

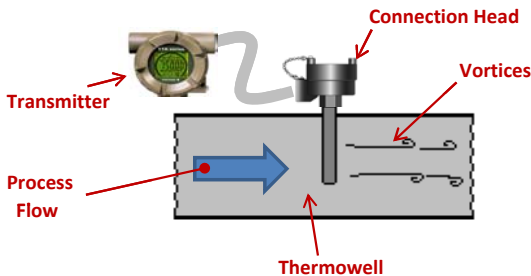
## TSE Series Temperature Sensor - Wake Frequency Calculations

### Introduction

The temperature of flowing media is a common process attribute measured for process control. Unfortunately, introducing a sensor with a thermowell into a flowing media can cause the Von Karmann effect. Although, this phenomenon can accurately measure flow with a vortex flow meter, it can be a destructive force for a thermowell.

### Von Karmann Effect

As the fluid moves past the thermowell, vortices form on both sides of the thermowell. The shedding (or detaching) of these vortices subjects the thermowell to periodic transverse force. This force will cause the thermowell to oscillate. As the oscillation frequency approaches the natural frequency of the thermowell, the thermowell can snap-off into the process.



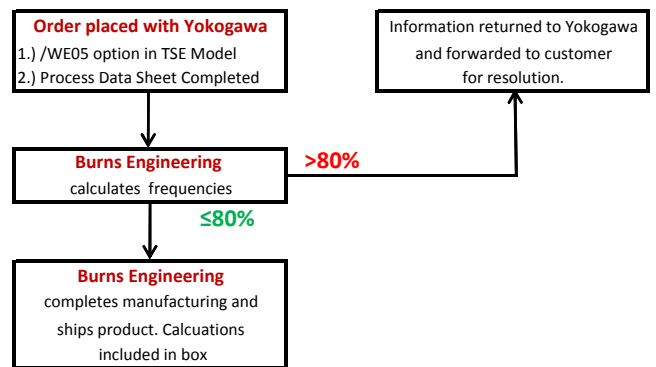
### Test

The natural frequency of the thermowell is a function of the size, shape, and material of construction of the thermowell. Oscillation frequency is a function of the thermowell diameter, fluid velocity, density, and the Reynolds # of the flow. With all these variables, the natural frequency and the oscillation frequency can be calculated and compared. As a general guideline, chose thermowells that have a oscillation frequency  $\leq 80\%$  of the natural frequency of the thermowell.

### Burns Engineering

Yokogawa's TSE series of sensors and thermowells offer an option code for Burns Engineering to run the calculation to determine whether the thermowell meets the 80% guide line. Adding code /WE05 to the TSE model code and supplying the required TSE model code and process information, Burns Engineering can run the calculations to ensure the guide line is being met.

### Work Flow



### Ordering Information

- 1) Add the /WE05 option code to each TSE series sensors that needs to be checked. There is a fee for this option; refer to the current EPB for the cost.
- 2) Complete the form on page 2 of this Application Guide for each TSE sensor with /WE05 option code.
- 3) Forward the information with your purchase order.

**Note:** Calculation can not be completed until a Purchase Order is received.



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## Wake Frequency Calculations

### Work Sheet

**Directions:** Complete all required information for each TSE series sensor requiring calculations. Supply this completed worksheet with your Purchase Order.

#### Section I Customer Order Information

Customer: \_\_\_\_\_  
Purchase Order #: \_\_\_\_\_ Item #: \_\_\_\_\_

#### Section II Sensor / Thermowell information

Sensor Model Code: \_\_\_\_\_  
Tag #: \_\_\_\_\_

#### Section III Operating Conditions

Maximum Operating Pressure: \_\_\_\_\_  
Maximum Operating Temperature: \_\_\_\_\_  
Maximum Flow Rate: \_\_\_\_\_ **Note:** Flow rate must be expressed in lbs/hr or GPM  
(SCFH or SCFM not acceptable)

#### Section IV Physical Attributes

Line Inner Diameter: \_\_\_\_\_

#### Section V Media Attributes

Media Name: \_\_\_\_\_  
Density @ Operating Temperature / Pressure: \_\_\_\_\_

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**All information must be provided. Any missing information will delay calculations and delivery of the product.**

**Below this line for Yokogawa use only.**

Order #: \_\_\_\_\_  
Item #: \_\_\_\_\_

