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Sample Probe Design Calculation Datasheet (based on ASME PTC 19.3 TW-2010)

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Tag Number: SPA/PG5(ASDFG) **Customer:** RAm Systems

Conax S/O No.: G99999C

Sample Probe Parameters

Probe Material:	316 SST	Fluid Media:	Glycerin
Configuration:		T = Operating Temperature:	100 °F
A = Shank Diameter:	.75 in	P = Operating Pressure:	100 PSI
B = Tip Diameter:		V = Operating Fluid Velocity:	10 ft/s
d = Bore Diameter:	.5 in	V_{IR} = In-Line Resonance Velocity:	12.32 m/s
L = Overall Length:	15 in	μ = Dynamic Viscosity:	
U = Unsupported Length (Z+Y):	0.211 m	ν = Kinematic Viscosity:	0.00036 St
Y = Shielding Length	5 in	ρ = Fluid Density	.2 lb/in³
Z = Insertion Length:	3 in	N_{Sc} = Scruton Number:	0.004
F_i = Insertion Force:	196.52 N	R_e = Reynolds Number:	2142956.1

Note: The Sample Probe Assembly Configuration falls outside the scope of ASME PTC 19.3 TW-2010, which was specifically developed for Thermowell Configurations. However, based on similar mounting methods and geometries, the analysis methodology of ASME PTC 19.3 TW-2010 will be applied to the Sample Probe Assembly configuration as an effort to validate its design acceptability.

Acceptance Criteria (Based on values for R_e, N_{Sc} and Fluid Type, use Acceptance Criteria: Case {x})

Case 1: For Gaseous Fluid Media and $N_{Sc} > 2.5$ and $R_e < 10^5$, In-Line Resonance is Suppressed and $f_s < 0.8\ f_n^c$

Case 2: For Gaseous Fluid Media and if $N_{Sc} > 64$ and $R_e < 10^5$, both In-Line and Transverse Resonance is suppressed. Analysis techniques are beyond the scope of ASME PTC 19.3 TW-2010.

Case 3: For Gaseous Fluid Media and if $N_{Sc} \leq 2.5$ or $R_e \geq 10^5$, or for Liquid Media, the following conditions apply:
a) If the SPA ***PASSES*** cyclic stress conditions at In-Line Resonance ($S_{o,max}$), then $f_s < 0.8\ f_n^c$
b) If the SPA ***FAILS*** cyclic stress conditions at In-Line Resonance ($S_{o,max}$), then $f_s < 0.4\ f_n^c$

S_{VM} (Von Mises Stresses) < 1.5 x S_T (Allowable Material Stress Limit) 1.5 X S_T =

$S_{o,max}$ (Cyclic Stresses) < $F_t\ F_e\ S_f$ ((Adjusted Materail Fatigue Limit) $F_e\ S_f$ = 8,757.7 psi

Frequency & Stress Analysis Results

Vortex Shedding Frequency (f_s)	35.2 Hz
Resonant Frequency (f_n^c)	213.4 Hz

$f_r = f_s / f_n^c$ Frequency Ratio	0.165
Frequency ratio limit	0.8

Stress Parameter	*At Process Velocity (V)*		*At In-Line Resonance Velocity (V_{IR})*	
S_{VM} = Von Mises Stresses:	23239 KPa	Pass	371257 KPa	Fail
$S_{o,max}$ = Peak Cyclic Stresses:	38542 KPa	Pass	612054133 KPa	Fail

Conclusion

Frequency Analysis pass/fail: 1 Dampening Factor ζ = 0.0005

Stress Analysis pass/fail: Fail

Sample Probe Assembly design pass/fail: Fail