‘The Code’

By: CLIFF KNIGHT, Owner/President
KnightHawk Engineering

Many times a discussion comes on static or rotating equipment concerning “the Code.” Frequently this statement is made: “It is in accordance with ‘the Code.’” Maybe it is a design or troubleshooting problem or even a big failure. In any case, “the Code” comes up in the conversation. What is “the Code” and what does it really mean to us? There are also many myths concerning “the Code.” A few are as follows:

1. If it does not meet Code, it will fail! While this certainly may be the case in some applications, it is not always the case. Many times when we fail the Code calculations, we go to a cyclic life. Rarely is there a single load cycle failure unless the equipment is grossly under designed and fails due to what is called “Load Controlled Stresses.” Code calculations account for uncertainty and provide a safety allowance for the life of the equipment. Situations may come up where the equipment is flawed or has defects. FFS (Fitness For Service)-1/API 579 concerns itself with fitness for service of pressure containment equipment. This Code has different levels of analysis to determine whether a piece of equipment is fit for service.

2. It’s within Code so it is not a design problem with the equipment! This one frequently comes up in major failure analysis. The Code is intended to be a guide for a competent designer in the field. Many times when a piece of equipment fails, and it is thought to be in accordance with the Code, all of the physics have not been defined that govern that particular situation. A good example is when a piping system cracks or fails due to acoustic resonance or transient pressure momentum. While the overall pipe stress might have been in accordance with the Code, these other special conditions were not covered in the design.

3. If it is in accordance with the Code, we should be OK. Certainly we want everything designed and operated in accordance with the Code, but the Code simply does not cover everything in industry that can occur in complicated process systems. The preamble to the Code covers situations when the Code does not apply or cover a specific area. Basically, good engineering judgment and standard industry practice can be implemented when deemed necessary by a Code expert and qualified professional engineer.

To address all these issues, there are two basic rules to follow when faced with a complicated situation where there may be some uncertainty:

Rule 1 — Nothing beats experience.

Rule 2 — Refer to Rule 1.

A good methodology as follows for Code analysis is:

- Make sure you understand all the conditions a piece of equipment will operate under in the process system. Talk to the process engineers and understand all the possible transient, steady state and upset conditions.
- Understand and make sure you identify all of the physics that govern your problem. This is a critical step and most often the source of design problems showing up in the field.
- Determine to what level in the Code to use. In regard to static equipment, the maximum level can include but is not limited to: elastic/plastic finite element analysis, computation fluid dynamics, testing and validation, and making sure “load controlled” and “stain controlled” conditions are properly identified. Load controlled conditions cause primary stresses in equipment and can lead to catastrophic failures if missed. Strain controlled usually lead to cyclic life failures if missed.
- Have a design review (metallurgical, mechanical, process and instrumentation/control) with an experienced individual.

I have worked many failures around the world in my career. A great majority of the failures involve unidentified physics no one thought of that was included in the actual operation of the equipment. Most often the failure involved transient conditions. These manifested themselves in the following ways (but are not limited to): local process thermal gradients, transient pressure/momentum forces, acoustic vibration and thermal shock.

Make sure all work is reviewed by a professional engineer competent in the field.

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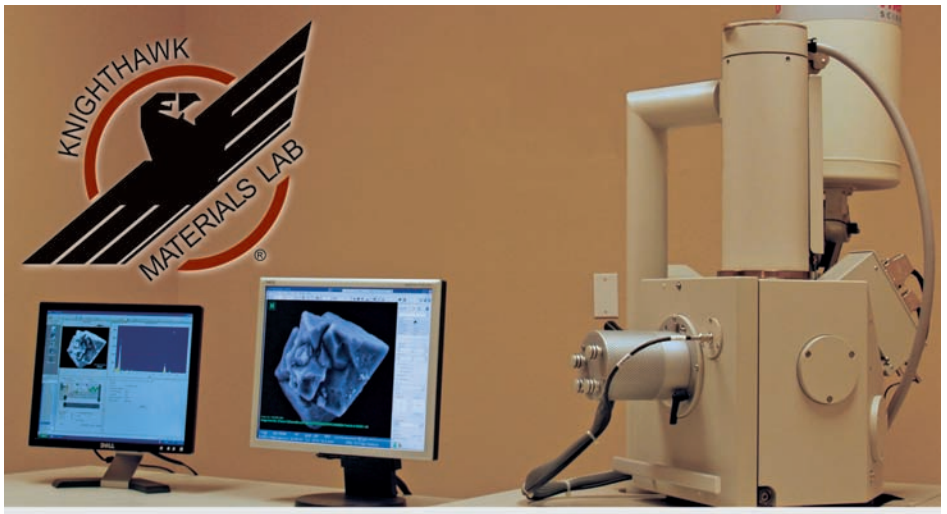

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