOR TABLE</strong></td>
<td>Hiline Steel</td>
<td>Hiline Copper</td>
<td>Hiline GRE</td>
<td>Hiline Aqua PP-R</td>
<td>Hiline Aqua Cool PE</td>
<td>Hiline e-Flex PE-Xa</td>
<td>Hiline FibreFlex Pro</td>
<td>Hiline S-Flex</td>
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<tr>
<td><strong>System Standards</strong></td>
<td>EN 253, EN 448, EN 488, EN 13941 &amp; EN 14419</td>
<td>(*) EN 253 / 15632-1/2</td>
<td>(*) EN 253 / 15632-1/2</td>
<td>(*) EN 253 / 15632-1/2</td>
<td>(*) EN 253 / 15632-1/2</td>
<td>EN 15632-1/2</td>
<td>Technical Specification OFI CERT ZG 200-2 Class A</td>
<td>Technical Specification OFI CERT ZG 200-2 Class D</td>
</tr>
<tr>
<td><strong>Service Pipe Standards</strong></td>
<td>Seamless EN 10216-2 Welded EN 10217-2 &amp; S</td>
<td>EN 1057</td>
<td>ISO 14692-1/2/3/4 ASTM D2310 ASTM D2996</td>
<td>DIN 8077 DIN 8078</td>
<td>DIN 8074</td>
<td>EN 12318-2 DIN 16892 DIN 16893</td>
<td>None applicable as it has a unique composite construction</td>
<td>None applicable as it has a unique composite construction</td>
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<tr>
<td><strong>Service Pipe Material &amp; Grade</strong></td>
<td>STEEL St 37.0 Seamless R-35, P235, P295, P355 &amp; TR2</td>
<td>COPPER Cu-DHP, R250 &amp; R290</td>
<td>GRE ASTM D2310-11&amp;2 X &amp; ASTM D2996</td>
<td>PP-R &amp; PP-RCT Multi-layer composite fibre reinforced</td>
<td>PE100 SDR13.6 or SDR11</td>
<td>PE-Xa with oxygen diffusion barrier and armid fibre reinforcement mesh</td>
<td>PE-Xa with oxygen diffusion barrier and armid fibre reinforcement mesh</td>
<td>Stainless steel alloy to AISI 316 - assigned state standard 03X17H14M3 enriched</td>
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<tr>
<td><strong>Casing Pipe Material</strong></td>
<td><strong>HDPE and Metallic Spiral</strong></td>
<td>HDPE and MDPE Barrier</td>
<td>HDPE and MDPE Barrier</td>
<td>PE (PP and ABS also available)</td>
<td>Corrugated LDPE</td>
<td>Corrugated LDPE</td>
<td>Corrugated LDPE</td>
<td>Corrugated LDPE</td>
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<tr>
<td><strong>Max Operating Pressure (bar)</strong></td>
<td>25</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10 (SDR17.6)</td>
<td>6</td>
<td>10</td>
<td>16</td>
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<tr>
<td><strong>Max Cont Operating Temp (°C)</strong></td>
<td>140</td>
<td>120</td>
<td>120</td>
<td>80</td>
<td>+60 (down to -40)</td>
<td>80</td>
<td>80</td>
<td>100</td>
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<tr>
<td><strong>Max Peak Operating Temp (°C)</strong></td>
<td>152</td>
<td>130</td>
<td>120</td>
<td>95</td>
<td>60</td>
<td>95</td>
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<td>115</td>
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<td><strong>Insulation Material</strong></td>
<td>PUR</td>
<td>PUR</td>
<td>PUR</td>
<td>PUR</td>
<td>PUR</td>
<td>PUR</td>
<td>PUR</td>
<td>PUR</td>
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<tr>
<td><strong>Insulation Series</strong></td>
<td>1 &amp; 2</td>
<td>1 &amp; 2</td>
<td>1 &amp; 2</td>
<td>1 &amp; 2</td>
<td>1 &amp; 2</td>
<td>1 &amp; 2</td>
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<td>1 &amp; 2</td>
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<tr>
<td><strong>Insulation Value (w/mK)</strong></td>
<td>0.0244</td>
<td>0.024-0.029</td>
<td>0.024-0.029</td>
<td>0.024-0.029</td>
<td>0.024-0.029</td>
<td>0.021</td>
<td>0.021</td>
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<tr>
<td><strong>Delivered Lengths</strong></td>
<td>6m &amp; 12m</td>
<td>6m</td>
<td>9m &amp; 11.9m</td>
<td>6m &amp; 12m</td>
<td>5m, 6m &amp; 12m</td>
<td>Up to 800m (coil)</td>
<td>Up to 500m (coil)</td>
<td>Up to 500m (coil)</td>
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<tr>
<td><strong>Electronic Surveillance</strong></td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
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</table>

**APPLICATIONS**

| District Heating | YES | YES | YES | YES | YES | YES | YES |
| District Cooling | YES | YES | YES | YES | YES | YES | YES |
| Potable Water Services | YES | YES | YES | YES | YES | YES | YES |

(*) Generally manufactured in accordance with EN 253 and/or 15632-1/2 as no current standards exist for pre-insulated service pipes of these material types
(**) HDPE & MDPE Casing can be supplied with oxygen diffusion barrier for diameters d75 - d400 (on request)

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About CPV Ltd
CPV operates in a wide array of sectors, with products satisfying many applications, most of which concern engineering pipe solutions for aggressive, corrosive, hot, chilled and potable liquids.

Its state-of-the-art production facility - based at the site of CPV’s headquarters near Romsey in Hampshire - is backed by a comprehensive selection of research, design, engineering, testing, quality, training and support services; ensuring the perfect marriage between its products and the applications in which they serve.

The details of the full range of products can be found on CPV’s website: www.cpv.co.uk

Product Solutions
Since the company’s inception in 1948, it has regularly led the way in the research and development of pipe systems, tanks and vessels. The current range encompasses:

- Pre-insulated pipe systems
- Chemical and hazardous drainage systems
- Pressure pipe systems
- Tanks and vessels
- Custom extrusions and fabrications

Project References
The Hiline system has been used on projects worldwide for a variety of applications. The list continues to grow, so please contact CPV for up-to-date project references. The list below illustrates a small selection of project types:

- City-wide district heating networks
- Hospitals
- Hotels
- Manufacturing facilities
- Ministry of Defence
- Public buildings
- Research Facilities
- Residential (social and private)
- Schools

Available from:

CPV Ltd
Woodington Mill
Woodington Road
East Wellow
Romsey
Hampshire
SO51 6DQ
United Kingdom

Tel: +44 (0)1794 322 884
Fax: +44 (0)1794 322 885
Email: enquiries@cpv.co.uk

Registered Office:
Station Road West, Ash Vale, Hampshire, GU12 5LZ
Registered in England and Wales No: 468471

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