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Heat Exchanger Services and Tube Slewing

Hydraulic Expansion vs. Mechanical Rolling Methods

1. Hydraulic expanding, or Hydro-expanding, is an innovation in expanding tubes into tubesheets. It is completely different from roller expanding, whether the tube expanders are driven electrically, by air, or hydraulically.
2. In Hydro-expanding, the degree of expanding is directly related to the preset expanding procedure. The pressure is exactly repeatable and does not vary from tube to tube, no matter what shape the tube is in. But, in mechanical rolling, whether you use torque setting or apparent percent tube wall reduction, the degree of expanding cannot be directly correlated. Furthermore, torque controllers measure only the power drawn by the rolls which can vary with the condition of the rolls and mandrel, lubrication, operator fatigue and other factors.
3. Mechanical rolling reduces the tube wall by; a) stretching the tube radially, and b) imposing high unit rolling forces that cause the tube to extrude axially. Hydro-expanding, however, only stretches the tube radially. The amount of wall reduction is barely measurable and, in fact, the tube end pulls in slightly as the tube is bulged out rather, than extruding.
4. Hydro-expanding produces no surface effects on the tube and almost no work-hardening. You never get bell shaped or hour glass shaped tube ends. Therefore, the tube-to-wall contact is always uniform.
5. When you roller expand tubes into grooved holes, tube metal extrudes into the grooves. But, when you Hydro-expand tubes into grooved holes, the tube bulges into the groove, providing additional tightness at the contact of the groove edges with the tube.
6. Mechanical rolling may cause tube-end fatigue, depending upon the frequency and amplitude of the stresses the rollers apply. The frequency is far more effective in producing fatigue than the amplitude. That is why five or seven roll expanders are used when the tube

material is subject to fatigue. From the fatigue standpoint, Hydro-expanding is like having an infinite number of rolls.

7. The high contact stresses imposed by rolling make it more likely that stress corrosion will cause tube-end failure. The transition from the reduced wall is a possible trouble source in rolled tubes.

8. You can Hydro-expand the tubes to the exact rear face of the tubesheet, thereby reducing the chance of crevice corrosion at the rear. This is accomplished by the uniformity of pressure being applied to the entire tube length at the same time. With mechanical rolling methods you are pushing the tube material out the rear of the tubesheet and because of this; you create a very noticeable rear crevice, resulting in premature tube failure.

9. The extreme ease of operation of the HydroSwage system requires almost no training.

10. If tube rollers cease and stall, the rolling motor may spin and injure the worker. The HydroSwage system does not produce torque.

11. To roll tubes into tubesheets thicker than 2", you have to step roll. This is time consuming and requires a tremendous amount of skill. You can Hydro-expand tubes into any thickness of tubesheet with one pass of the mandrel per tube.

12. When you re-roll leakers after hydro testing, you further reduce the tube wall. Also, you may move the ligaments enough to start other leaks and may even cause ligament damage around the other tubes. This can also create problems in having to chase the leaks completely around the tubesheet, creating even more problems, and so on. With Hydro-expanding, because you can accurately control the exact expansion pressure, you can eliminate the problem of having torc-expand leakers. If you do have a leaker, you know exactly which pressure will provide a seal without disturbing any of the adjacent holes.

13. Expansion time depends on the tube material and averages from 2 to 5 seconds per tube. Only one worker is needed to do the work. Tube ends are prepared in the same way as for roller expanding.

14. Hydro-expanding is successful in out-of-round holes and in holes distorted by tube plugging. However, axial scratches in the hole or tube material will cause leaks in any expanded tube to tubesheet joints, regardless whether expanding by rolling, near contact explosions, compressing a rubber expander, or by hydro-expanding. Therefore, it is recommended that scratched holes be burnished free of axial scratches or a groove be cut into the tubesheet. It might be further noted that because of the uniformity of hydraulic expansion, it does further reduce the probability of axial scratches when re-tubing. The extraction of hydro-expanded tubes will be extremely even and uniform, thereby producing cleaner tube holes ready for re-tubing.