KNIGHTHAWK TECH NOTES

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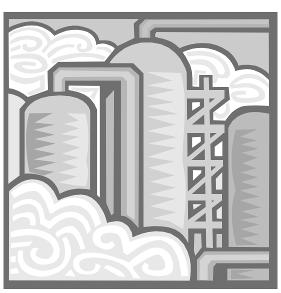
It Does Not Meet Code or Does It Really?

One day you show up at a meeting in a production facility and find yourself with the mechanical folks concerning issues with your pressure vessel. You have a vessel that has operated fine for years and recently you placed an order for similar equipment. You hear words that ring in your ear and confuse you. The Mechanical Group Leader for static equipment informs you that the equipment does not meet Code. You hear the words it is "overstressed" !!!!

You are confused because it has never failed and now all the "alarms and red flags" are going off. What started as a relaxing day turns into stress because the OEM is half way through fabricating this duplicate multimillion dollar vessel. Of course you want the equipment to meet code, but what you are told does not make sense. After all, you are a chemical production engineer and this equipment has never had problems. Now the Mechanical Group Leader is correct, it does not meet Code with the rules it was evaluated under. So what options are available?



Frequently, there are issues that develop with the ASME code regarding compliance in new vessels and "fit-for-service" applications. If a piece of equipment does not meet code, it is not a given that it will fail. The equipment might simply be operating in the factor of safety region contained within the Code rules analyzed. On the other hand it is a possibility that the stress levels are so high that indeed it might fail.

Well there are options available to evaluate an existing piece of equipment or challenging design as follows:

Level 1. The first level is the standard code calculations that are normally the standard Code check. It is an elastic analysis, typically consisting of the solution of simple elastic formulas to satisfy code requirements.

Level 2. Perform an elastic finite element (FE) analysis. Evaluate in accordance with governing Code rules. Depending on the governing rules this could be ASME Section VIII, Division 2, Appendix 4.

Level 3. An FE fatigue analysis could be performed in accordance with governing code.

Level 4. Next is an elastic-plastic FE analysis in accordance with governing code.

Level 5. Experimental analysis

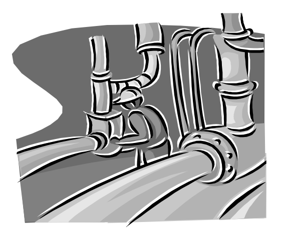
Level 6. Reevaluate Design Criterion

Level 7. You're out of luck – redesign it

Levels 2-6 require high knowledge and low uncertainty involving the design and operation of the equipment. If there are upset conditions or high uncertainties, stick with Level 1 or maximum Level 2 and redesign the equipment if there are problems.

In all cases involving Level 1 through 7, an experienced Registered Professional Engineer competent in pressure containment equipment design utilizing the methodologies outlined should be involved. Going to Level 3 or above Production, Materials, and Mechanical should also be involved in the analysis and a detailed review process should be implemented by those not directly involved in the analysis. The results have to make sense and one should simply "try to meet Code". Don't forget the old saying "Garbage in Garbage Out".

So, as you can see, there are options. Again, any vessel work at the levels described above need to have a qualified vessel engineer involved. The computer jockeys that are FE wizards are not enough if they are not familiar will pressure vessels in your operating environment.



Cliff's Notes:

Our staff has extensive experience in the analysis methods described above. We also have the production experience to make certain the analysis makes sense. At KnightHawk, we have pioneered plastic FE analysis techniques to evaluate pressure containment equipment.

We are also pleased to have Mr. David Lowry join KnightHawk as a Group Leader. David has 20 years of experience in Failure Analysis and Troubleshooting of structural and materials problems as well as development of structural and system analysis methodologies. David has also performed defect and non-conformance design troubleshooting and redesign analysis. David has a BSME and MSME from Texas A&M. He also has performed doctorate work at SMU. He is an expert in mechanical design and failure analysis. Welcome David.

On another note, to all my biker friends out there, this is for you. My son and I took an awesome trip to "Big Bend" in West Texas during spring break. We even stopped to visit the Judge Roy Beam Museum. It was a great ride and beautiful, however at 43, 2000 miles in three days still hurts.

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KnightHawk Project Update

- Pipe Stress – Refinery
- Pelletizing Die Design – Petrochemical
- CFD on GAS Turbine Inlet - OEM
- Piping Acoustical Vibration – Petrochemical
- Structural Dynamics – Rotating Equipment - Petrochemical
- TLE Coking Analysis – Petrochemical
- TLE Failure Analysis – Petrochemical
- Piping Failure – Refinery
- Pipe Stress – Refinery
- TLE inlet aerodynamics - Petrochemical
- Furnace Design CFD – Petrochemical
- Centrifugal Compressor Analysis – Petrochemical
- Secondary TLE analysis – CFD, FEA, Custom Software – Petrochemical
- Exchanger Failure – Petrochemical
- Structural Dynamics – Petrochemical