

Wake Frequency and Strength Calculations

APPLICATION

*ASME PTC 19.3 TW - 2010

PTC 19.3 TW-2010 is a completely new standard that establishes the practical design considerations for thermowell installations in power and process piping. This code is an expanded version of the thermowell section contained in the PTC 19.3-1974, and incorporates the latest theory in the areas of natural frequency, Strouhal frequency, in-line resonance and stress evaluation. ASME responded to changing industry demands for a more comprehensive set of thermowell evaluations. Key enhancements over the 1974 edition include:

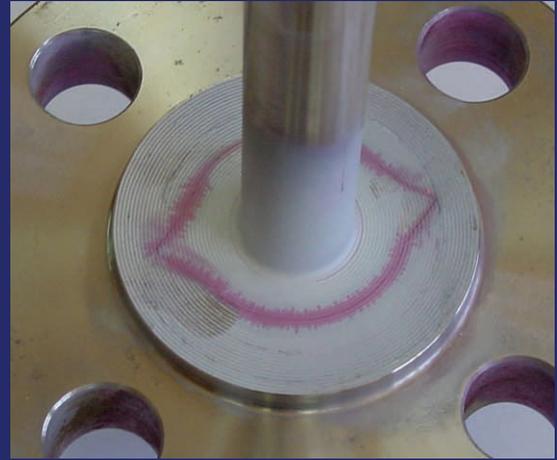
- Expanded coverage for thermowell geometry
- Natural frequency correction factors for mounting compliance, added fluid mass, and sensor mass
- Consideration for partial shielding from flow
- Intrinsic thermowell damping;
- Steady state and dynamic stress evaluations
- Improved allowable fatigue limit definition.

CHALLENGE

Any thermowell can fail due to the effects of high or viscous flow rates. Performing strength and wake frequency calculations will indicate a safe immersion length and stem configuration. This needs to be balanced with the minimum immersion length required to obtain an accurate temperature measurement. For typical thermowells this means an immersion of 4.5" or greater to avoid stem conduction error. If the two requirements do not agree then the thermowell design needs to be modified or an alternate location or method of obtaining the temperature needs to be considered. The ASME spec recommends shortening the immersion length and/or increasing the stem diameter to alleviate the affects of flow. Previously velocity collars or other similar devices to support the stem were allowed. The new revision does not recommend their use.

*Excerpted from ASME website: <http://staging.files.asme.org/Catalog/Codes/PrintBook/25750.pdf>

Flanged Thermowell



Crack in flange due to stress

SOLUTION

Every thermowell installation should have the calculations performed to insure that the well will not vibrate due to wake frequency and is strong enough to resist the drag caused by viscous fluids or high flow rate. Specifying option code WE05 to any Burns thermowell or sensor and thermowell assembly will get you the information you need to insure that your installation is successful. You will be asked to provide the process conditions which are used in performing the calculations.

The example pictured is a flanged thermowell that failed because the effects of flow were not considered or the calculations were not done properly. The crack is outlined in purple and would have resulted in a complete failure if not noticed earlier. The stem can break off, travel downstream, and cause all sorts of damage.

Photo courtesy of Alloy Engineering
<http://www.thermowells.com/library.html>