



Thermally expandable top plate for tray enclosure in deaerator tanks

The purpose of the top plate of tray enclosures in deaerator tanks is to separate the environments, one of high oxygen content and the other one of low (or no) oxygen content. Currently, top plates experience thermal stresses due to a one-piece plate design that is completely welded around the top of a solid tray enclosure box. This leads to expansion/contraction growth of a restrained plate, accumulating thermal stresses and cracks. These localize thermal stresses lead quickly to weld cracks and leakage of high oxygen steam into the deaerated steam.

Additionally, a critical complication of performing repairs inside a volume limited vessel without opening it is to have a plate that is geometrically bigger than the access area provided. If the plate is sectioned in four pieces then it will have to be put together inside the vessel by using conventional joining methods. If the plate is welded in place along the cut common edges, thermal stresses localize along the welds once the deaerator tank is under typical operational high temperatures.

One way to solve this installation and repair problem is by using a segmented plate that minimizes the utilization of welding and expands under high temperature without localizing thermal stresses along the common welded edges to the tray enclosure. In addition, this plate needs to keep high oxygen steam separated from deaerated (low oxygen) steam.

Víctor O. Méndez and Ken Morse of the University of Colorado have developed a thermally expandable top plate for the tray enclosure of a deaerator tank vessel. Under typical high temperatures in the deaerator tank, this top plate expands proportionally in four different sections around the perimeter of the vessel, increasing sealant tightness against it. It also expands along the special assembly seams that self lock tighter with temperature increase. Initially, this plate was designed as a replacement part for the top cover of the tray enclosure which separates non-deaerated from deaerated steam. The original top plate experienced thermal stresses due to its one piece plate completely welded assembly. This led to cracks which allowed mixing of deaerated and non-deaerated steam, increasing the presence of oxygen in the feedwater and causing rapid localized corrosion in boiler tubes. This improved design restores the original deaeration efficiency by preventing steam leakage, as well as preventing plate warping, localized thermal stresses and future cracks.

Advantages:

- ⇒ Prevents damage from thermal stresses
- ⇒ Easily installed through an 18" (46 cm) manhole
- ⇒ Reduces installation time and cost
- ⇒ Reduces downtime of deaerator tank
- ⇒ Increases tank's efficiency 83%
- ⇒ No pressure vessel recertification
- ⇒ Eliminates asbestos abatement

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