

INTRODUCTION

Thermowells must be carefully selected for processes where significant velocity is present. By penetrating the process flow, the thermowell is subject to the stress and friction of the flow. This may set up a natural vibration in the well. If this is not done correctly, the vibration will be such that the well will shear off in the process. This can be especially troublesome in high velocity steam lines. As the engineer needs to have the well deep enough into the process to accurately measure the temperature, the selection of the length and diameter of the well needs to be checked against the process to insure that they are compatible. This is done through a calculation known as a Murdock. This calculation will determine whether a thermowell will be acceptable for the proposed process. The Von Karman Trail refers to the turbulent wake which is formed as fluid flows past the thermowell. A vibration frequency is determined by the diameter of the thermowell and the fluid velocity. Should this frequency equal the natural frequency of the thermowell it will cause the thermowell to vibrate to the point where it will break off. Therefore it is important that the thermowell be designed to insure that the natural frequency of the thermowell always exceeds the potential wake frequency. Thermo Electric can perform calculations for specific applications to aid in designing the proper thermowell based on the stated application parameters.



Project Name:
Project Number:
Purchase Order Numb
Project Document No.:

Tag Numbers: 120-TE-XXXX

Material of Thermowell: SS-316
Support outside diameter: 1.063 [inch]
Support inside diameter: 0.26 [inch]
tip outside diameter: 0.625 [inch]
Tip inside diameter: 0.26 [inch]
Tip thickness: 0.25 [inch]
Overall length: 7 [inch]

Inside Pie Diameter: 6.065 [inch]

Fluid data:
Temperature : 47 [C]
Pressure : 18 [Bar]
Velocity : 31.5 [ft/s]

Results Pressure calculation:
Max inside pressure : 575 [Bar]
Max outside pressure : 498 [Bar]

Results Bending calculation:
Displacement tip : 0.0000 [inch]
Displacement caused by the weight of the thermowell.
Stress at support side : 23.79 [psi]
Max allowable stress : 16281.90 [psi]

Results Frequency calculation:
Natural Frequency : 615 [Hz]
Forced Frequency : 157 [Hz]
Frequency Ratio : 0.3

Velocity at tip :33.68 [m/s]
Reynolds at tip :4.6E+06
Strouhal at tip :0.24
FRF correction :0.85

These well design calculations are based on the ASME power test code PTC 19.3-1974 formulas. The result calculations should only be used as a guide for thermowell design. Thermo Electric does not guarantee the performance of a specific well design obtained from the use of these calculations as all application parameters have been supplied by the customer.

A frequency ratio of 0.80 or less is recommended for its intended service. Based on the above results this thermowell
Passed or Failed: **Passed**

Adjust to Pass
Change Overall Length to:
Or Change Major Shank Diameter to:



SECTION INTR

VELOCITY CALCUATIONS

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