



ON SYSTEMS ULTRA-LIGHTWEIGHT AIR
DISTRIBUTION & INSULATION SYSTEMS ULTRA-LIGHTWEIGHT AIR DISTRIBUT

senior
Aerospace
BWT



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ATION SYSTEMS WORLD LEADER IN ULTRA-LIGHTWEIGHT AIR DISTRIBUTION AND INSULATION SYSTEMS WORLD

Senior Aerospace BWT (formerly Baxter Woodhouse and Taylor) is recognised as a world leader in the design and manufacture of ultra-lightweight low pressure air distribution and insulation systems and has established a position of preferred supplier to the aerospace industry worldwide.

Senior Aerospace BWT have a global reputation and an impressive customer base across which they provide systems for fixed winged and rotary winged aircraft, for all market sectors and for both civil and military applications.

Senior Aerospace BWT is a subsidiary company of Senior plc and its outstanding design and manufacturing expertise complement the activities of other group companies.

With manufacturing facilities and offices in 15 countries across all continents, Senior plc is the world's leading supplier of thin-walled flexible tubing and related high performance products across a number of specialised markets.

Senior Aerospace BWT continues its policy of major investment in product development, materials research, manufacturing process and integrated business systems. Combined with the capabilities of other Senior plc companies, Senior Aerospace BWT is firmly placed to retain and expand its market position.



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LIGHTWEIGHT SYSTEMS A FLEXIBLE RESOURCE FOR ULTRA- LIGHTWEIGHT SYSTEMS A FLEXIBLE RESOURCE FOR ULTRA-LIGHTWE

ENGINEERING

As one of the most experienced organisations in this sector of the aerospace industry, Senior Aerospace BWT is committed to maintaining a multi-disciplined engineering team capable of supporting its customer's needs.

The team has responsibility for all activities from design conception through to first-off production. Design activities are supported by a state of the art computer aided design capability, enabling the visualisation of components in advance of manufacture.

Commitment to customer support is pivotal to Senior Aerospace BWT's success. The engineering team offers on-site support at the customer's facility through initial design onto installation of the finalised system.

MANUFACTURING

Senior Aerospace BWT's manufacturing facilities meet and exceed the demanding requirements of its customers, providing high quality products in the shortest possible lead-time.

The highly motivated, multi-skilled and flexible workforce are dedicated to exceeding their customers expectations for quality products delivered on time.

An integrated business operating system provides information to support front end sales & operations planning, production scheduling, product tracking and business performance monitoring data.

Continuous investment in production processes and facilities enables Senior Aerospace BWT to strive toward meeting its goal; to provide customers with quality products at competitive prices, delivered on time.

QUALITY

Senior Aerospace BWT is accredited with BS EN ISO9001, AS9100 and EASA PART 21 Subpart G approvals. In selecting Senior Aerospace BWT, customers have placed their confidence in its ability to design and manufacture products to the highest standard of quality and reliability.

The company quality management system complies with both military and civil quality assurance requirements and is implemented through formal company procedures.

Senior Aerospace BWT's quality management team provides an independent quality assurance authority and product quality control system, responsible for product integrity throughout the manufacturing process.

CUSTOMER SERVICE

Senior Aerospace BWT is proud of the unrivalled service and support provided to its customers.

On day-to-day issues such as order placement, inquiries, progress, and change notification, each customer is allocated a dedicated member of the Customer Service Team. This single point of contact provides the level of service that is both expected and demanded by the customer.

For additional customer service a global network of sales offices is operated and supported by Senior Aerospace BWT Regional Managers.

For AOG requirements Senior Aerospace BWT operates a 365 days a year 24 hour service.

A FLEXIBLE RESOURCE FOR ULTRA-LIGHTWEIGHT SYSTEMS
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Windscreen demisting



Flight deck supply

LEADING EDGE SOLUTIONS FOR ULTRA-LIGHTWEIGHT SYSTEMS

A comprehensive range of products enables Senior Aerospace BWT to provide integrated system solutions, both modular and aircraft specific, which optimise weight, cost, installation time and effective use of the space envelope.

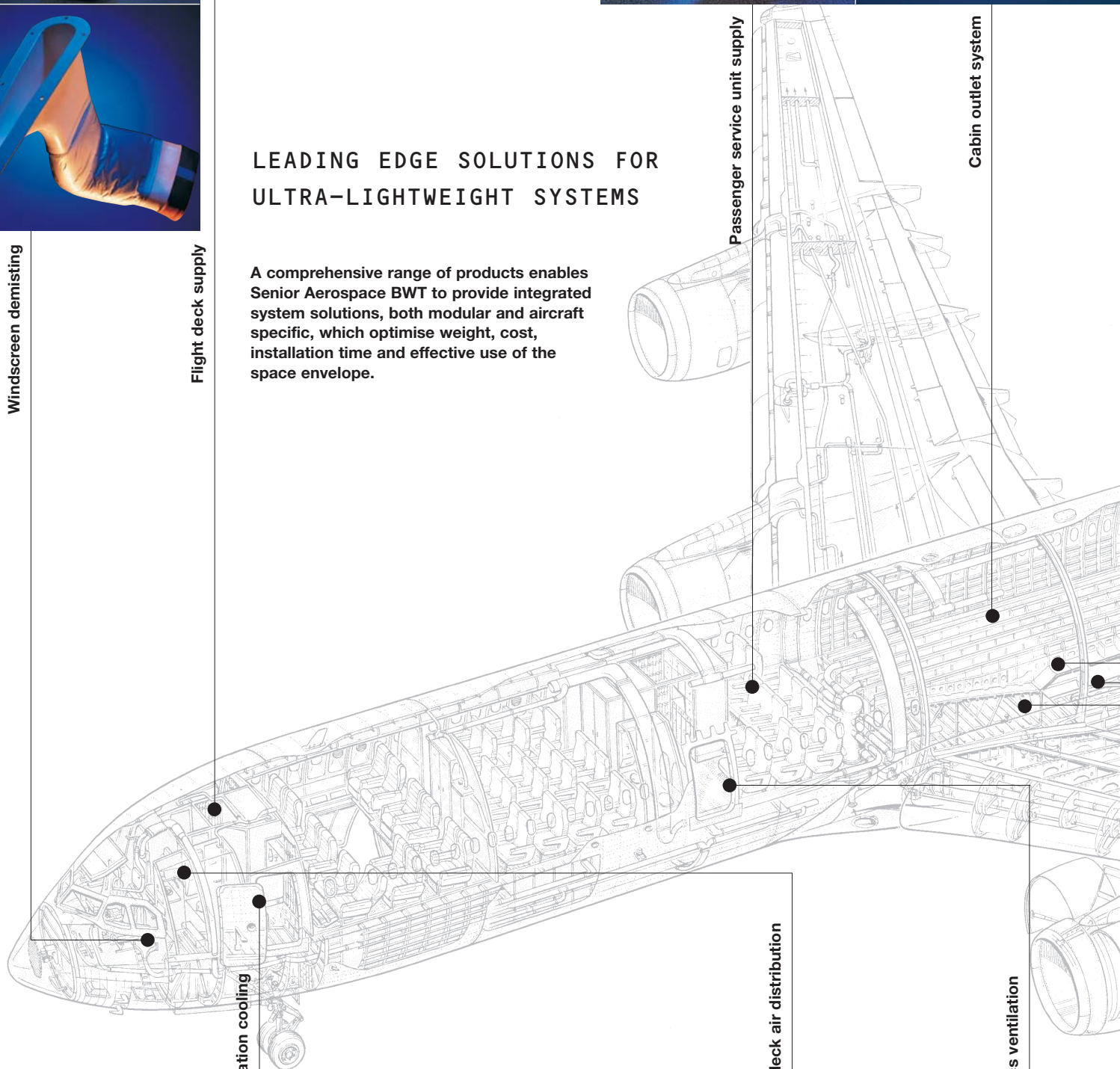
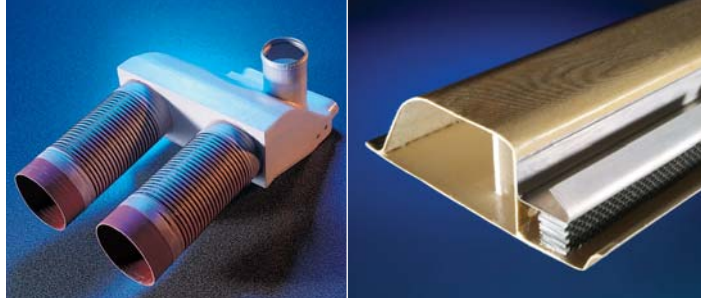
Flight deck instrumentation cooling

Flight deck air distribution

Passenger service unit supply

Cabin outlet system

Avionics ventilation

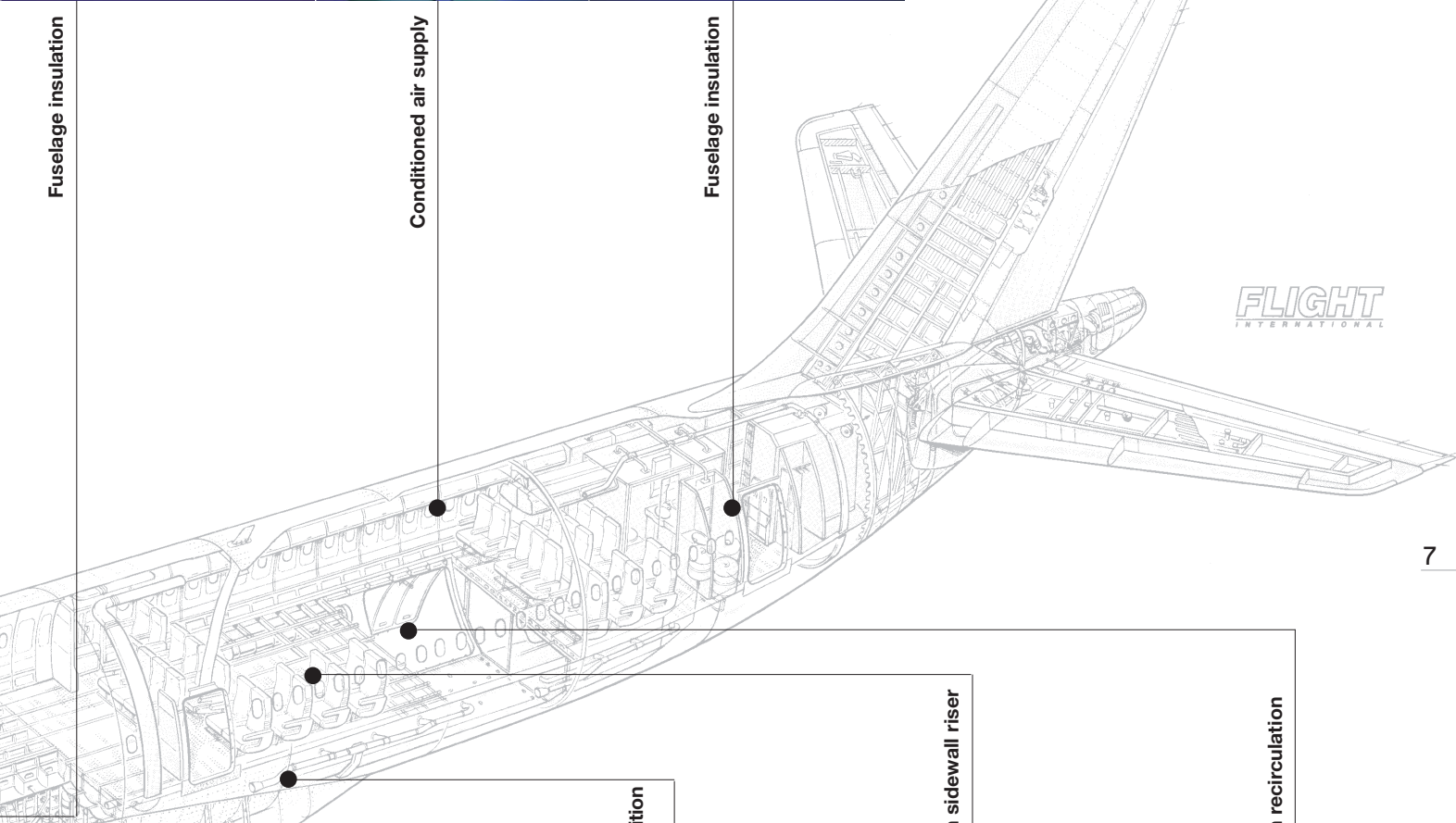




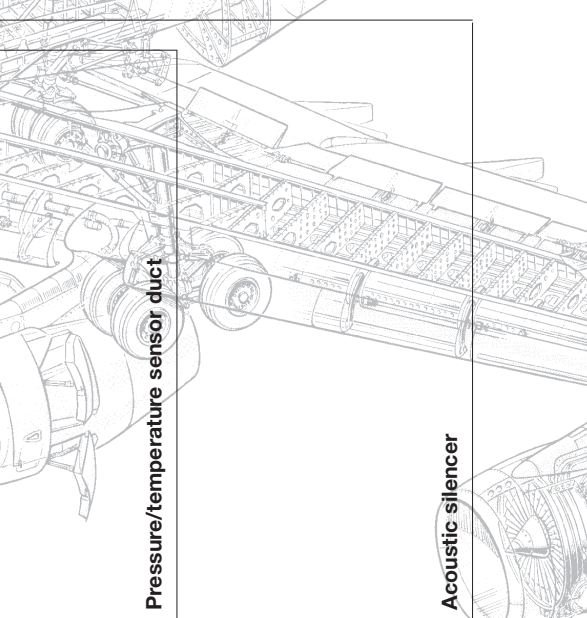
Fuselage insulation

Conditioned air supply

Fuselage insulation



FLIGHT
INTERNATIONAL



Pressure/temperature sensor duct

Transition duct

Cabin sidewall riser

Cabin recirculation



Acoustic silencer

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Senior Aerospace BWT's range of flexible and semi-rigid ducting provides system solutions, both modular and aircraft specific, which optimise weight, cost, pressure loss, installation time and efficient use of the available space envelope.

Flexible ducting is available with urethane/nylon or silicone based constructions, for low and high temperature applications respectively. They can be supplied as standard circular or shaped profiles, incorporating transitions, set bends and various end interface connections.

Ultra-lightweight flexible duct constructions are designed to meet the requirements of the aerospace industry,

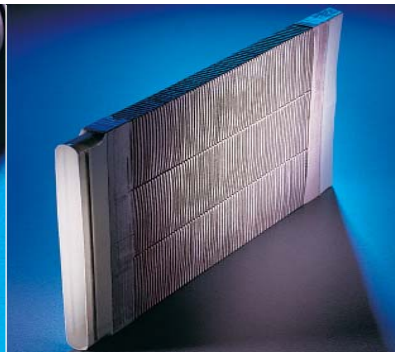
where light weight, flexibility, durability, low maintenance and ease of installation are essential considerations.

Semi-rigid ducting can be supplied as standard connectors and branches or tailored to maximise air flow on installations with a restricted space envelope. Used as part of the system solution, Senior Aerospace BWT's semi-rigid ducting is the ideal partner for the flexible range.

Manufactured from proprietary ultra-lightweight reinforced composite materials, offering smooth bore solutions, Senior Aerospace BWT's semi-rigid materials are ideally suited for use in complex duct geometries.



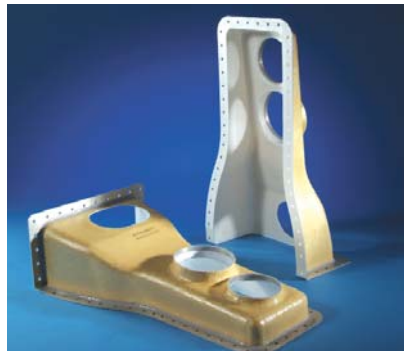
Various connecting methods



Shaped flexible ducts



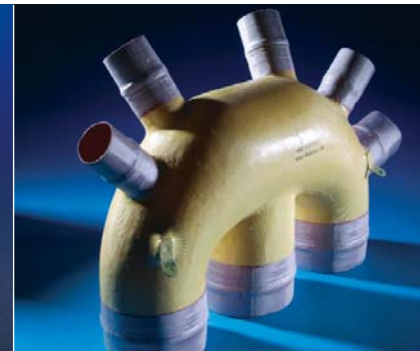
Flexible & semi-rigid duct combinations



Bespoke products

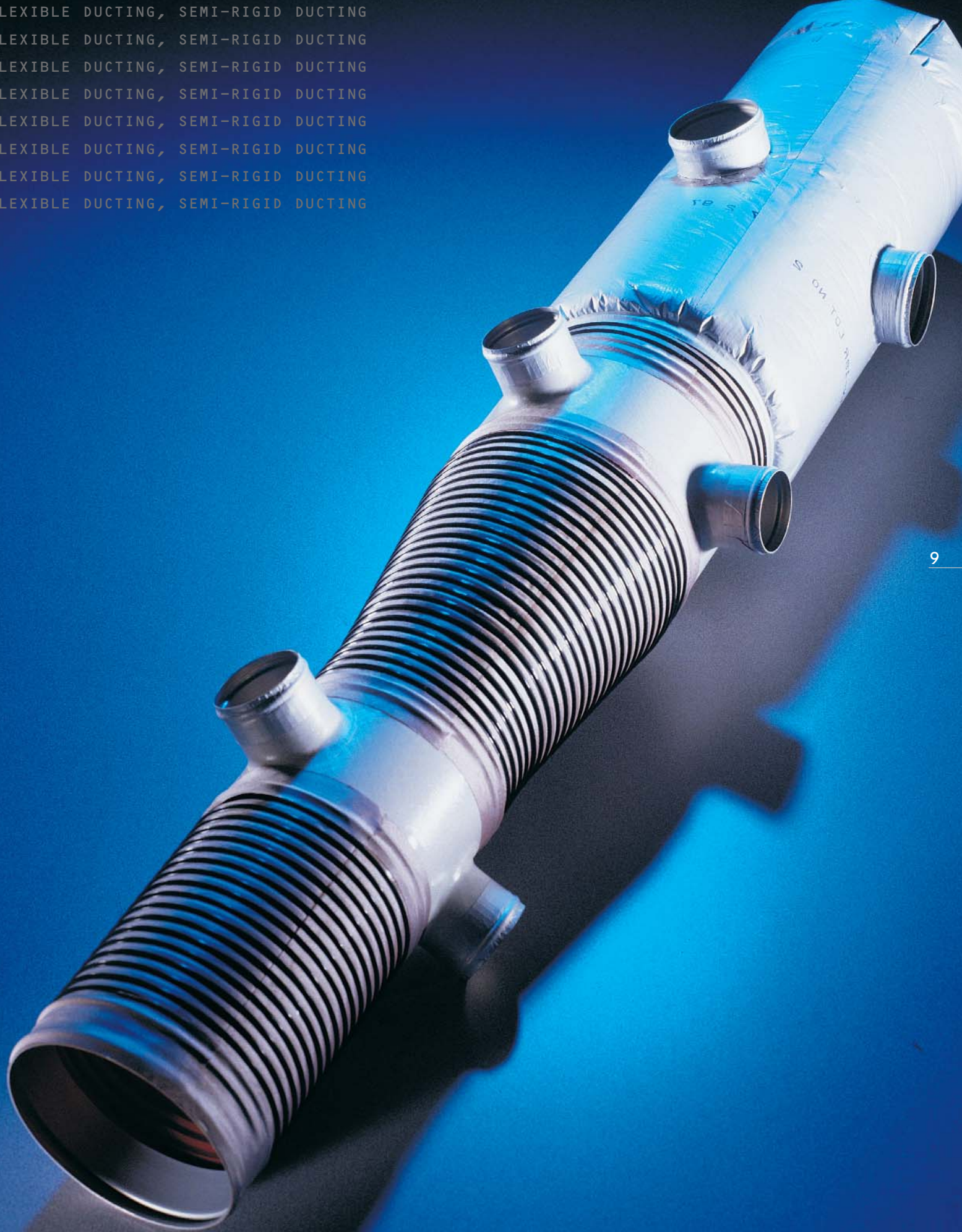


Complex duct geometries



...simple solutions to demanding requirements

FLEXIBLE DUCTING, SEMI-RIGID DUCTING
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RIGID DUCTING, ACOUSTIC SILENCERS, INSULATION SYSTEMS
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RIGID DUCTING, ACOUSTIC SILENCERS, INSULATION SYSTEMS



Senior Aerospace BWT is able to supply components for more specialised installations and applications.

Rigid components are available with composite or aluminium constructions, offering greater resilience to service and/or maintenance activities. As with the semi-rigid components, the duct profiles can be tailored to optimise the use of available space.

Thermal and acoustic insulation in aircraft air distribution systems is an area where Senior Aerospace BWT can offer a range of options providing cost effective and practical solutions.

These solutions minimise heat loss by providing complete coverage of the ducting system.

Noise transmitted through an air distribution system is greatly reduced through the use of Senior Aerospace BWT silencer ducting. These acoustically insulated ducts can be supplied in flexible or semi-rigid constructions, incorporating a wide range of profiles and end connections.

Fuselage insulation systems combine thermal and acoustic properties to maximise passenger and crew comfort within the flight compartment. Individually tailored, they ensure coverage of the airframe throughout the aircraft, optimising performance.



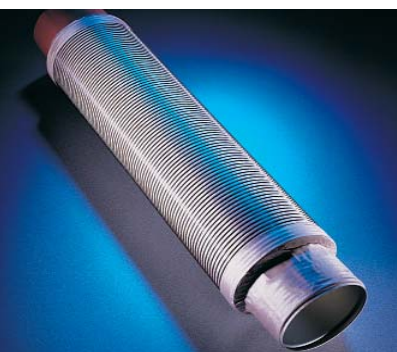
Transition duct



Rigid duct with metallic flange connectors



Rigid duct with installation provision



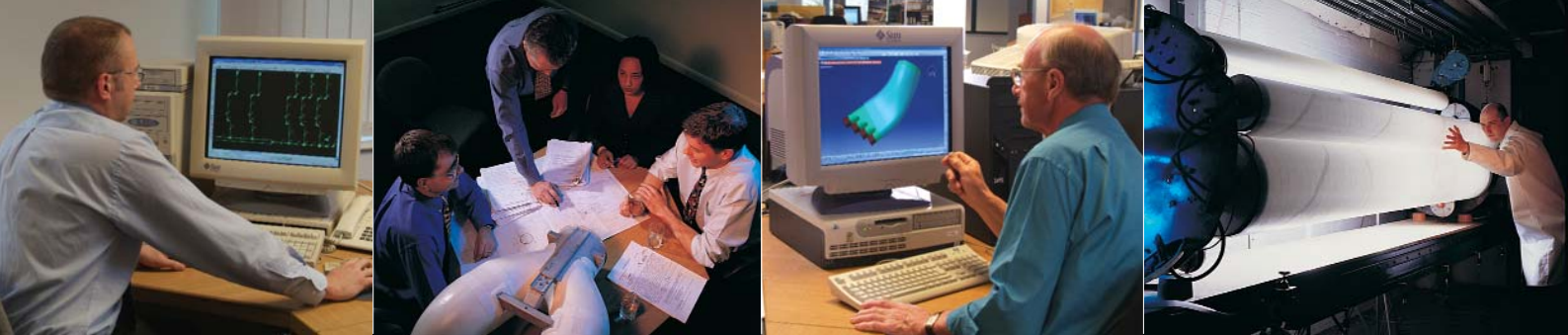
Standard acoustic silencer



Bespoke acoustic silencer



Fuselage insulation panel with integral air distribution ducting



ENGINEERING DESIGN CAPABILITIES

As one of the most experienced organisations in this sector of the aerospace industry, Senior Aerospace BWT takes pride in its capability to offer a comprehensive range of design and product support services.

Senior Aerospace BWT maintains its position as a world leader in the design and manufacture of ultra-lightweight air distribution ducting and cabin insulation systems through a commitment to engineering excellence.

Senior Aerospace BWT employs a multi-disciplined engineering team with extensive experience in the application and development of ultra-lightweight material technology in the aerospace sector. This team has been influential in the successful implementation of many of the air distribution and insulation systems currently in service.

Speed of response and the flexibility of the engineering function is achieved through the use of advanced technologies and development techniques. State of the art computer aided design and analysis capabilities, in-house tooling manufacture, reverse engineering and skilled project management are just some of the attributes that contribute to Senior Aerospace BWT's unrivalled ability to design components and systems.

Tools available to the engineering team include:

- CATIA
- AutoCAD
- Flowmaster2 flow analysis

TECHNICAL SUPPORT

Senior Aerospace BWT offers a range of engineering services to support its customers throughout design, installation, qualification and certification phases.

These include:

- Technical representation on-site during the initial design phase, providing knowledge and experience of AMS/ECS ducting integration

and lightweight materials, assisting customers at the most beneficial stage of a project, optimising design considerations, reducing costs.

- Samples manufactured and tested to prove design concepts.
- A dedicated research and development team committed to the investigation and implementation of new materials and processes.
- Airflow analysis thus reducing costly flight and development test programs.

QUALIFICATION

Senior Aerospace BWT through their extensive experience can manage a comprehensive program to support the qualification process. Senior Aerospace BWT will compile documentation, plan, test and report on all relevant aspects of product and material performance.

Testing may be customer specific or to set standards, for example RTCA/DO-160, MIL-STD-810 or ASTM. Performance data has been collected from a number of programs and includes:

- Environmental – High & Low Temperature, Temperature Variation, Humidity, Waterproofness, Salt Spray, Fluid Susceptibility and Fungal Resistance.
- Mechanical – Vibration, Operational Shock, Crash Safety, Over Pressure and Endurance (Pressure Cycling).
- Airworthiness – Flame Resistance, Radiant Panel Flame Propagation, Smoke and Toxicity.

RIG TEST FACILITIES

Senior Aerospace BWT has the capability to offer a cost effective solution to airflow testing and balancing on distribution ducting systems, by means of purpose built test rigs, thus aiding the qualification and certification process.

Testing can be carried out on complete ducting systems, or sections of the system to define airflow balancing provisions.

The main distribution systems, avionics ventilation and recirculation systems are typical of those that can be balanced and proven.

DESIGN REQUIREMENTS INNOVATIVE SOLUTIONS FOR COMPLEX
DESIGN REQUIREMENTS INNOVATIVE SOLUTIONS FOR COMPLEX DES





TEE CONNECTOR



STUB CONNECTOR



'Y' CONNECTOR

SEMI-RIGID COMPONENTS

Fully compatible with the standard flexible components, Senior Aerospace BWT's propriety ultra-lightweight composite construction is a proven solution for low pressure air distribution components. The versatility of this range means that both modular and bespoke solutions, according to system requirements, can be provided as a complete package.

Senior Aerospace BWT has pioneered the use of ultra-lightweight composite constructions in the manufacture of a comprehensive range of standard semi-rigid connectors. Targeting low pressure, medium temperature ECS air distribution applications, the Senior Aerospace BWT range of "PD" connectors has been designed to be fully compatible with standard flexibles. They are available with two standard interface styles:

- Threaded (or screw connection) - a simple, economic solution, eliminating the need of a clamp, for small diameter interfaces.
- Beaded (to AS5131) - for larger diameters and applications requiring additional restraint.

BESPOKE COMPONENTS

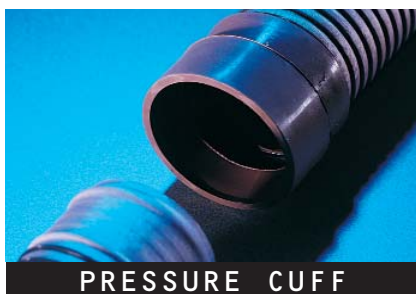
The design of aircraft and the incorporation of many modern features, means that space to install any aircraft system is at a premium. Coupled with the need to minimize weight and pressure drop, Senior Aerospace BWT are able to call on many years experience of designing ducting systems, to design and manufacture products to almost any complex geometry whilst maintaining performance integrity.

This complexity is achieved by the utilisation of a propriety ultra-lightweight, smooth bore, semi-rigid composite construction. The manufacturing process allows the product to be formed into almost any shape, thus making ultimate use of the space envelope.

With the unique ability to combine ultra-lightweight product types, Senior Aerospace BWT's innovative design team has unrivalled options when developing solutions to particular problems associated with installation and performance constraints.

As well as designing bespoke system solutions, Senior Aerospace BWT are also able to utilise a number of standard connectors manufactured from the ultra-lightweight semi-rigid composite construction. These connectors are fully compatible with the standard flexible products offered by Senior Aerospace BWT by making use of either threaded or beaded end styles. The versatility of this range means that both modular and bespoke solutions, according to system requirements, can be provided.

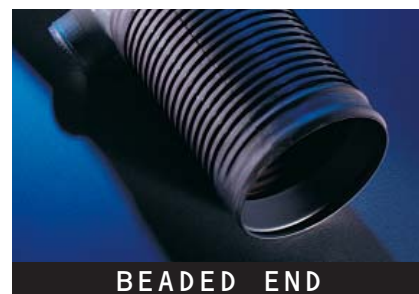
STANDARD INTERFACE CONNECTORS



PRESSURE CUFF



STANDARD CUFF



BEADED END

A push-on connector used in conjunction with a beaded end connector where access is limited and quick installation is required. Eliminates the need for clamps or sleeves which reduces the overall system weight.

An elastomeric end connection, produced as an integral part of the duct which improves installation times and reduces system weight by eliminating the need for an additional sleeve.

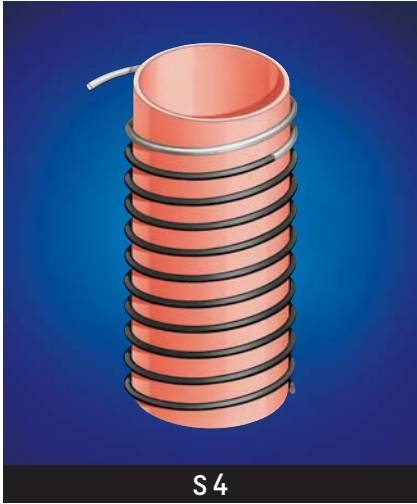
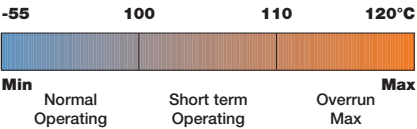
A beaded interface to AS5131 compatible with both standard or pressure cuffs. Other bead styles, such as shaped inserts, are available to suit customer applications, and can also be incorporated.



A flexible duct qualified to AS1591 for low pressure, medium temperature systems. Primary applications are cold air distribution and PSU feeds.

CHARACTERISTICS

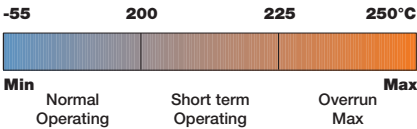
- Temperature Range -55 to 100°C (-67 to 212°F)
- Material construction: urethane/nylon membrane with nylon helix
- Materials compatible to RTCA/DO-160
- FST to ABD0031 (ATS1000.001)
- Pressure loss to SAE 1168/1 E/D = 0.002
- Ultra-lightweight 92g/m (1oz/ft) at 2.0" diameter
- Standard diameter range 0.375" to 6"
- 0.5D inner bend radius
- Standard colour: White



A flexible duct for low pressure, high temperature systems. Primary applications are warm air distribution systems. Can be lagged to reduce thermal loss.

CHARACTERISTICS

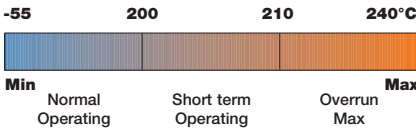
- Temperature Range -55 to 200°C (-67 to 392°F)
- Material construction: silicone/glasscloth membrane with stainless steel helix
- Materials compatible to RTCA/DO-160
- FST to ABD0031 (ATS1000.001)
- Pressure loss to SAE 1168/1 E/D = 0.002
- Ultra-lightweight 112g/m (1.2oz/ft) at 2.0" diameter
- Standard diameter range 0.5" to 6"
- 0.5D inner bend radius
- Standard colour: Red or Black

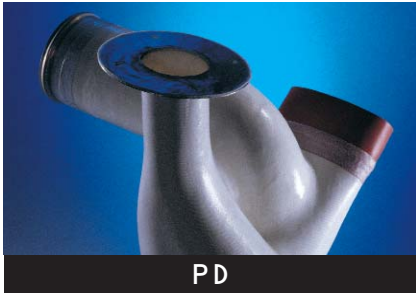


A flexible duct with excellent deformation recovery for low pressure, high temperature systems. Primary applications are warm air distribution systems. Can be lagged to reduce thermal loss.

CHARACTERISTICS

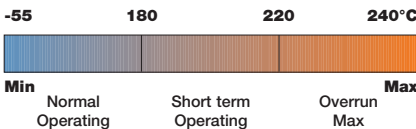
- Temperature Range -55 to 200°C (-67 to 392°F)
- Material construction: silicone/glasscloth membrane with high performance non-metallic helix
- Materials compatible to RTCA/DO-160
- FST to ABD0031 (ATS1000.001)
- Pressure loss to SAE 1168/1 E/D = 0.002
- Ultra-lightweight 92g/m (1oz/ft) at 2.0" diameter
- Standard diameter range 0.5" to 6"
- 0.5D inner bend radius
- Standard colour: Red or Black





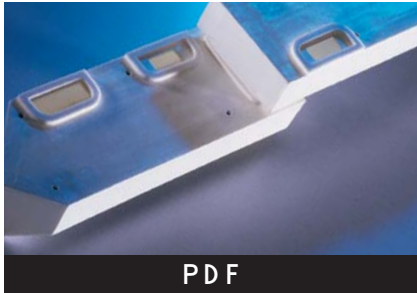
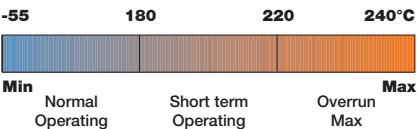
Proprietary ultra-lightweight glass reinforced composite laminate, for low pressure high temperature air distribution systems. Primary applications are for complex duct geometries where low weight and low pressure drops are essential.

- CHARACTERISTICS
- Temperature Range
-55 to 180°C (-67 to 356°F)
 - Materials compatible to RTCA/DO-160
 - FST to ABD0031 (ATS1000.001)
 - Pressure loss: Smooth bore makes PD ideal for bends and complex shapes in duct runs
 - Ultra-lightweight: Approx 0.11kg/m2 (0.023lb/ft2) per lamination
 - Wall thickness: Each lamination is approx. 0.08mm (0.003") thick
 - Durability: Excellent puncture resistance, its ability to flex without fracturing allows easy installation
 - Standard colour: Off white. Other colours are available. Compatible with many paint bases



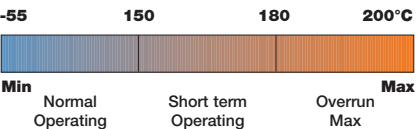
Proprietary ultra-lightweight glass reinforced composite laminate, with a continuous spiral wound stainless steel reinforcing helix, for low pressure high temperature air distribution systems. Primary applications are for circular and straight air supply ducting runs where low weight and low pressure drops are essential.

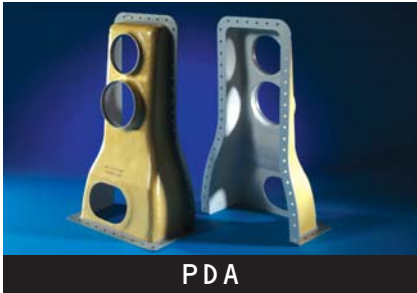
- CHARACTERISTICS
- Temperature Range
-55 to 180°C (-67 to 356°F)
 - Materials compatible to RTCA/DO-160
 - FST to ABD0031 (ATS1000.001)
 - Pressure loss: Smooth bore makes PDS ideal for long straight duct runs
 - Ultra-lightweight: Approx 0.61kg/m2 (0.13lb/ft2)
 - Wall thickness: Approx. 0.76mm (0.03") thick
 - Durability: Stainless steel reinforcement provides crush resistance
 - Standard colour: Off white. Other colours are available. Compatible with many paint bases



Proprietary ultra-lightweight glass reinforced composite sandwich, incorporating a foam core, providing self insulating properties for low pressure medium temperature air distribution systems. Primary applications are for fabricated avionics plenums where low weight is essential.

- CHARACTERISTICS
- Temperature Range
-55 to 150°C (-67 to 302°F)
 - Materials compatible to RTCA/DO-160
 - FST to ABD0031 (ATS1000.001)
 - Pressure loss: Smooth surface ensures PDF provides minimal loss solutions
 - Ultra-lightweight: Approx 0.61kg/m2 (0.13lb/ft2)
 - Wall thickness: Approx. 4.5mm (0.18") thick
 - Durability: Double wall construction ensures excellent puncture resistance
 - Standard colour: Off white. Other colours are available. Compatible with many paint bases



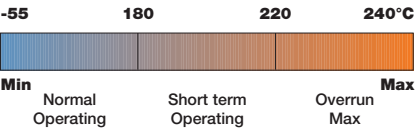


PDA

Proprietary ultra-lightweight glass and aramid reinforced composite laminate, providing high performance solutions to specific ducting requirements. Suitable for low pressure high temperature air distribution systems. Primary applications are for complex duct geometries where durability, toughness and resistance to higher pressures is essential.

CHARACTERISTICS

- Temperature Range -55 to 180°C (-67 to 356°F)
- Materials compatible to RTCA/DO-160
- FST to ABD0031 (ATS1000.001)
- Pressure loss: Smooth surface ensures PDA provides minimal loss solutions
- Ultra-lightweight: Approx 0.15kg/m2 (0.031lb/ft2) per lamination
- Wall thickness: Each lamination is approx. 0.15mm (0.006") thick
- Durability: Extremely tough and puncture resistant
- Standard colour: Yellow. Compatible with many paint bases

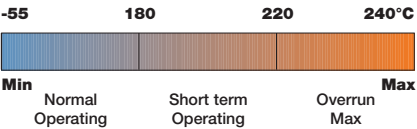


PDC

Proprietary ultra-lightweight glass and carbon reinforced composite laminate, providing high performance solutions to specific ducting requirements. Suitable for low pressure high temperature air distribution systems. Primary applications are for complex duct geometries where high strength and resistance to higher pressures is essential.

CHARACTERISTICS

- Temperature Range -55 to 180°C (-67 to 356°F)
- Materials compatible to RTCA/DO-160
- FST to ABD0031 (ATS1000.001)
- Pressure loss: Smooth surface ensures PDC provides minimal loss solutions
- Ultra-lightweight: Approx 0.16kg/m2 (0.033lb/ft2) per lamination
- Wall thickness: Each lamination is approx. 0.18mm (0.007") thick
- Durability: Extremely strong. Usually combined with other laminate materials to enhance overall performance
- Standard colour: Black. Compatible with many paint bases

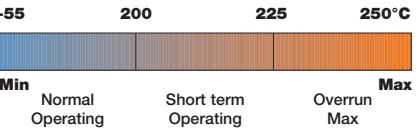


ACOUSTIC DUCTING

Noise transmission is a feature of any air distribution system. The installation of an acoustic silencer adjacent to the noise source is a proven solution to reducing noise within the system. Attenuation is achieved by encapsulating sound absorbent materials between either a rigid or flexible duct outer wall and a porous inner membrane.

CHARACTERISTICS

- Temperature Range -55 to 200°C (-67 to 392°F)
- Materials compatible to RTCA/DO-160
- FST to ABD0031 (ATS1000.001)
- Pressure loss: Designed to minimize loss whilst maintaining acoustic performance
- Lightweight 490g/m (5.3oz/ft) at 2.0" diameter
- Standard wall thickness 0.5"
- Standard diameter range 0.75" to 6"



Senior Aerospace BWT's insulation provides optimum thermal and acoustical performance where space and weight are regarded as critical design parameters.

THERMAL INSULATION

Senior Aerospace BWT's thermal insulation ensures a consistent air temperature flow is maintained throughout the ducting system, thus maximising efficiency. The insulation can be supplied as an integral part of the duct or as an add-on sleeve.

Various material densities and thicknesses are available enabling the engineer to balance performance, weight and cost according to system requirements.

FUSELAGE, ACOUSTIC AND THERMAL INSULATION PANELS

Fuselage insulation systems combine the benefits of both thermal and acoustic insulation.

Senior Aerospace BWT's insulation panels are tailored to accommodate the fuselage airframe sections. This ensures an excellent fit, thus eliminating any heat loss or noise transmitting voids.

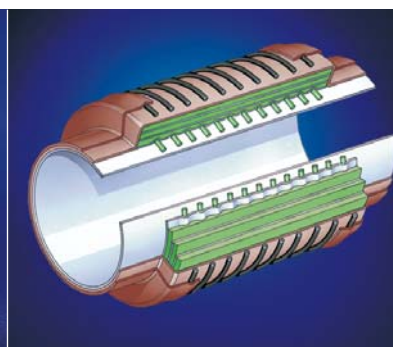
Senior Aerospace BWT's ultra-lightweight ducting can be incorporated into the insulation panel providing continuous air from the main feed duct into the cabin environment. This maximises the use of the space envelope between the fuselage skin and interior side wall panel.



Fuselage insulation



Roll-back duct insulation



Acoustic silencer detail



Thermal insulation



In recognition of its environmental responsibilities Senior Aerospace BWT searched for an innovative solution to meet the legislative requirements for solvent emissions abatement. Not satisfied with conventional methods that add to the growing problem of CO₂ in the atmosphere and global warming, Senior Aerospace BWT researched, piloted and eventually commissioned Europe's first bioreactor for biomass abatement of solvent emissions. The process is inert, significantly reduces process emissions and produces no harmful secondary waste to be cleaned or disposed of.

Senior Aerospace BWT's commitment to continuous improvement is further reflected in its drive to achieve lean and efficient manufacturing processes that drive down the cost of manufacture to provide a competitive advantage to its customers. Ongoing capital investment in equipment and facilities complements the long term development of new materials and processes required to meet the ever changing demands of the aerospace market.



