



WATERBRIDGE

Wedge Meters – Tank Bottom Measurement

March 29, 2023

Challenge

Tank Bottoms – Disposal and Treatment

- Oil Tanks at SWD's
- Loss of product
- Separation Issues
- **Measurement**
 - Accuracy
 - Maintenance
 - Pros vs Cons
 - Longevity
 - Truck vs Meter



Darryl Brooks, HSE, WaterBridge

Measurement Devices

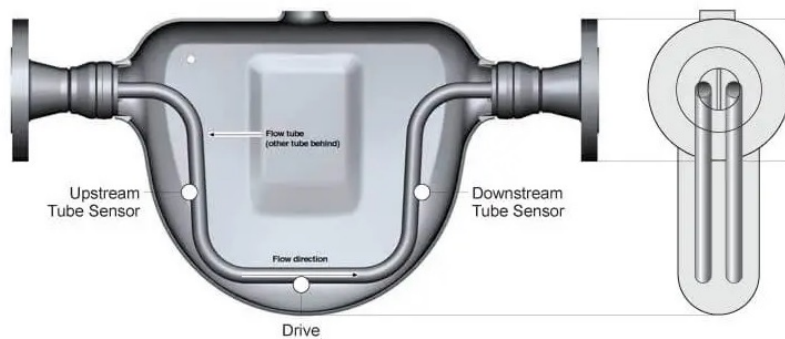
Electromagnetic Flow Meter



Turbine Meter



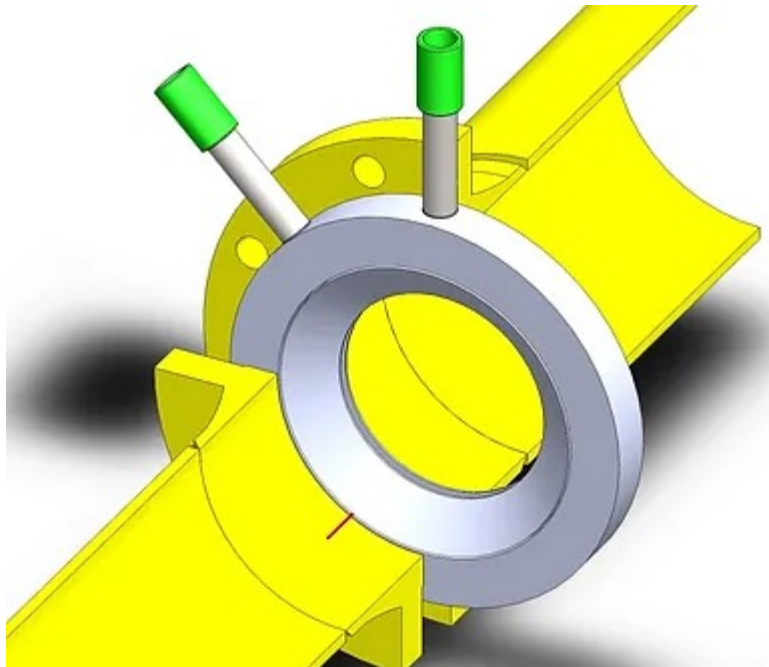
Coriolis Meter



Vortex Meter



Torus Wedge Meter



What Is It?

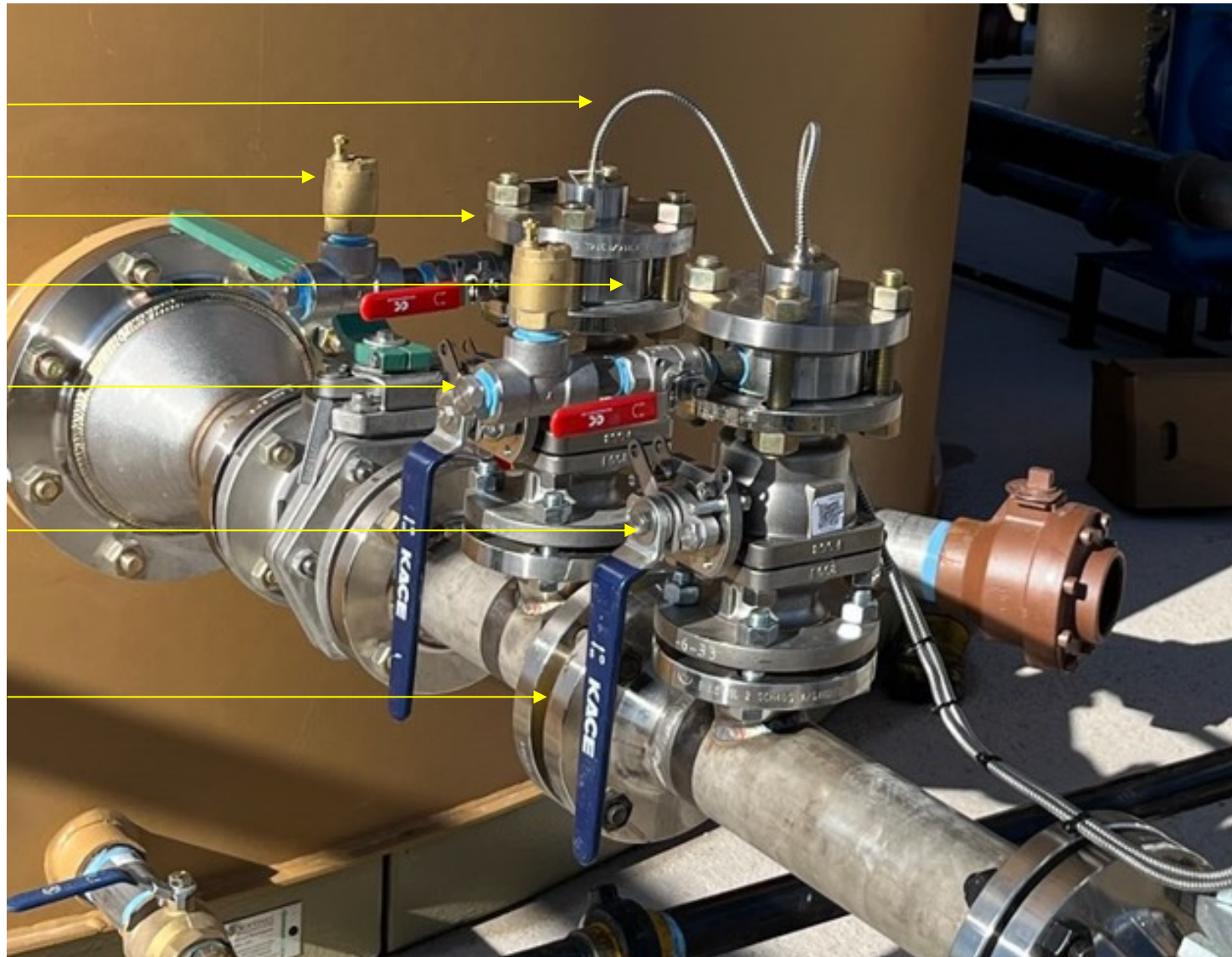
- Differential Pressure meter
- No moving parts (like a mag meter)
- Fully customizable fabrication for size and industry application
- Various installation methods (Torus, OFU, 3 Pressure Points)
- Simple Diagnostic KPI (Dual Differential)
- Fluid Independent
- **In-Situ Cleanout**

Cons (Application Specific)

- Plugging
- Fluid Viscosity and Density
- Pressure Dependent
- Multiple methods of flow calculation
- Non-Intuitive
- Downtime for Replacement
- Multiple parts
- No Manifold (Calibration)

Application

- Capillary Tube
- Air Eliminator
- Diaphragm Plate
- Flushing Ring
- Service Port
- Ball Valve
- Wedge



Commissioning

Equipment and Procedure

- Proving Loop
- DP Transmitter
- RTD
- Coriolis Master Meter
- Flow Computer
 - ROC800L vs ABB Flow-X
- Cd Value (Coefficient of Discharge)
 - Static vs Dynamic



Proving Loop

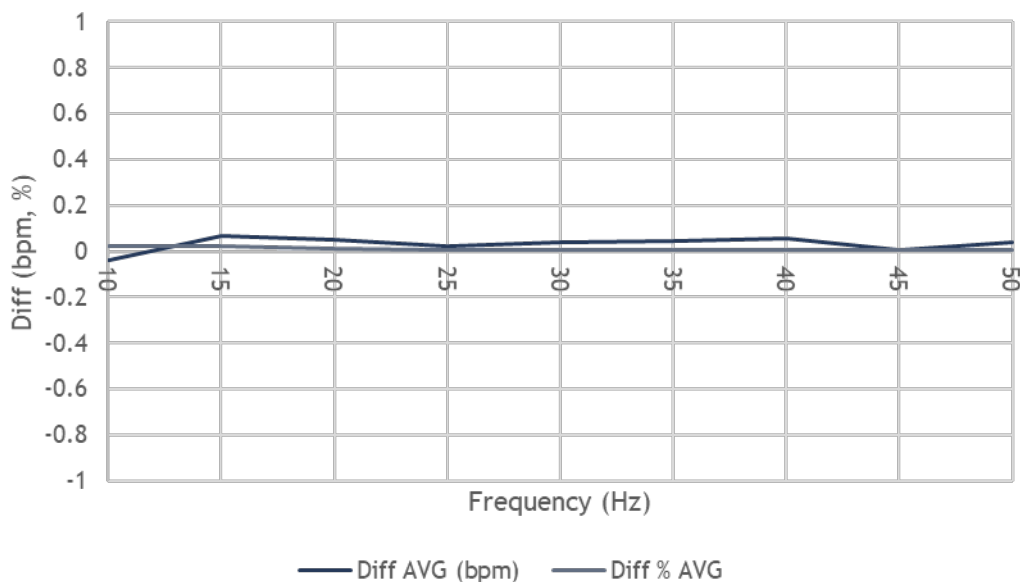




Results

1st Round – 2” Wedge – Varying Cd

VFD Hz	cD	Coriolis AVG (bpm)	Wedge AVG (bpm)	Diff AVG (bpm)	Diff % AVG	SP AVG (psi)	DP AVG (psi)	Temp AVG (degF)
10	0.731148	1.91	1.94	-0.038	2.00%	2.48	4.92	95.71
15	0.79	3.29	3.29	0.067	2.05%	2.77	12.19	95.99
20	0.82308	4.57	4.54	0.049	1.07%	3.31	22.38	96.36
25	0.848473	5.82	5.80	0.023	0.39%	4.04	35.64	96.78
30	0.867356	6.97	6.95	0.037	0.53%	4.85	50.72	97.24
35	0.886674	8.17	8.13	0.045	0.56%	5.81	69.15	97.80
40	0.908955	9.4	9.35	0.056	0.60%	6.74	91.24	98.52
45	0.935885	10.61	10.61	0.006	0.57%	7.82	116.65	99.26
50	0.949910	11.79	11.77	0.042	0.36%	9.08	143.82	100.16
Total AVG				0.032	0.90%			



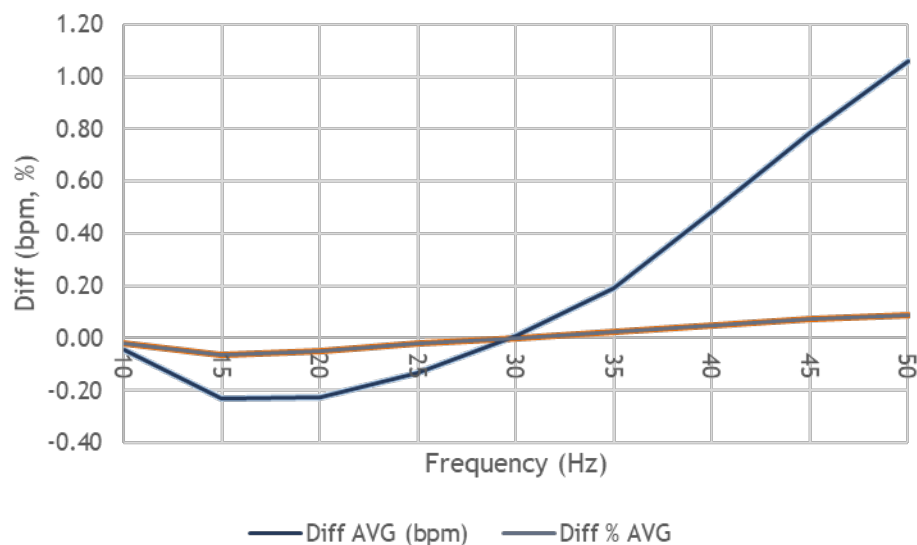


Results

1st Round – 2” Wedge – Single Cd

VFD Hz	cD	Coriolis AVG (bpm)	Wedge AVG (bpm)	Diff AVG (bpm)	Diff % AVG	SP AVG (psi)	DP AVG (psi)	Temp AVG (degF)
10	0.867356	2.33	2.37	-0.04	-1.93%	2.56	5.24	95.82
15	0.867356	3.53	3.76	-0.23	-6.55%	2.94	13.49	96.46
20	0.867356	4.81	5.04	-0.22	-4.82%	3.51	24.83	96.58
25	0.867356	5.97	6.10	-0.13	-2.19%	4.17	37.94	96.72
30	0.867356	7.10	7.09	0.01	0.13%	4.97	53.14	96.85
35	0.867356	8.28	8.09	0.19	2.30%	5.91	72.04	97.07
40	0.867356	9.50	9.02	0.48	5.08%	6.85	93.52	97.35
45	0.867356	10.68	9.90	0.79	7.36%	7.95	117.56	97.65
50	0.867356	11.83	10.77	1.06	8.96%	9.14	144.82	98.09

Total AVG	0.21	0.93%
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Results

Final Round – 4” Wedge – Varying Cd

cD	Coriolis AVG (bpm)	Wedge AVG (bpm)	Diff AVG (bpm)	Diff % AVG	DP AVG (inH2O)	SP AVG (psi)
0.731148	0.26	0.26	-0.003	-0.010	4.08	1.22
0.765876	0.39	0.39	-0.005	-0.012	7.91	1.22
0.774376	0.50	0.50	0.002	0.004	12.38	1.22
0.780876	0.61	0.61	0.000	0.001	17.75	1.70
0.790476	0.72	0.72	-0.006	-0.009	23.88	2.44
0.796076	0.82	0.82	0.002	0.003	30.78	2.44
0.802076	0.92	0.92	0.002	0.002	38.35	2.44
0.806076	1.02	1.02	0.002	0.002	46.50	2.50
0.811076	1.79	1.79	-0.004	-0.002	139.79	6.11
0.816076	2.30	2.31	-0.010	-0.004	222.02	9.83

Total AVG	-0.002	-0.26%
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Density:	64.26	lbm/ft3
Pipe diameter	4.026	in
Cone diameter	2.895	in
Temp	68	degF
Beta V-cone	0.69493	
Beta Torus	0.71908	
Cd corr. Factor	0.912944	



Flow-X Results

Discharge coefficient

R1 Discharge coefficient curve i Enabled ▾

R1 Point 1 - Diff pressure	21.86 inH2O...	R1 Point 1 - Discharge coefficient	0.89633
R1 Point 2 - Diff pressure	26.91 inH2O...	R1 Point 2 - Discharge coefficient	0.93650
R1 Point 3 - Diff pressure	32.55 inH2O...	R1 Point 3 - Discharge coefficient	0.97056
R1 Point 4 - Diff pressure	38.86 inH2O...	R1 Point 4 - Discharge coefficient	0.99287
R1 Point 5 - Diff pressure	53.89 inH2O...	R1 Point 5 - Discharge coefficient	1.02032
R1 Point 6 - Diff pressure	71.13 inH2O...	R1 Point 6 - Discharge coefficient	1.03852
R1 Point 7 - Diff pressure	89.98 inH2O...	R1 Point 7 - Discharge coefficient	1.05120
R1 Point 8 - Diff pressure	136.65 inH2O...	R1 Point 8 - Discharge coefficient	1.07097
R1 Point 9 - Diff pressure	170.24 inH2O...	R1 Point 9 - Discharge coefficient	1.08036
R1 Point 10 - Diff pressure	214.54 inH2O...	R1 Point 10 - Discharge coefficient	1.07033
R1 Point 11 - Diff pressure	277.72 inH2O...	R1 Point 11 - Discharge coefficient	1.02974
R1 Point 12 - Diff pressure	353.76 inH2O...	R1 Point 12 - Discharge coefficient	0.98850







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Q&A