Product Information Page



WAKE FREQUIENCY CALCULATION INFORMATION

Wake frequency calculations are performed on thermowells for assurance the designed well can withstand the stresses applied to it without failure. Thermowells that are exposed to flow can fail if the wake frequency comes within 20% of the natural frequency. If the wake frequency (the turbulent wake created by the flow of the process media past the thermowell) is too close to the natural frequency (the frequency at which the thermowell will oscillate/vibrate without external forces) the vortex shedding that occurs will destroy the thermowell. Other forces and stresses that can cause serious failures are also considered with this calculation.

PIP #: TH-PI-1

Applicable to: Thermowells

Wake frequency calculations are executed per the ASME PTC 19.3 TW-2016 standard. These calculations can also be referred to as Von Karman, velocity or vibration calculations. Ashcroft Inc. uses variation code XW5 within the thermowell part number to identify this variation. This process is performed prior to the manufacture of the well. Should the thermowell fail, shortening of the "U" dimension or increasing the wall thickness are just a couple of the recommended solutions. The calculation is then rerun to determine if the design change is acceptable. Once approved, the well is manufactured. In order to run the calculations six pieces of information are mandatory.

- 1. Thermowell part number or complete thermowell details
- 2. Maximum operating temperature
- 3. Maximum operating pressure
- 4. Velocity of the process media in feet or meters per second
- 5. Density of the process media
- 6. Viscosity of the process media

The attached form providing this information, must be completed for each thermowell requiring a wake frequency calculation (XW5) and submitted to your Inside Sales Rep at Ashcroft Inc. along with the purchase order. Pricing for this variation can be found in the Thermowell portion of the Ashcroft Price List, within the Tests and Certifications section. Ashcroft also offers a wake frequency calculator on our website under the tools tab so you can run your own precheck to verify the thermowell you choose is acceptable in your application.



Wake Frequency Calculation Information Request Form (Required for each XW5)

Date:	Tag No
Completed by:	

(Must include name and company)

Complete Thermowell PN: _____

Application Conditions	Definite Conditions	Units Of Measure Must Be As Specified Below
Maximum Operating Temperature:		°F, °C, K
Maximum Operating Pressure:		psi, bar, Pa, MPa, KPa, Kg/cm ²
Velocity of the process media:		ft/s, m/s, mm/s, cm/s
Density of the process media:		lb/ft ³ , kg/cm ³ , g/cm ³ , lb/in ³ , kg/m ³
Viscosity of the process media:		cP

Acceptable Units of measure

Any other reference numbers: ______ Additional Information:

Page _____ of _____

Product Information Page

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WAKE FREQUENCY ANALYSIS

In accordance with ASME PTC-19.3-TW-2016

Report Information								
Customer: Ashcroft		Analyst: 0		Date :	6/25/2020			
Tag Numbers: Sample		Reference #: Sample						
Process Operating Conditions								
	-	Process Fluids:		0				
		Max Temperature (T)		270 °F				
	80000 TB	Max Pressure (P):		108 psi				
		Fluid Velocity (v):		6.57 ft/s				
	│ / ₩₩ /	Fluid Density:		1.15 lb/ft^3				
FILLET		Fluid Viscosity:		1.4 centipoise				
	Et Q							
	Lò	-						
		Thermowell Material Prope	Thermowell Material Properties					
Ų / 8		Density (Pm):		0.29 lb/in^3				
		Elastic Modulus, E(T):		27000000 psi				
		Allowable Stress (S) / Fatigue Limit	(ទព:	15600 psi/9100 psi				
		(-//						
t BORE Stress (Support Plane)								
	SIZE	In-Line Reson, Velocity(VIR)	16.47 m/s	Von Mises Stress (Root)-	18.35 psi			
+-+	-в	Rending Stress at VIR (So may)	18708.51 nsi		and par			
		Peak oscill, bending stress (So may)	2.8 nsi					
		rear oscial octaining su cos (ooniner)	210 p.31					
		Frequency						
Thermowell Configuration	m	Frequency	0.40	Retmolds # (Re)-	501.94			
Process Connection:	Flanged FP Weld	Frequency must be below-	151 32 [11-1	Stroubal # (Ne).	02104			
Stem Style	Tangeutt weiu	Installed Natural Ence (fee)	270.20 [12]	Sarotan # (Noc).	1.00			
Stem Style:	Tapered 216	Installed Natural Freq (mc):	378-28 [HZ]	Scruton # (NSC):	1.89			
Floren Size Boting	310	Scrounal Frequency (IS):	22-12 [HZ]	Freq Ratio (IS/IIIC):	0.06			
Flange Size I Rading:	I GUU#	Processo						
Flange Facing:	Raised race	Pressure (D)	(100.00)					
Flange Material:	316	Allowable Stem Pressure(Pc):	6429.08psi					
Bore Size:	0.26"	Allowable Tip Pressure(Pt):	110917.93psi					
Overall Length (L):	10,25"							
Unsupported Length (U):	8"	Thermowell Rating						
Shielded Length (Lo):	0"		Status		Value			
Root Diameter (0):	0.875"	Oscillating Stress (psi)	PASS		2.79			
Tip Diameter (B):	0.75"	Steady-State Stress (psi)	PASS		121.34			
Tip Thickness (t):	0.25"	Pressure (psi)	PASS		108			
Fillet (Root):	0.125"	Frequency (Hz)	PASS		22.11			
(
l								
	The thermowell (design has PASSED the wak	e freguency (calculation				
"These well design calculations are based on the ASME PTC 19.3 TW-2016 formulas. The results of these calculations should only be used								
as a guide for thermowell design. Ashcroft Inc. does not guarantee the performance of a specific well design obtained from the use of								
these calculations".								

Figure 1- Wave Frequency Analysis

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