



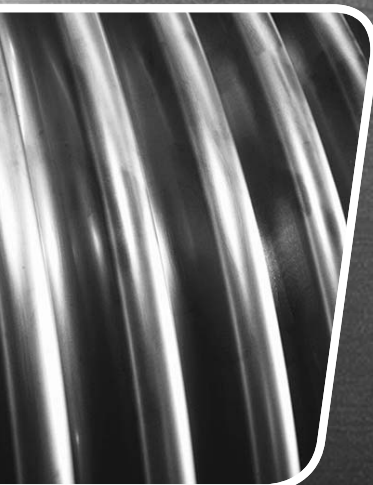
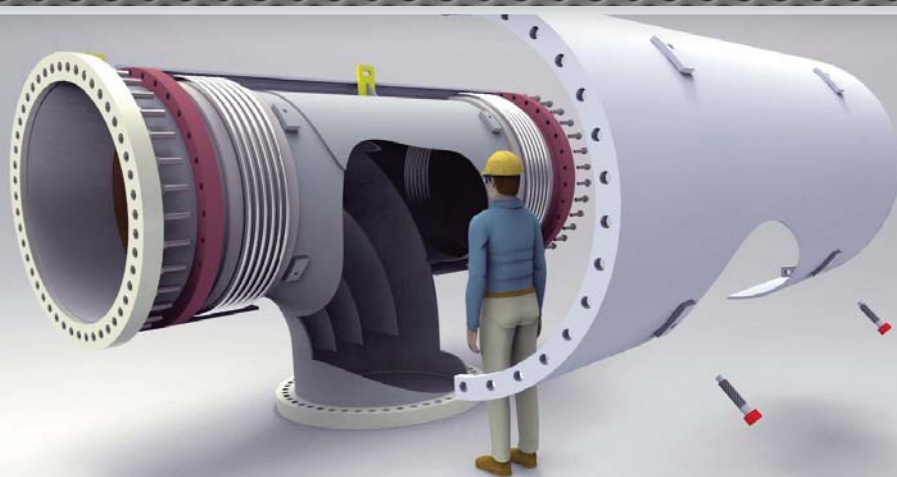
**THERMAL
PRODUCTS** INC.
Engineered Solutions To
Industrial Applications

Flexider[®]

INDUSTRIAL

STEAM TURBINE

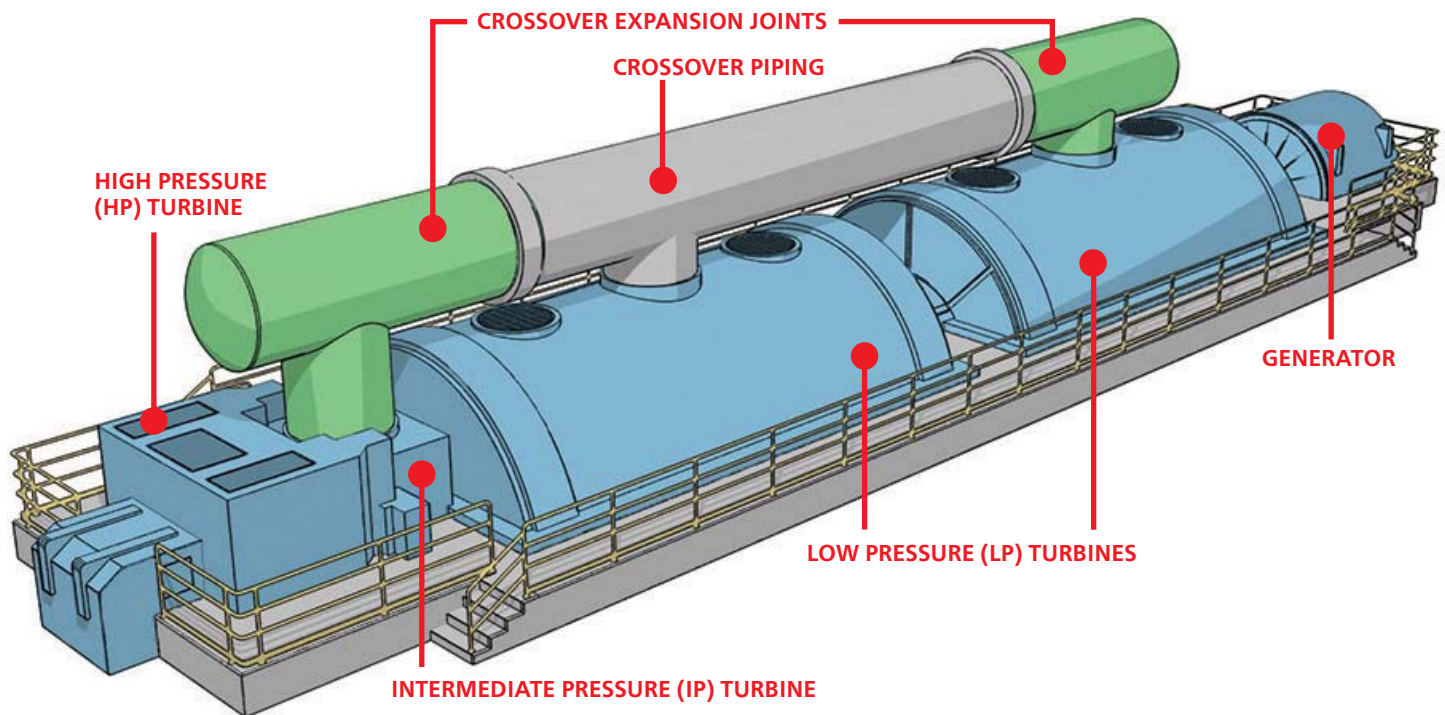
CROSSOVER EXPANSION JOINTS



Introduction

Steam Turbines in coal-fired plants, and in combined cycle plants, use crossover piping to transfer high-pressure, high temperature steam from the IP Turbine to LP Turbine(s).

Expansion joints are located within most crossover systems to absorb the thermal growth of the piping.



Variations of Crossover Piping & Expansion Joints

Although pressure balanced crossover expansion joints are the most common type of expansion joint used throughout the industry, the design of pressure balanced expansion joints vary greatly between various turbines and turbine manufacturers.



Single pressure balanced expansion joint

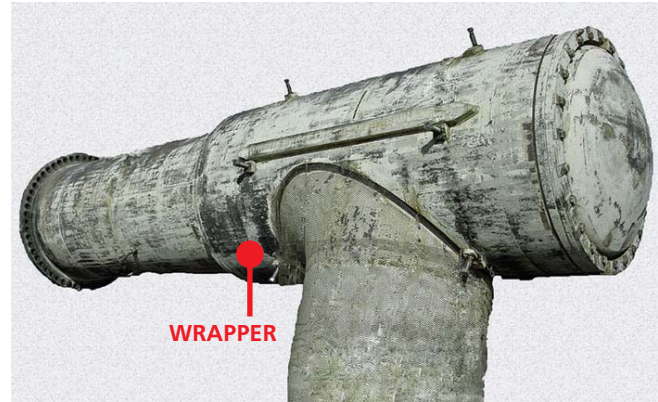
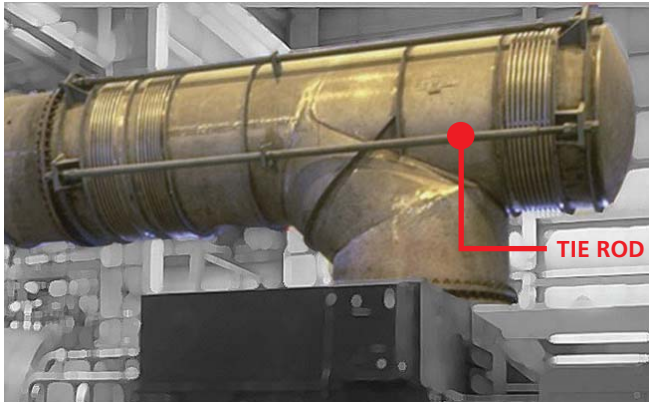


Multiple pressure balanced expansion joints



Hinge and gimbal expansion joints

Some pressure balanced expansion joints may contain external wrappers around the bellows while other pressure balanced crossover expansion joints may contain tie rods.

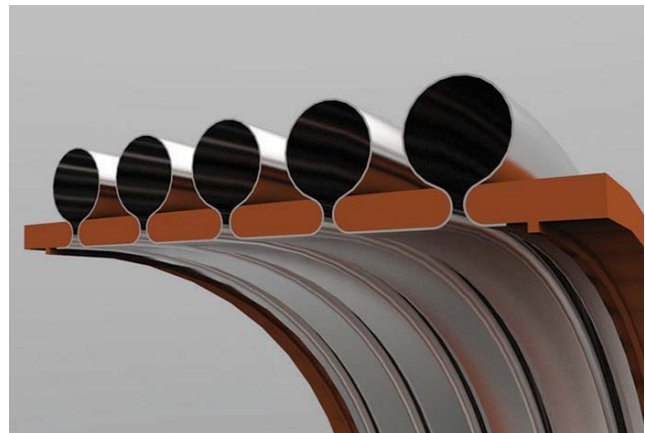


In addition to the variation in the type and design of crossover expansion joints, the type and design of the bellows element(s) in the crossover expansion joint(s) vary between turbines and turbine manufacturers.

The bellows in crossover expansion joints may vary from a single ply or multi-ply, from un-reinforced or reinforced with root rings, or from U-shaped to toroidal shaped convolutions.



U-shaped convolutions with round bar root rings

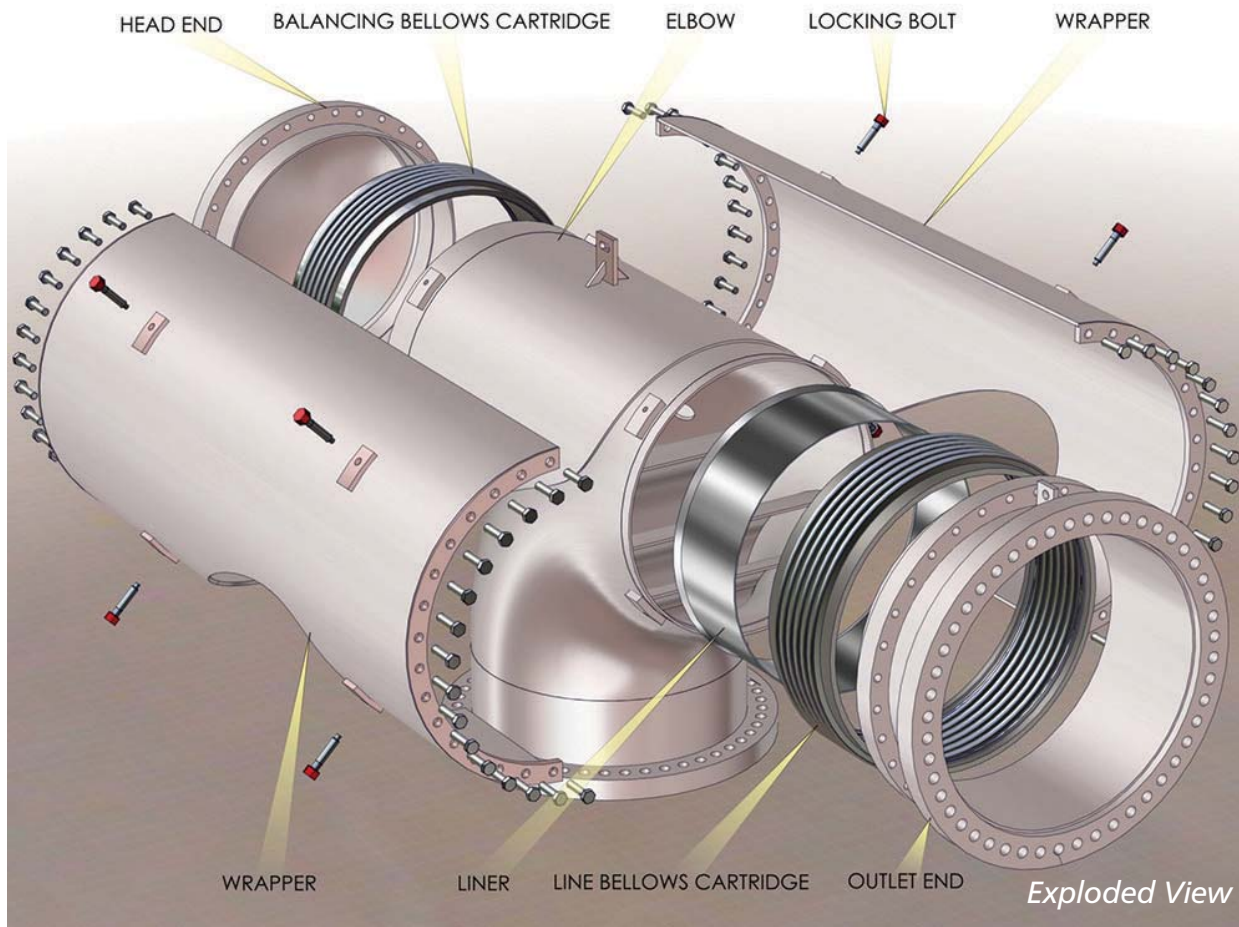


Toroidal shaped convolutions

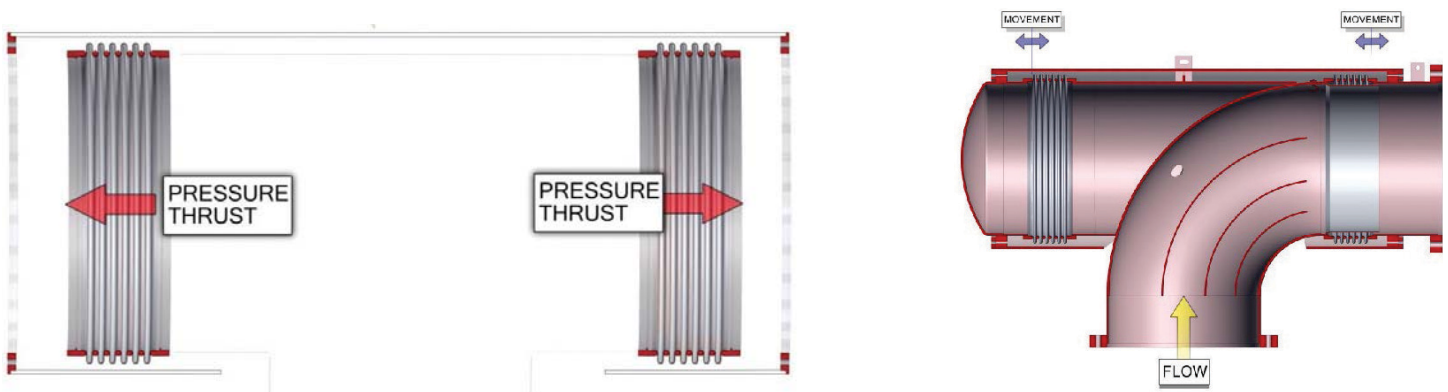
Commitment to Quality



Operation



The steam exiting the Intermediate Pressure Turbine will typically be 700°F and varies from 75PSIG to 200PSIG. The pipe size can be anywhere from 36" to 84" in diameter. The resulting pressure thrust of the main pipe line bellows develops hundreds of tons force. In order to avoid transferring this load to the turbine nozzles, the expansion joint has a second identical bellows that creates an equal and opposite thrust load. These loads are tied together using an external device such as tie rods or "Wrapper".



Preventive Maintenance

Avoid an unscheduled forced outage due to a crossover expansion joint bellows failure. There are no Non-Destructive Examination (NDE) methods that can be used to predict the remaining service life of a thin-wall bellows element in a steam turbine crossover expansion joint. To eliminate the possibility of a premature bellows failure, resulting in an unscheduled forced outage, it is recommended that the bellows elements in a steam turbine crossover assembly be replaced after 20 years of service.

If an existing crossover bellows has been in service for more than 20 years and is not scheduled for replacement, it is recommended that a spare bellows be fabricated and placed in storage. By having a spare replacement bellows in storage, the duration of an unscheduled forced outage caused by the failure of a crossover bellows can be minimized by eliminating the time required to fabricate the replacement bellows. Flexider can reverse engineer and fabricate replacement crossover bellows to match specific requirements for each specific turbine.



Typical replacement bellows cartridge

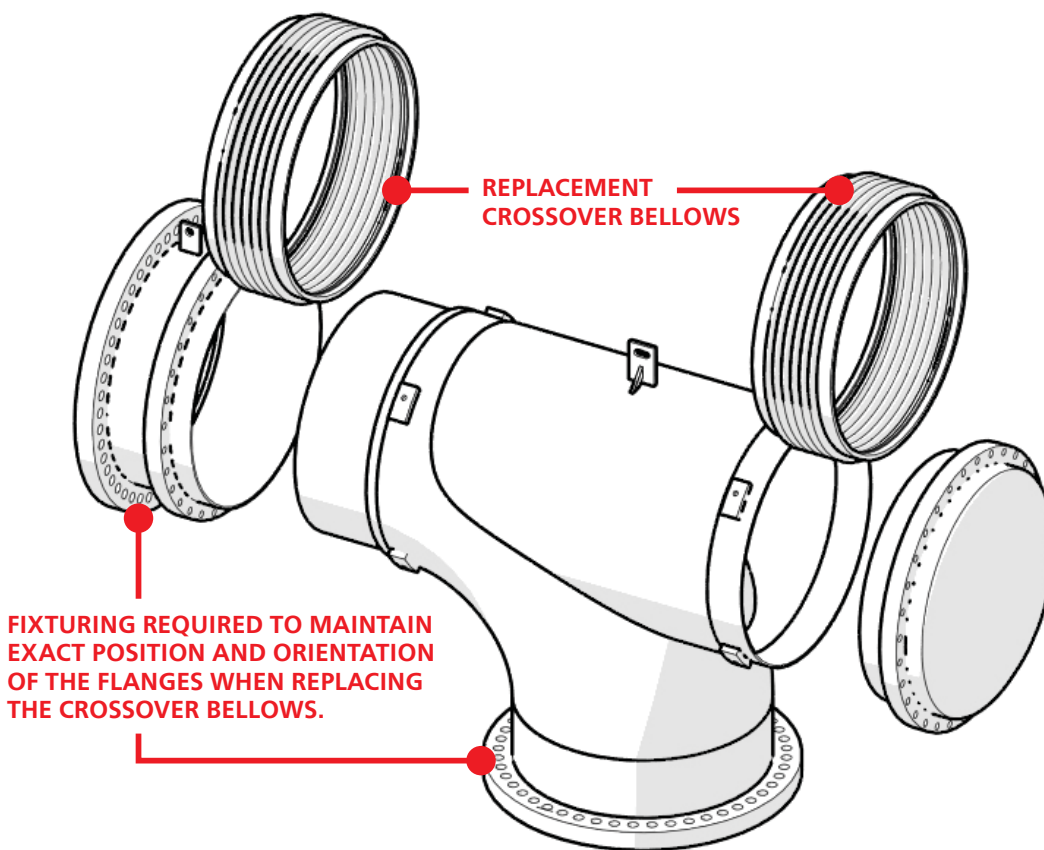
The reversed engineered replacement bellows should have the same movement capability, bellows spring rates (stiffness), cycle life, natural frequency, materials of construction, and heat treatment as the existing bellows.

Replacing the Bellows

In addition to fabricating the replacement crossover bellows, Flexider can also replace the bellows in an existing crossover expansion joint assembly.

When replacing the bellows in an existing crossover assembly, it is critical that the exact position of both ends of the expansion joint be maintained to ensure the crossover expansion joint can be re-bolted to the turbine or the adjacent crossover piping.

Flexider has experienced personnel and the required fixturing to replace the bellows while maintaining the exact position of the inlet and outlet ends of the crossover assembly.



Flexider can also provide fabric, rubber, and metal expansion joints for a variety of applications and industries. We have the expertise for all of your expansion joint needs.

For more information regarding crossover bellows replacement hardware and services, call us and a friendly customer service representative will be happy to assist you.



About IMCI

Industrial Manufacturing Company (IMC) and Industrial Manufacturing Company International (IMCI) are a proud family of companies that produce a wide variety of innovative products for industry. With more than 3,500 employees and 33 worldwide manufacturing, sales and distribution facilities, it produces aircraft and aerospace ducting systems, gears, lubrication systems, steel and plastic lockers, storage systems, steel mezzanines, high-performance strainers, car and truck components, industrial hoses and industrial expansion joints.

Although each IMC and IMCI company operates independently, common to all of them is a profound respect for the integrity of established industrial principles and a practical openness to applications of new technology.

With individual histories spanning decades – and in two cases more than a century – the IMC and IMCI companies are time-tested leaders in their national and global markets.

Each IMC and IMCI subsidiary strives to tailor its products and services to the wishes of its customers, and each company's success has been built on the development of enduring customer relationships. They take pride in providing not only products of consistently high quality, but also in flexible and responsive service and in realistically competitive prices.

IMC and IMCI will continue to expand their present holdings through investment in new manufacturing facilities and state of the art machinery and equipment. They will also grow through carefully selected acquisitions while maintaining an exceptionally sound financial base.



Flexider USA
115 Franklin Road
Oak Ridge, TN 37830

(+1) 888-979-FLEX TOLL-FREE
(+1) 619-618-2445 TEL
(+1) 619-573-4412 FAX

sales@flexiderusa.com | www.FlexiderUSA.com