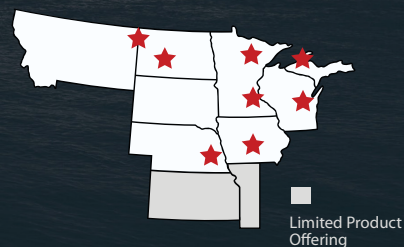




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High performance & resilient Seated butterfly valves; ball valves



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Butterfly valves: high performance & resilient seated



Flow, level, pressure & temperature displays, indicators, totalizers, transmitter, & batch controllers



RTD's, thermocouples, wells, & temperature transmitters



Tower packing, trays, & mist eliminators



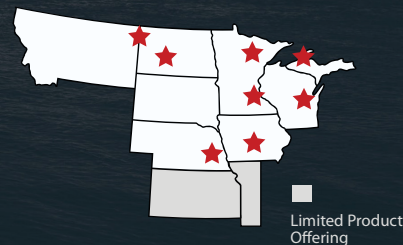
Inline process refractometers concentration measurement



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INSTRUMENTATION, HEAT TRACE, & CONTROL VALVES CONTINUED



Portable clamp on ultrasonic transit time flow meters



Liquid leak detection systems, wired & wireless web-based monitoring solutions, & raised floor airflow management



Pressure & temperature switches, transmitters, sensors, and controls for safety, alarm and shutdown; wireless gas detection



Industrial grade, gas detection systems

Ishpeming, MI
Phone: 906-485-6361
Fax: 952.935.7772

CONVERSIONS, FORMULAS, & ENGINEERING DATA

Pressure Conversions

1 PSI = 2.771 inches water
1 PSI = 2.0418 in. Hg @ 60F
1 PSI = 51.81 mm Hg @ 60F
1 PSI = .0689 bar
1 PSI = 6.895 kPa
1 inch water = 1.8718 mm Hg
1 inch water = .2489 kPa

Volume Conversions

1 Gallon = .1337 cubic feet
1 Gallon = 231 cubic inches
1 Gallon = .003785 cubic meters
1 Gallon = 3.785 liters
1 Barrel (oil) = 42 gallons
1 Bushel = 1.2445 cubic feet

Mass Conversions

1 lb. = .4536 Kg
1 Ton (short) = 2000 lbs.

Volumetric Flow

1 GPM = .227 cubic meters/hour
1 GPM = 3.785 liters per minute

Water Density

At 60 degrees F = 62.371 lbs./ft.
At 60 degrees F = 8.3378 lbs./gal.

Flow Velocity of Water

$V(\text{ft./second}) = .4086 * Q/D * D$
Q is flow in GPM
D is pipe ID in inches

Flow Velocity of Gas

$V = 3.056 * Q/D * D$
V is flow velocity in SFPS
Q is flow in SCFM
D is pipe ID in inches

Volumetric Gas Flow

$SCFM = ACFM * (pf * 520) / (14.7 * Tf)$
Pf = Pressure at flow conditions PSIA
Tf = Temp. at flow conditions Deg. R

Volumetric to Mass Flow of Water

33F water, 8.325 lb./gallon density
 $Q(\text{GPM}) = Q(\text{lbs./hour}) * .002$

Distance

1 inch = 2.54 centimeters
1 foot = .3048 meters

Pressure

PSI (absolute) = PSI (gauge) + 14.696

Steam Data

Gage Press.	Temp Spec.	Volume
PSIG	Deg. F	Cubic
ft/minute		
0.0	212	26.8
25.3	267.25	10.5
50.3	297.97	6.66
100	337.90	3.88
150	365.99	2.75
200.3	377.89	2.13
250.3	406.13	1.74

Table of Liquid Flows in Schedule 40 Pipe

Pipe Size	GPM at 3 fps	GPM at 15 fps
1	8.086	40.43
1.5	19.026	95.13
2	31.358	156.79
3	69.12	345.6
4	119.046	595.23
6	270.27	1351.35
8	468.748	2343.74
10	738.342	3691.71
12	1044.78	5223.88
16	1651.38	8256.88
24	3761.76	18,808.78

Control Valve Sizing

Liquid - $C_v = q * \sqrt{\Delta P / (G_f \cdot DP)}$
Steam - $C_v = W / (2.1 * \sqrt{\Delta P (Pf1 + Pf2)})$
Gas - $C_v = Q / 963 * \sqrt{\Delta P / (G * Tf / DP (Pf1 + Pf2))}$
q is GPM, Δ is Square Root
gf is liquid specific gravity
DP is Differential pressure
W is steam flow rate lbs./hr
Pf1 upstream pressure in psia
Pf2 downstream pressure in psia
Q is gas flow rate

Additional Sales Offices

Bismarck, ND
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