FINDING PROBLEMS THAT CAUSE FLAWS

Part I: Focus on the tube or pipe mill

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Editor's Note: This is the first article in a two-part series on finding the causes of tube or pipe flaws. Part I discusses tube and pipe mills. Part II will discuss materials.

IN the beginning was the coil and all was well. The coil was large and heavy and not very useful, except as a big doorstop, so it was unwound, and then all was not well. Now it was a tripping hazard, and though impressive to behold, it still served no purpose. Ultimately, all things were put under man's control, so man thought, I can make tube from the coil—after all, I have the fire-breathing dragon as a friend. Now as long as coil came from heaven all was well, but when the apple fell from the tree, things started to go wrong. Coil came from many locations, and because languages had become confused, no one understood the other. Shipments were missed, grades and gauges were inconsistent, and the coil became more like the snake that had started the problem in the first place.

Material-related problems have been around a long time. Maybe not since Adam and Eve left the Garden of Eden, but a long time nonetheless. To add to the confusion, the industry has many more types and grades of material than before, so if you make tube for a living, your life is interesting ... to say the least.

PROBLEMS YOU CAN CONTROL VERSUS PROBLEMS YOU CAN'T CONTROL

To confront material problems, you must have hard information and know how to separate fact from fiction. No one will let you off easily; you may cite material problems as a reason for failure only when you can prove they exist. You can separate material problems into two groups: the ones within your control and the ones beyond your control.

To distinguish one from the other, you must first think about how a tube mill works. To prove that a material problem exists, you must know and document the capabilities of your mill and tooling. This way you will know when the material is the culprit. The basic rules that control the process are:

1. A tube mill controls only the outside dimension; the wall thickness is a direct reflection of the coil's characteristics.
2. Every combination of OD, wall thickness, and material grade requires its own strip width for optimal performance in the tube mill.
3. Your tube mill performs well only if it's maintained like a toolholder; that is, you have to maintain the tool mounting surface alignment. All bearings, seals, gear reducers, roll shaft, keys, and other hardware must be in good repair or they will not perform as designed. This rule also applies to the roll tooling.
4. The tooling installation and mill setup determine the tube mill performance. You must follow a written procedure every time so that, for a given product, the setup is consistent.
5. Cold work on strip edges must be uniform (both edges coined equally in the fin passes) for good forge welding results. The strip edges must be parallel to each other through the induction coil and into the weld forge zone. These parameters apply also if you are fusion welding.
6. Keep it clean! With the advent of synthetic mill coolants, sump life has increased, and many tube mills run for six to 12 months between coolant changes. Using deionized water for makeup reduces the mineral buildup from water evaporation. Use magnetic separators, particle filters, and oil separators, especially on the impeder coolant supply and the fluid lines used between the last fin pass and the weld forge area, or you may cause a material problem of your own. Scale, mineral oxides, and hydrocarbons (washed-out greases and oils) can and do create weld faults such as pinholes and unbonded areas.

Now that you have followed all the rules and documented the process, the next step is to determine whether the tube is acceptable. To do this, you need to verify two of the mill's capabilities: its ability to form the tube sufficiently to achieve a sound weld, and its ability to hold acceptable tolerances (diameter, shape, ovality, straightness). You should use destructive tests and continuous nondestructive tests (NDTs) to prove these capabilities.

Material problems can interfere with these two capabilities. Unless you manage the components within your control, you will be suspect when things go wrong. It must be clear that only one variable, material, is creating the problem. TPJ

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