Bird Bellows

FOR THE AEROSPACE INDUSTRY PRESSURE DUCT SYSTEMS & FLEXIBLE JOINTS
FOR THE AEROSPACE INDUSTRY PRESSURE DUCT

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Aerospace

CONTENTS

GLOBAL AEROSPACE ENGINEERING

Senior is an international manufacturing group with over 6000 employees and operations in 12 countries. Structured in two divisions; Senior Flexonics and Senior Aerospace (Structures and Fluid Systems) Senior designs, manufactures and markets high technology components and systems for the principal original equipment producers in the worldwide aerospace, diesel engine, exhaust system and energy markets.

Senior Aerospace Bird Bellows is a world leader in the design and manufacture of metal bellows, bellows assemblies and aerospace products. As one of the most respected names in the industry, Bird Bellows is uniquely positioned to meet the demands of our customers for precision engineered and manufactured products.

Our development and product testing facilities are among the best available. Sophisticated analysis and design practices include:

- Finite-element analysis (Ansys)
- Stress analysis
- Motion and load analysis
- Flow and pressure drop analysis
- Modal testing
- Insulation and heat transfer analysis
- Fatigue analysis
- CAD/CAM
- CATIA Version 5
- 3-D modelling
- EDI capability
- Inventor

Bird Bellows technical staff utilise the most contemporary computer aided design programmes in the industry. We work with systems compatible with those of our customers to ensure efficient and accurate exchange of information between our facilities and off-site locations.
We believe that technological information is one of the most critical measures of excellence.

RESOURCES

- Specialisation in pressurised duct systems and flexible duct joints
- Design facility including systems engineering and stress analysis
- Comprehensive manufacturing and non-destructive testing processes
- Fully certified QA systems to EASA Part 21 and AS9100 Rev.C
- Extensive product development facilities for future growth
- Full materials capability
- The total resources of Senior Aerospace in Europe, North America and SE Asia

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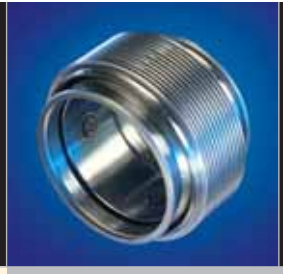

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DEDICATED SERVICES AND FACILITIES

Senior Aerospace Bird Bellows specialises in the design of bellows, bellows assemblies, gimbal bellows, flexible joints and aerospace bleed air ducting systems. Drawing on years of design experience, the latest in computer-aided design programmes, and finite-element analysis, our engineering team has the flexibility and speed required to respond to the needs of our customers.

DESIGN

Bird Bellows utilises AutoCAD 2000/3D Modelling, FEA Ansys and CATIA Version 5, allowing 2D and 3D realisation of products, and the preparation of detailed drawings and technical specifications. These design tools give us the ability to work in the computer environment best suited to our customers and to directly exchange electronic data with customers and suppliers worldwide. A key element in the design process is our ability to develop innovative and cost effective solutions to customer challenges.

Design propositions will satisfy all international codes of practice.

ENVIRONMENTAL TESTING

Environmental testing is carried out to ensure that components will perform satisfactorily in service, the degree of testing being determined by the class of equipment and the performance testing required.

A typical test regime for duct equipment and bellows-sealed components may include:

- Cyclic fatigue testing at cryogenic, ambient or elevated temperature
- Pressure pulse testing at ambient or elevated temperature
- Operational shock and vibration testing
- Susceptibility to fluids including salt spray
- Fire testing
- Ultimate proof pressure test

TYPICAL PRODUCT APPLICATIONS

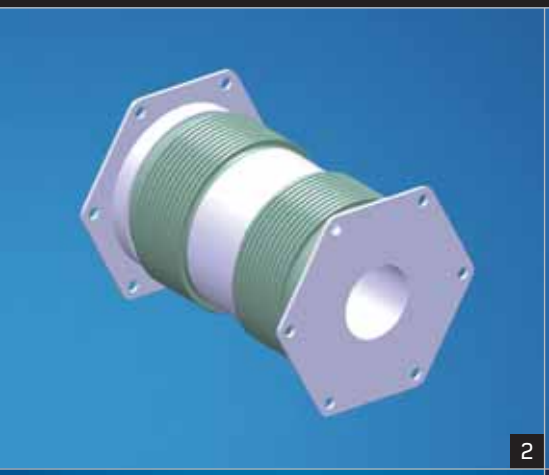
- Environmental control systems (ECS)
- APU ducting and components
- Anti-ice ducting
- Cabin air system ducting
- Silencer assemblies
- Engine bleed air ducting
- Engine drain systems
- Flexible joints and couplings
- Air start ducting systems
- Ground start ducting systems

INSULATION

Insulation is a key component in the design of a ducting system and a significant factor in weight calculations. The duct insulation may be either detachable or permanently fixed, and metal cladding can be supplied in stainless steel, titanium or aluminium.

PRODUCTION

Bird Bellows has a reputation for high quality craftsmanship, which is maintained through continuous training and development in a lean manufacturing environment. The Company has responded to the challenges of weight reduction by adopting the use of high strength titanium alloys, such as 6Al4V, for critical components. Hot forming and hybrid SPF of these alloys is an established production process. Quality assurance and control is integral to the manufacturing process, which is also subject to continuous improvement from the implementation of best practice techniques.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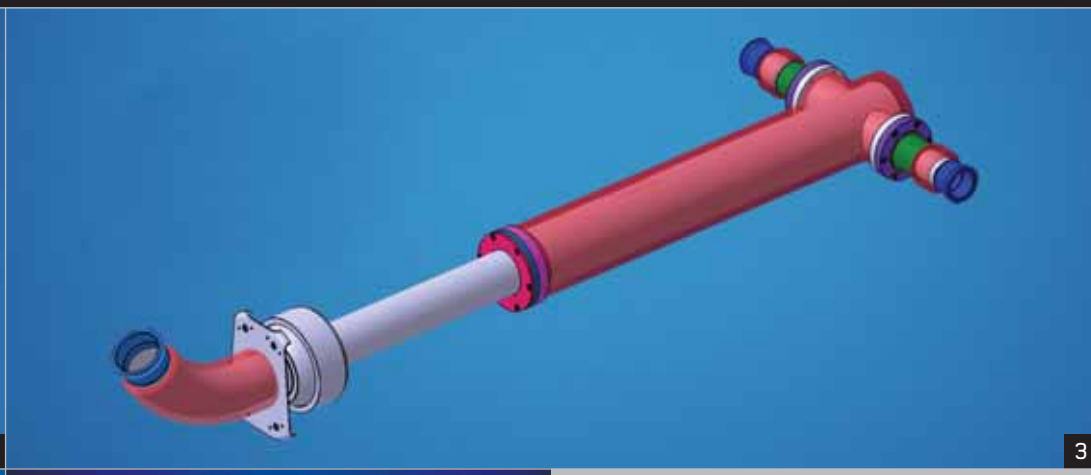
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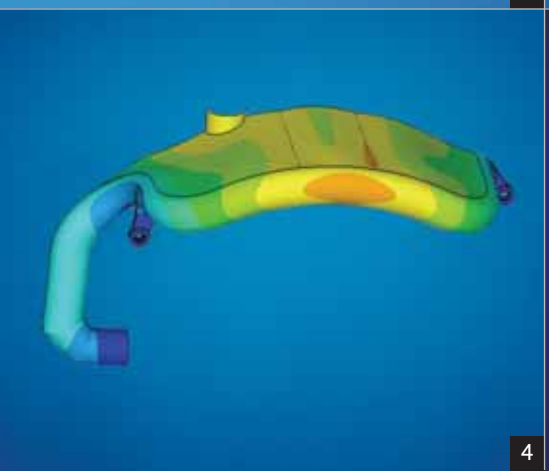
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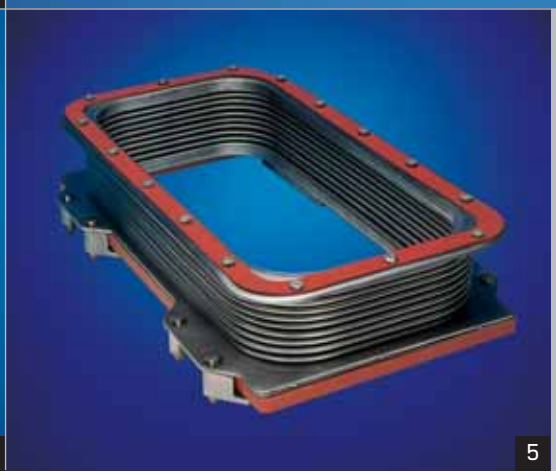
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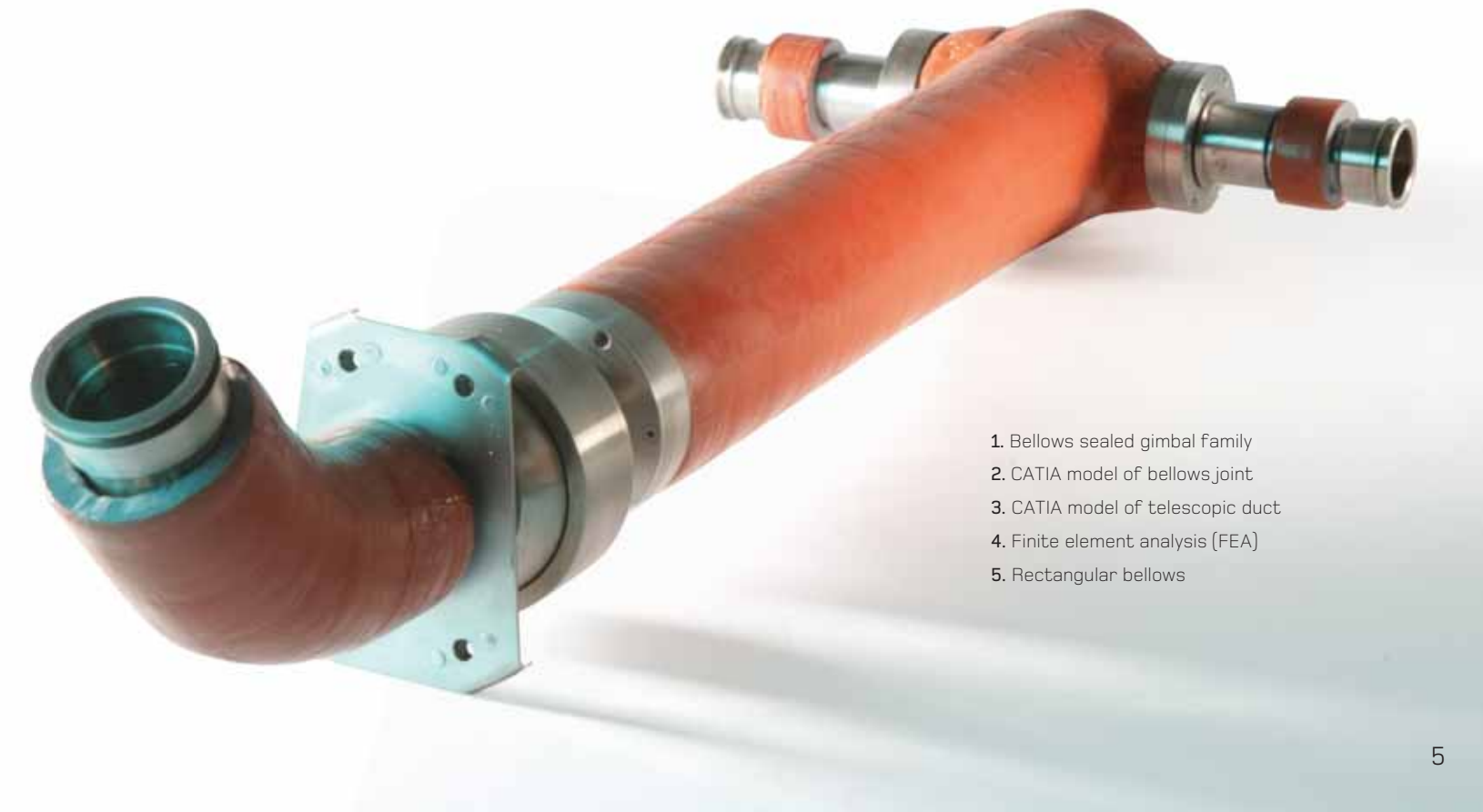


1. Bellows sealed gimbal family
2. CATIA model of bellows joint
3. CATIA model of telescopic duct
4. Finite element analysis (FEA)
5. Rectangular bellows

Bellows –
sealed gimbal joint

Anti-ice duct

FLEXIBLE SOLUTIONS FOR PRESSURE DUCTING JOINT APPLICATIONS

An aircraft pneumatic duct system is required to accommodate loads and movements arising from internal pressure, temperature extremes, and airframe movement. To avoid fatigue failure of the ducting, flexible joints are incorporated to absorb expansion and angular movements. Flexible solutions are needed in the pneumatic system ducting from tail to wingtips, applications for which Senior Aerospace Bird Bellows have provided solutions.

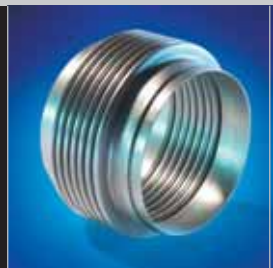
Bellows – sealed ball joint

Vibreaker

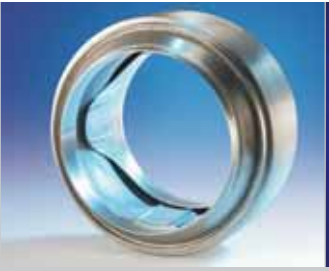
Vibreaker

senior Aerospace

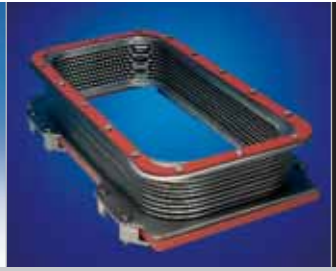
Plain bellows



Flexible ECS duct



Bellows – sealed gimbal



APU air intake duct

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Telescopic duct

Tolerance take-up unit

Tolerance take-up unit

Piccolo tube

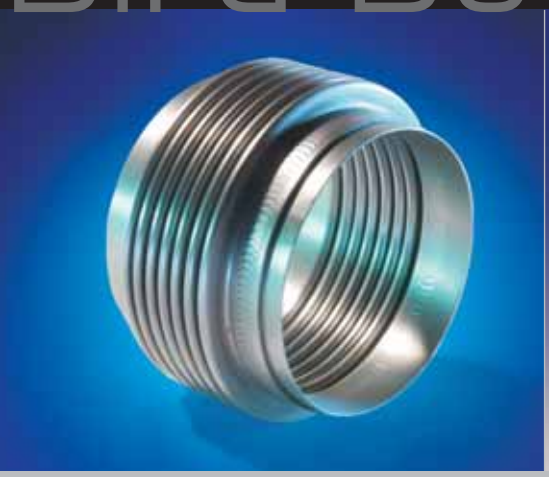
Bellows – sealed gimbal

Bellows – sealed gimbal

Wing ducts

Braided bellows

Bird Bellows



PLAIN BELLOWS

Bellows are used primarily to absorb axial movements and can also be used for angular or lateral offset, or misalignment. Unsupported bellows have many applications including aircraft fuel systems and APU air intake and exhaust applications.

BRAIDED BELLOWS

Braided bellows are designed to accommodate lateral and angular movement with absorption of pressure end loads, offering a cost effective solution for moderate deflections in low-pressure systems. Titanium bellows can be supplied with stainless steel braid to minimise cost.

NON-BELLOWS VIBREAKER JOINTS

To complement the range of bellows based components, Bird Bellows are manufacturers of Vibreaker parts for major aircraft build programmes.

The Vibreaker uses a non-metallic seal moving in compression on a polished surface to achieve a fluid tight assembly. Produced in both stainless steel and titanium, vibreakers allow rotation in addition to angular and lateral movement.

A COMPREHENSIVE PRODUCT SOLUTION

EXTERNALLY PRESSURISED BELLOWS

In this type of joint, the duct pressure is transferred to the outer surface of the bellows, the pressure being held by the outer casing. This type of unit has applications where lateral movement must be accommodated in a rigid duct.

PRESSURE BALANCED BELLOWS

Pressure balanced bellows are designed to absorb axial and lateral deflection without transmitting pressure loads to adjacent ducts. The ability to eliminate end load due to pressure is particularly valuable where space is limited and where ducts cannot be adequately restrained. Alternative configurations are available.

BELLOWS SEALED BALL JOINTS

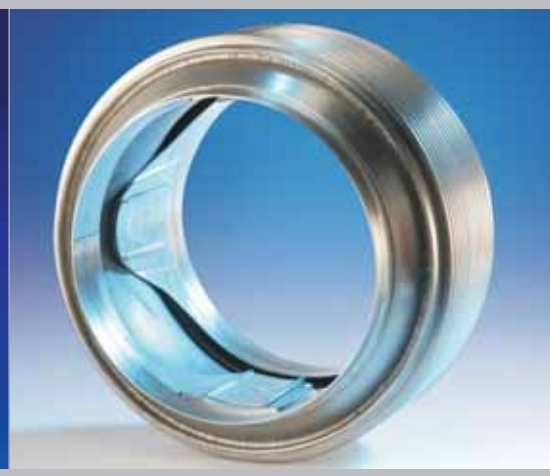
Ball joints can be used in lower pressure systems to save weight; the ball joint allows angulation through 360 deg. and withstands duct end loading.

RECTANGULAR BELLOWS

Rectangular bellows accommodate relative movements on low-pressure systems and provide a long-life and fire safe alternative to non-metallic APU air intakes. Other configurations can be designed for specific applications.

DUCTING SYSTEMS

Bird Bellows manufacture complete ducting systems for ECS, bleed air, air start, anti-icing and fuel transfer applications in civil and military aircraft. Duct systems are produced in titanium, stainless steel and nickel alloys and supplied as components or aircraft kits ready for assembly into the aircraft. Specific experience of engine test ducting is offered to power plant manufacturers.



GIMBAL BELLOWS

Gimbal bellows act as universal joints in the duct and offer angulation through 360 deg. Together with absorption of duct end loads. The Senior Aerospace Bird Bellows gimbal joint has been developed for minimum weight whilst retaining the advantage of full bellows-sealed construction, and is supplied with vee flanges or weld ends.

A WORLDWIDE REPUTATION FOR QUALITY

Quality Assurance is fundamental to the ethos of Senior Aerospace Bird Bellows. Proven systems have been in place since the inception of the Company.

Great emphasis is placed upon understanding the customer requirements and application. Our quality assurance systems are approved to AS9100 and EASA Part 21 Section A, Subpart G.

Good systems and procedures are important but the quality of personnel is vital. Senior Aerospace Bird Bellows enjoys the services of committed and highly motivated people in all areas. In particular the Quality Inspection Team is dedicated to the monitoring of all processes and to ensuring that only fully acceptable product is despatched to customers.

With our own radiography, dye penetrant and pressure test facilities, together with mass spectrometer leak detection and three-axis measuring resource, we are well equipped to perform all required tests and checks.

MAJOR QUALITY APPROVALS

AS9100

BS EN ISO 9001: 2000

ISO14001

EASA Part 21 Section A, Subpart G

Performance Review Institute AS7110 (Nadcap) for Welding

Performance Review Institute AS7114 (Nadcap) for Non-destructive testing

Additionally, Senior Aerospace Bird Bellows is approved by many customer organisations including the following: Rolls-Royce; BAE Systems; Airbus UK; Airbus France; Airbus Deutschland; PFW; Agusta Westland; Honeywell; ITP; ITD; EADS Military; Aircraft Services Lemwerder; Israel Aerospace Industries; Embraer; UAV Engines.

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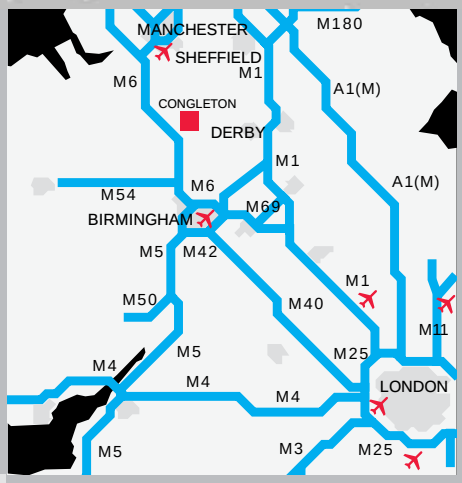
WEIGHT
360KG UNLOADED
1020 KG
FULLYLOADED
44 PLATES

SENIOR AEROSPACE GLOBAL OPERATIONS

WHERE TO FIND US

From M6 J18, A54 to Congleton, Radnor Park Estate is signposted on the left, via Back Lane.
From M6 J17, A534 to Congleton, Radnor Park is signposted on the left via Box Lane, turn right onto A54 and then left to Radnor Park Estate via Back Lane.



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