Thermowell Calculation Report

Calculation Number: 110831-0001

Tag Name: TW-US Customary

Calculation Date: 31 August, 2011

INPUTS

Customer Data

Company Name:	RTC Engineering
Project Name:	Sample Project
Requestor Name:	Dirk Bauschke
Customer Drawing:	
Thermowell Model:	
Analyst:	Dirk Bauschke
Reviewer:	Michael Schwartz
Customer Purchase Order:	
Emerson Sales Order:	
Emerson Sales Order Line:	Preliminary Report

Process Data

Fluid Name:	Water	
Physical State:	Liquid	
Dynamic Fluid Viscosity (μ):	1.423	[cP]
Fluid Density (ρ):	62.4	[lb/ft3]
Operating Temperature (*T*):	100	[°F]
Operating Pressure (*P*):	100	[psi]
Process Fluid Velocity (*V*):	10	[f/s]

This report is only valid with respect to thermowells produced and supplied by Emerson Process Management in accordance with our exacting quality standards.

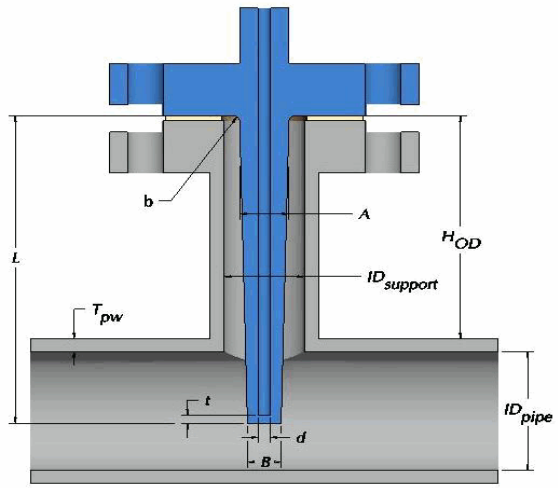
Other Information / Notes:

Mounting Dimensions

Pipe ID (ID_{Pipe}):	22.626	[in]
Pipe Wall Thickness (T_{PW}):	0.687	[in]
Support Height to Pipe OD (H_{OD}):	6	[in]
Support Inside Diameter ($ID_{Support}$):	2.5	[in]

Thermowell Dimensions

Mounting Configuration:	Flanged-Full Penetration Weld		
Process Connection:	2" Class 300		
Stem Material:	ASTM A 479 GR 316		
Stem Style:	Tapered Shank		
Root Diameter (*A*):	1.25	[in]	
Tip Diameter (*B*):	0.75	[in]	
Bore Diameter (*d*):	0.26	[in]	
Fillet Radius at Root (*b*):	0.125	[in]	
Fillet Radius at Base of Step (*bs*):	Not Applicable		
Unsupported Length (*L*):	12	[in]	
Reduced Diameter Length (*LS*):	Not Applicable		
Minimum Tip Thickness (*t*):	0.19	[in]	(Not representative of tip allowance)



Representation of Thermowell Dimensions

OUTPUTS

Thermowell Properties

Mod of Elasticity at Op Temp (*E*):	2.82e+07	[psi]	
Max Allowable Working Stress (*S*):	1.90e+04	[psi]	
Fatigue Endurance Limit (S_F*F_T):	9.08e+03	[psi]	(Temp adjusted)
Von Mises Stress Limit:	2.85e+04	[psi]	
Material Density (*ρm*):	501	[lb/ft3]	

Stress

In-Line Resonance Velocity (V_{IR}):	45.1	[f/s]	
Peak Bending Stress at *VIR* ($S_{o,\ max}$):	4.33e+05	[psi]	(Support Plane)
Dynamic Stress at *V* ($S_{o,\ max}$):	2.16e+02	[psi]	(Support Plane)
Steady State Stress at *V* (S_{max}):	3.12e+02	[psi]	(Support Plane)
Peak Bending Stress at *VIR* ($S_{o,\ max}$):	Not Applicable		(Reduced Diameter)
Dynamic Stress at *V* ($S_{o,\ max}$):	Not Applicable		(Reduced Diameter)
Steady State Stress at *V* (S_{max}):	Not Applicable		(Reduced Diameter)

Frequency

Reynolds Number (*Re*):	4.08e+04	
Strouhal Number (*Ns*):	0.19	
Scruton Number (*Nsc*):	0.0	
Frequency Limit:	0.4	
In-situ Natural Freq (*fnc*):	264.1	[Hz]
Strouhal Frequency (*fs*):	30.3	[Hz]
Frequency Ratio (*fs /fnc*):	0.11	

Pressure

Max Allowable Stem Pressure (*Pc*):	7.83e+03	[psi]
Max Allowable Tip Pressure (*Pt*):	7.81e+04	[psi]

THERMOWELL IS ACCEPTABLE FOR PROCESS CONDITIONS

Calculations are based on the process data provided by the customer. The system designer is responsible for ensuring the thermowell material is compatible with the process fluid including identification of stress corrosion or embrittlement effects. These calculations are intended to be an aid in choosing thermowells for specific applications. Calculations conform to ASME PTC 19.3 TW-2010 and are not meant to be a guarantee against failure.