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HREW vs. DOM Tubing Testing

At 4x Innovations we want our customers to get the most value for their money and we are always checking to ensure that they are. In an effort to ensure this we have tested two of our most popular materials, 1-3/4" Hot Rolled Electrically Welded (HREW) and 1-3/4" Drawn Over Mandrel (DOM) tubing. There are been articles circulating the web that claim HREW tubing is just as strong as DOM tubing and therefore is unnecessary and even a waste to spend premium dollars on DOM for your next cage, sliders, or bumper. Unfortunately, this is information is misleading because of the test parameters and the materials that were tested. The HREW material in those test came from a trusted US steel distributor whereas the competing DOM material is a low quality offshore material. The standards of manufacturing differ greatly resulting in different material properties and a lower quality product. At 4x Innovations we only use high quality Made in the USA steel tubing, which delivers a much more reliable, consistent, and superior product.

The setup:

For this testing we used laboratory grade equipment located in the University of Wisconsin Platteville's material testing lab. Two tests were performed to determine the strength of each tube sample; a load test and a Rockwell B hardness test.

Since the test cross sectional area is constantly changing during this test it is not possible to create a true stress-strain curve for a tube in compression loading. Because of this the true testing stress is not able to be calculated for the tube and a load force vs. displacement graph is the only option to display the data. To create these curves a MTS Criterion, figure 1, universal testing machine (UTM) was used to crush the tubes to 0.4" (10mm) of displacement. The 4-inch-long sample pieces were tack welded to a plate for safety reasons and two parallels were placed on the top of the sample and on the bottom to distribute the load to the cross head, figure 2.

Figure 1 - MTS Criterion

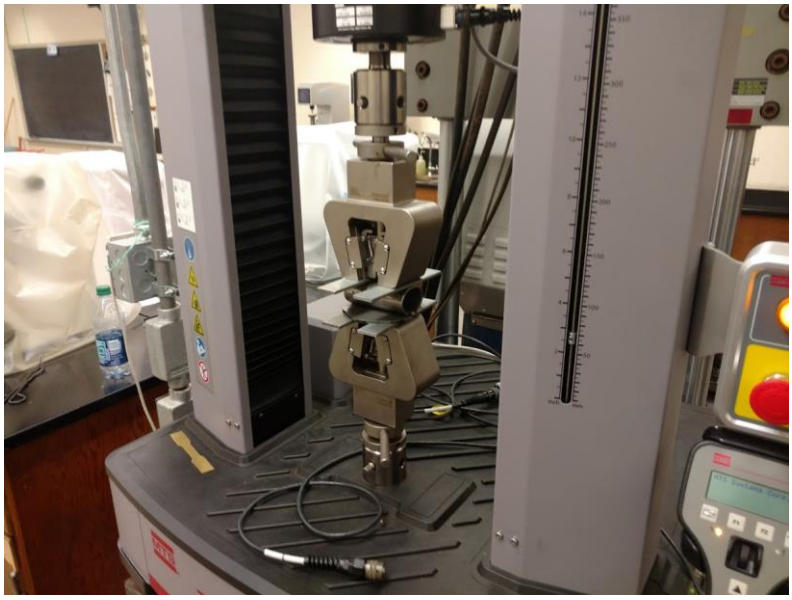

Figure 2 - Tube setup

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We wanted to collect the hardness data from the exterior of the tube where it will be exposed to weather, rocks, and any other forms of torment that a real world application would produce. To ensure the part would not deflect under the load of the machine a machined insert was put into the tube being tested, figure 3. This results in a very accurate hardness rating of the outside of the tube by keeping the tube from deflecting. Rockwell B hardness was used for collecting this data and the testing was done on a ROCKY series machine.

Figure 3 - Hardness test insert

The test:

Specimens for the crush test were loaded into the machine all in the same orientation and the test was executed. The load cell collects data on the load vs. the displacement of the crosshead as the test takes place and displays it on the computer display, figure 4.

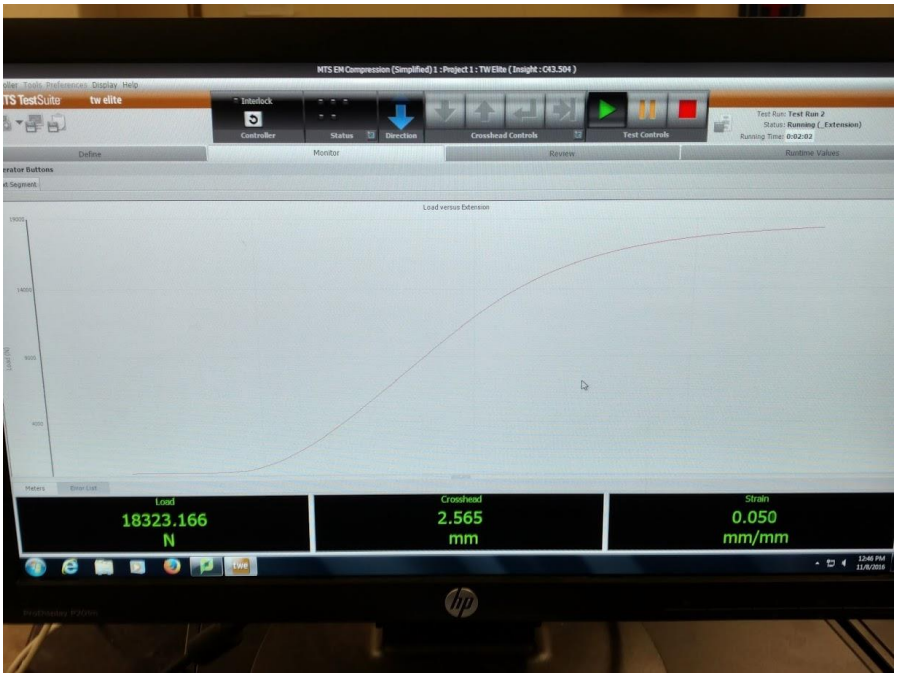

Figure 4 - Read out

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Needless to say the results were very impressive. The DOM tubing was the clear winner with a maximum sustained load of 6688 pounds-force being applied. This is compared to the HREW material which produced a maximum sustained load of 4239 pounds-force. It was interesting to see that seam placement with the HREW samples made a difference of about 210 lbf. The max force is not always the most useful comparison unfortunately, instead the point at which permanent deformation starts to occur should be used to compare these samples. In the case of the DOM tubing it occurs at approximately 5000 pounds of force and for the HREW around 3000 pounds, figure 5. This means that **the DOM tubing is 66% more resistant to permanent deflection** due to a static load than its HREW counterpart.

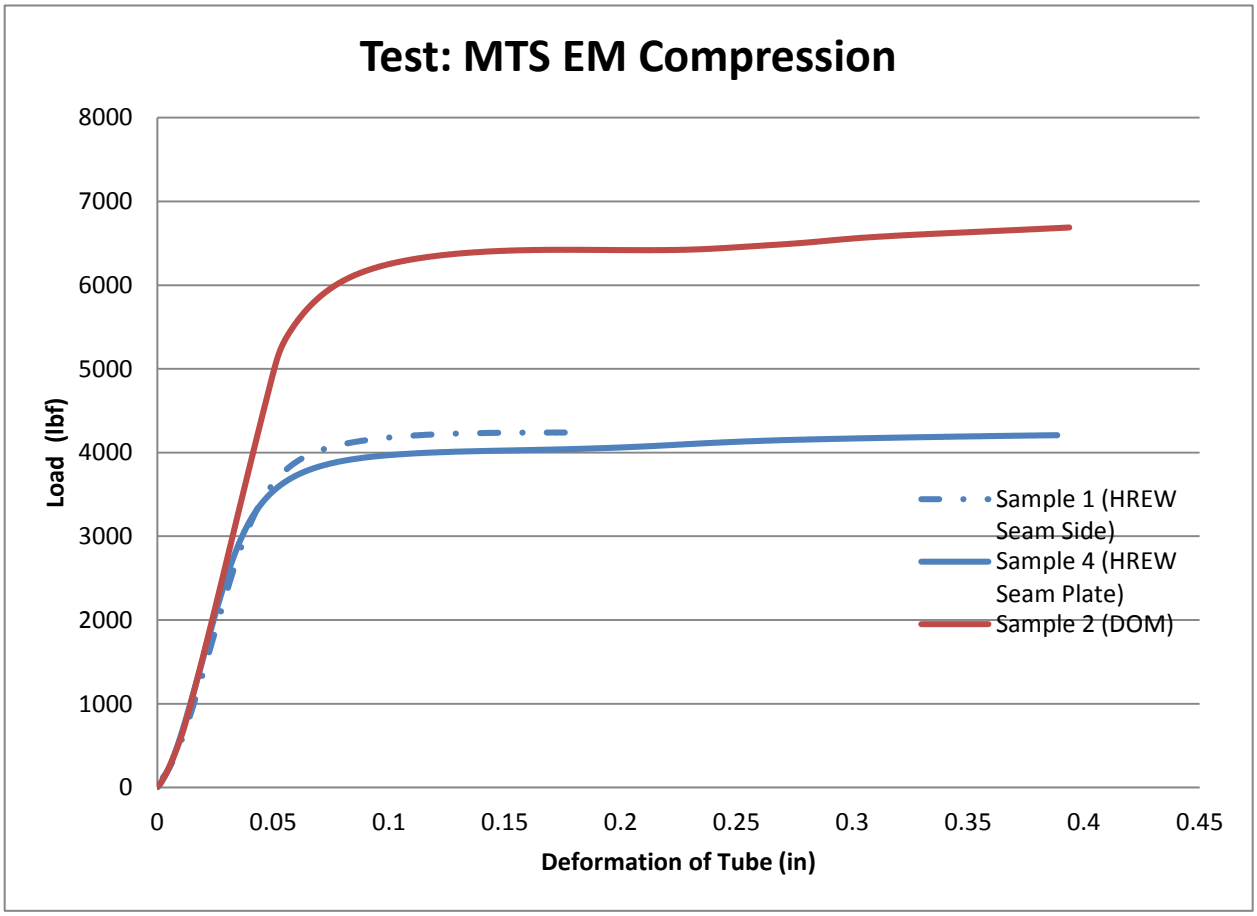

Figure 5 - Graph of load vs. deflection

Similar amounts of spring back were seen in the tested samples regardless of the extreme difference in the forces needed to crush them. As seen in figures 6 and 7 the HREW and DOM tubing demonstrated classic tube yielding mechanics.

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Figure 6 - DOM

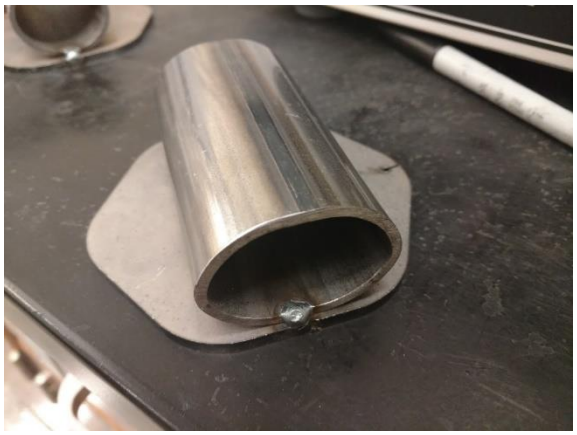

Figure 7 - HREW

The hardness test demonstrated a similar trend of results with respect to the crush test. The Rockwell B hardness for the DOM was approximately 84, where the hardness for the HREW samples exhibited an approximate average of about 66, table 1.

Table 1 - Rockwell B hardness

HREW	DOM
62.3	81.1
66	84.8
71.5	86.3
Average: 66.6	84.06666667

The verdict:

If you are an explorer checking out fire roads, wooded adventures, driving the typical class 1-3 type trails and run a fairly light truck who needs basic protection from trees, stumps, or the occasional rock HREW might be perfectly suitable for your application. If you are getting into the class 4-5 trails, trails with a lot of rocks and drops, or into expedition and weeklong camping, running a heavier truck you should probably upgrade to the DOM tubing. The added strength of DOM, 66%, will really shine when you "test" your cage or slam your sliders hard on the rocks.

Real world test:

In addition to our egg-head style laboratory tests we conducted some, scientific but, more practical tests on the sliders. We had a 1996 4Runner that we added the three types of rock sliders we offer to; HREW, DOM, and Square Main Tube with DOM outer tube. We then dropped the truck onto a large boulder from varying heights and positions on the rock slider. A video of this test and the results can be found here.

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