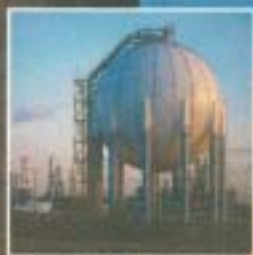
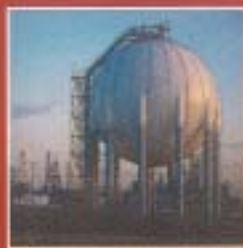
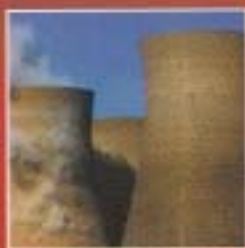


JOHN CARDWELL LTD

FLEXION[®]
DIVISION



making the right **connections**



m a k i n g t h e

A true single source capability for all your expansion joint requirements

Our strength is provision of optimum design led solutions, from first principles, which ensure compatibility with adjacent pipework components. Our applications and design experience is supported by in-house manufacturing of hydraulically and mechanically formed metallic bellows - available in a wide range of stainless steel and nickel alloy materials. Contact us at an early stage of system design to benefit from a problem solving approach, backed by a commitment to soundly engineered and cost-effective solutions.

Full support to specifiers, installers and end users

Our package of support puts us at the forefront of the industry - rapid quotations and manufacture ensure unrivalled lead times. **JOHN CARDWELL LTD** reliable completion of projects is enhanced by its 'fast-track' methods of design and manufacture. Our systems work in conjunction with your project planning to avoid often costly disruption to scheduling.

Product and service quality

ISO 9001 accreditation gives you the security of properly documented projects. Supporting documentation including materials and test certification is provided, with the facility for your own or third party surveillance if required. **JOHN CARDWELL LTD** works to EJMA and BS 6129 Part 1 together with associated vessel and piping codes such as ASME B 31.3 and VIII, and BS 5500 as applicable to our product. Welding is carried out by trained and qualified staff, coded and working in accordance with approved weld procedures and qualifications to ASME IX and EN 287/288. Design calculations covering both pressure containing and structural components can be provided.

Serving a wide range of industrial sectors

Main industry partners we work with include:

- Sensitive equipment - steam turbines, compressors, pumps, process vessels
- Chemical and process plant
- Petrochemical
- Offshore
- Power generation and distribution
- Marine
- Diesel exhaust
- Building service and fire protection

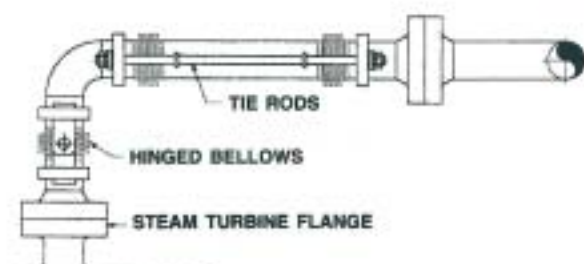
RECENT CASE STUDIES

These demonstrate our capabilities in expansion joint applications engineering, design and manufacture. All projects listed involved extensive input from **JOHN CARDWELL LTD** prior to order placement to arrive at a practical and cost effective solution.

'Nerve of Steel'

The client required a special 150mm restrained compensator to replace an existing arrangement in a power plant on a large steelworks. The compensator is fitted to a steam turbine which drives a critical feedwater pump. The unit is designed to relieve the turbine nozzle of pipework loads caused by pipework thermal expansion and deflection at the turbine nozzle.

3-PIN BELLOWS SYSTEM AT STEAM TURBINE



Design duty is 45 Bar.G/450°C and the unit was designed to fit into the space left by removal of the old system without pipework modifications. Nickel alloy bellows elements were specified by **JOHN CARDWELL LTD** as security against possibility of inter-granular and stress corrosion. The assembly was supplied as a complete 3-pin restrained system with flanged connections arranged to match existing.

Manufacture was scheduled during overhaul of the turbine and commitment to the delivery date was fully met. All design work was carried out in association with the consulting engineer and a fully documented QA package was provided in support of design and manufacture.



'Taking the Heat'

A number of 250mm special universal bellows expansion joints handling charge air at the tuyere on a smelting furnace at a pressure of 1.0 Bar and a temperature of 1025°C. The units were required to compensate for significant axial and lateral movements occurring simultaneously.

EXPANSION JOINT FOR HIGH TEMPERATURE



A special construction was necessary to suit operating conditions and involved bellows made from Inconel 625 with special low cyclic fatigue metallurgy and type 310 stainless steel flanges. To reduce the temperature at the bellows, an insulating barrier of ceramic fibre is introduced between the bellows and flow liners. We worked closely with our client in the specification of the units and recommended the material used for the bellows construction to give maximum security of design and enhanced service life.

'Striking a Balance'

To relieve a compressor of loads imposed by nozzle deflections and pipework growth under operating conditions, a universal pressure-balanced compensator was specified by our client. The 900mm unit shown has flanges which match the compressor and pipework connections. It is capable of accepting complex travel in axial and multi-plane lateral modes while keeping forces and movements at the compressor discharge within acceptable parameters.

Design duty is 100 PSI at 150°C and the unit was supplied as part of a package including articulated units for high pressure steam service, to a steel works in India.



'Going Dutch'

This project required purpose designed compensators to cater for thermal movement and to bring loading at machinery connections within acceptable limits on a compressor installation in the Netherlands.

JOHN CARDWELL LTD designed and manufactured special fully articulated compensators. The system is designed to operate at 145 PSI and 100°C.

A feature of the 300mm units shown is the special design of the restraining devices (tie rods) which overspan the entire length of the leg containing the bellows. Any thermal growth within the leg can therefore be absorbed as axial compression of the bellows which also angulate individually to accommodate the multi-plane shear produced by pipework growth.



The 'U' shaped unit compensates for differences in expansion between two parallel pipe runs which, depending on valve reactions to demand for air from the plant, can have significant temperature variations. Pressure thrust forces from the bellows are eliminated by the restrained, articulated design and the highly flexible nature of the bellows arrangement results in very low loadings at system terminal points. All units supplied were 'bespoke' with lengths arranged to suit the client's piping arrangement to give the least possible number of connections in the system, and so minimise installation costs.

'Stress Management'

A complex problem was identified by our client, a major chemical producer, when pipework connecting two process vessels was at the design stage. Although the vessels are in close proximity and the temperatures were moderate, the vessels expand at different rates due to temperature variations and mounting arrangements.

The vessels are mounted on load cells and so for correct operation of the process imposed pipework, loads needed to be minimal. In addition, the process demanded external heating of the process medium by means of a steam jacket. We designed and built a double gimbal compensator and a single hinged unit to take up pipework expansion and vessel growth via a 3-pin system.

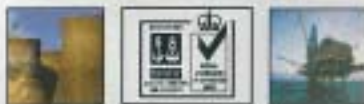
The units are 100mm nominal size at the process line with a 150mm jacket. Care was necessary to ensure that sufficient clearance was provided between the line and jacket bellows so that an adequate flow of steam through the jacket is maintained. The units were built using Incoloy 825 for the bellows to avoid problems emanating from possible chloride presence. All other parts in contact with the process medium were manufactured in 316L stainless steel. Restraining devices utilised structural quality carbon steels.

The units were inspected by our client in our works prior to despatch. Inspection included pressure testing of line and jacket sides of units with review of material certification and traceability.

For further information or a quotation
please contact our sales department

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NOTE: We reserve the right to alter this specification without prior notice