The Bellows Bottom Line

APRIL 2008

Practical advice on expansion joints

by Greg Perkins

This month - The Hidden World of Steam Extraction Piping

What you can't see… can cost you

You want me to go where?

You drew the short straw and have to climb down into the bowels of the low pressure turbine to inspect the steam extraction piping expansion joints. Not a bad gig – if your hobby is spelunking. There is only one problem; you can't inspect what you can't see.

The bellows are protected by a steel cover. That cover, along with the end rings, is securely welded down to the piping. It is not removable.

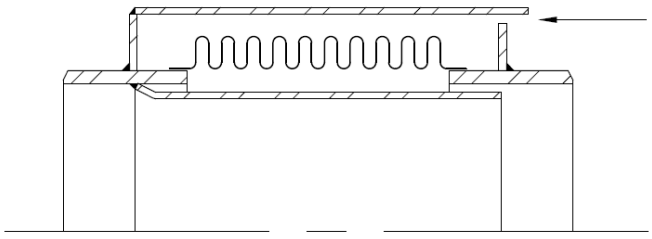
A few facts to ponder while in the dark

The fixed covers are there for a purpose – to protect the bellows from the high velocity of the spent turbine steam. And to ensure they stay put, they are welded on solidly. This protection comes with a trade-off; the bellows can't be easily inspected visually.

It is a sure bet that if the expansion joints are older than 20 years, many of the bellows will have leaking cracks. Those leaks are affecting the turbine's efficiency.

Limited inspection methods

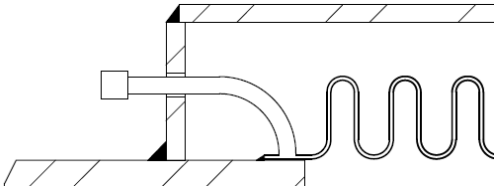
The figure below shows a typical cover arrangement. You should be able to get a borescope through the gap on one side. The scope will give you some idea of the condition of the bellows, but there will still be some difficulty in getting a good peek down between the convolutions.



Look for signs of cover damage. Often the original designs had lighter covers (and liners) that would not hold up under the high flow velocities. Those fragments are lodged somewhere down in the condenser.

Replacement and upgrade options

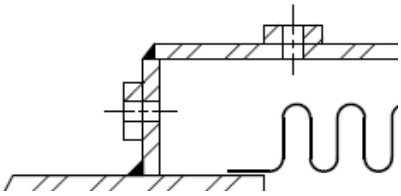
A 2-ply testable bellows (see issue #12, Aug. 2005) provides a test port between the plies which allows maintenance to check for pressure integrity during outage inspections.



Also consider upgrading from stainless steel bellows to alloy 625 for better protection against chloride stress corrosion.

You may conclude that a 20+ year service for the expansion joints is a good run. If you decide to go back with the original design, at least throw in a few inspection port couplings to improve the view of the bellows with a borescope.

In addition make sure the covers and liners are at least ¼" thick with continuous fillet welds of the same size.



The bottom line

What you can't see can cost you – go see what's lurking down there. Replacing the old expansion joints with upgrades will open up an otherwise hidden world.

Happy spelunking.

Next Month - resurrecting metal duct joints in a lagging world

The Bellows Bottom Line is a publication of Oakridge Bellows
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