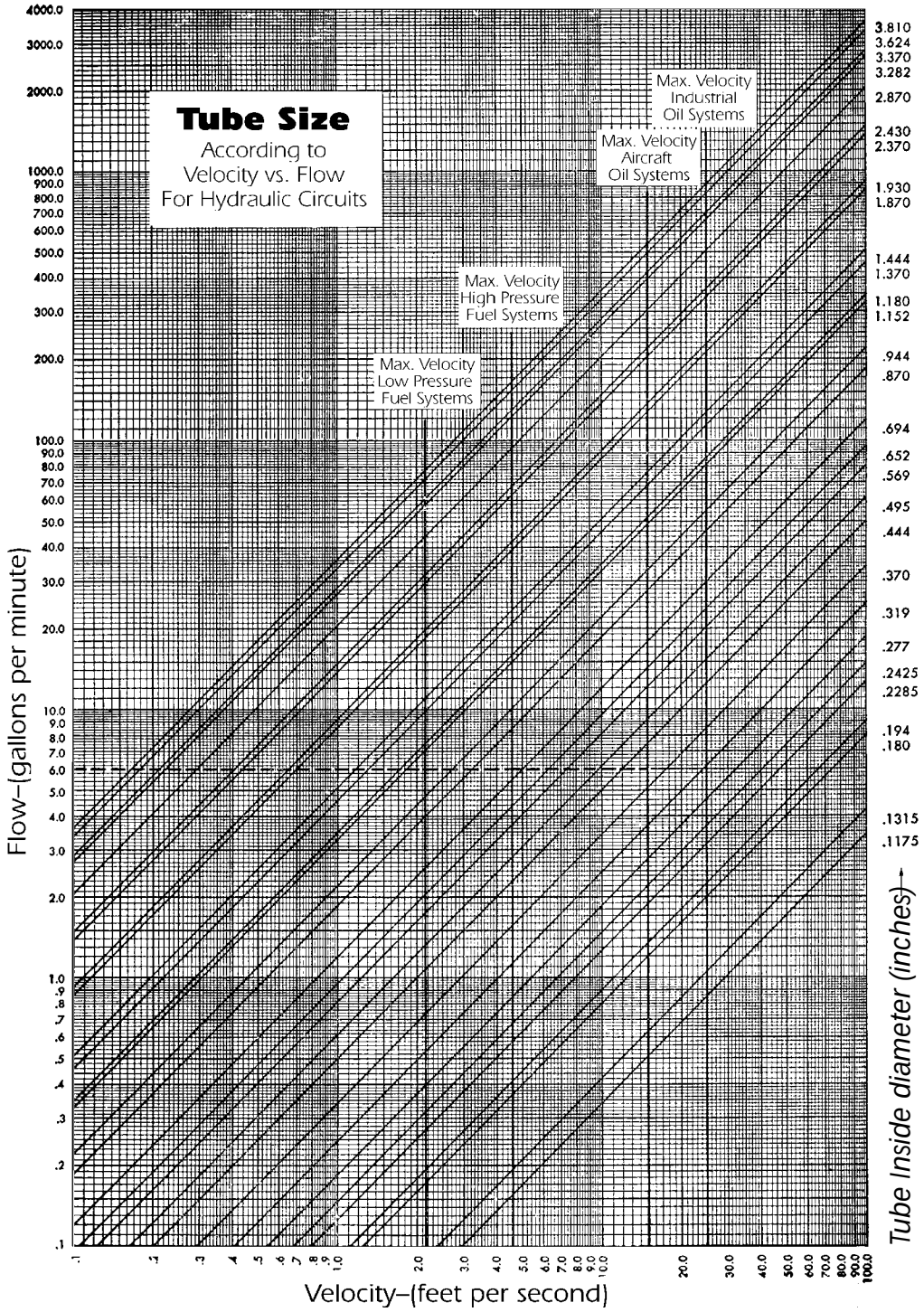
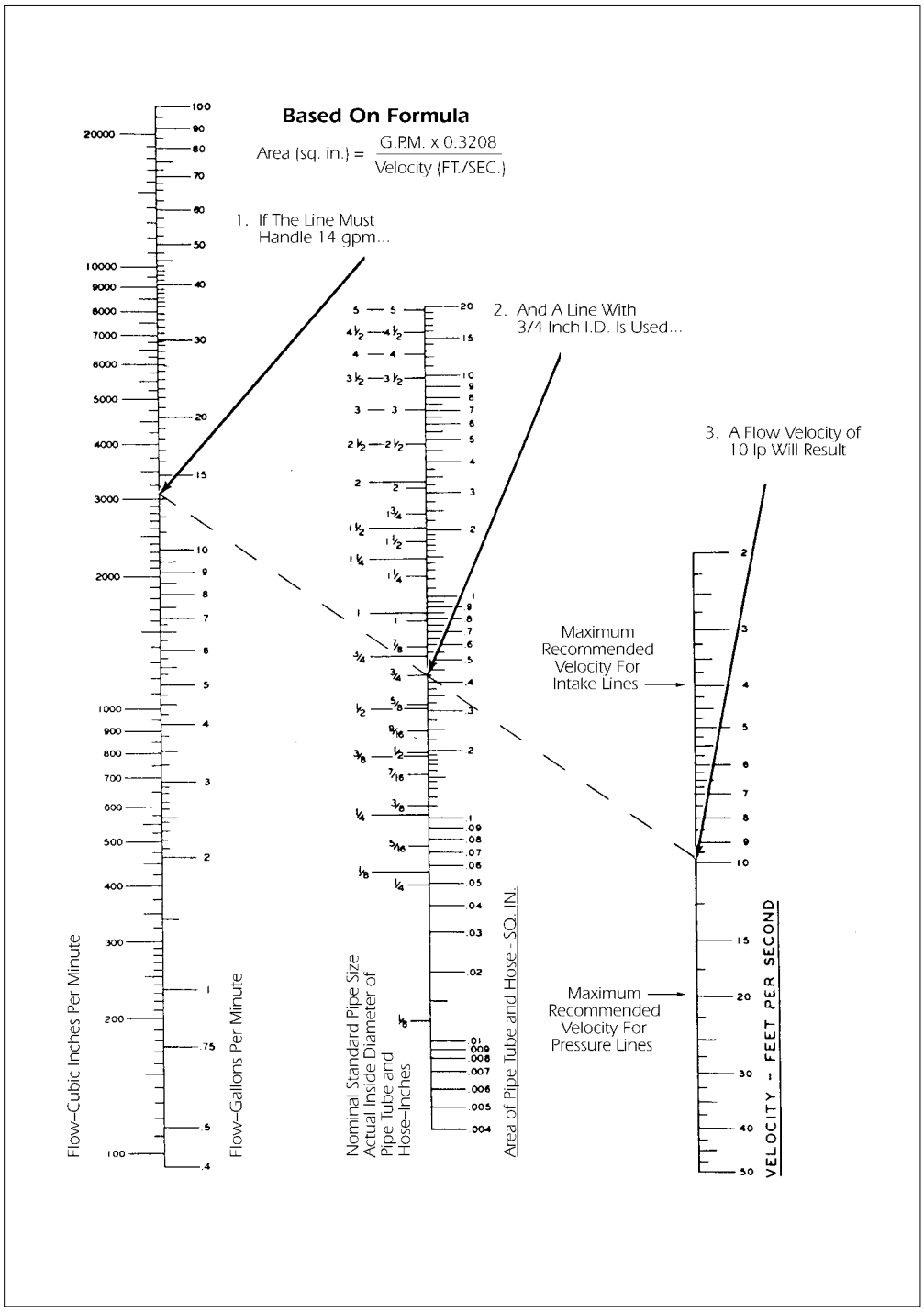
Technical Manual

VELOCITY VS. FLOW TABLE



Conductor I.D. Selection Chart



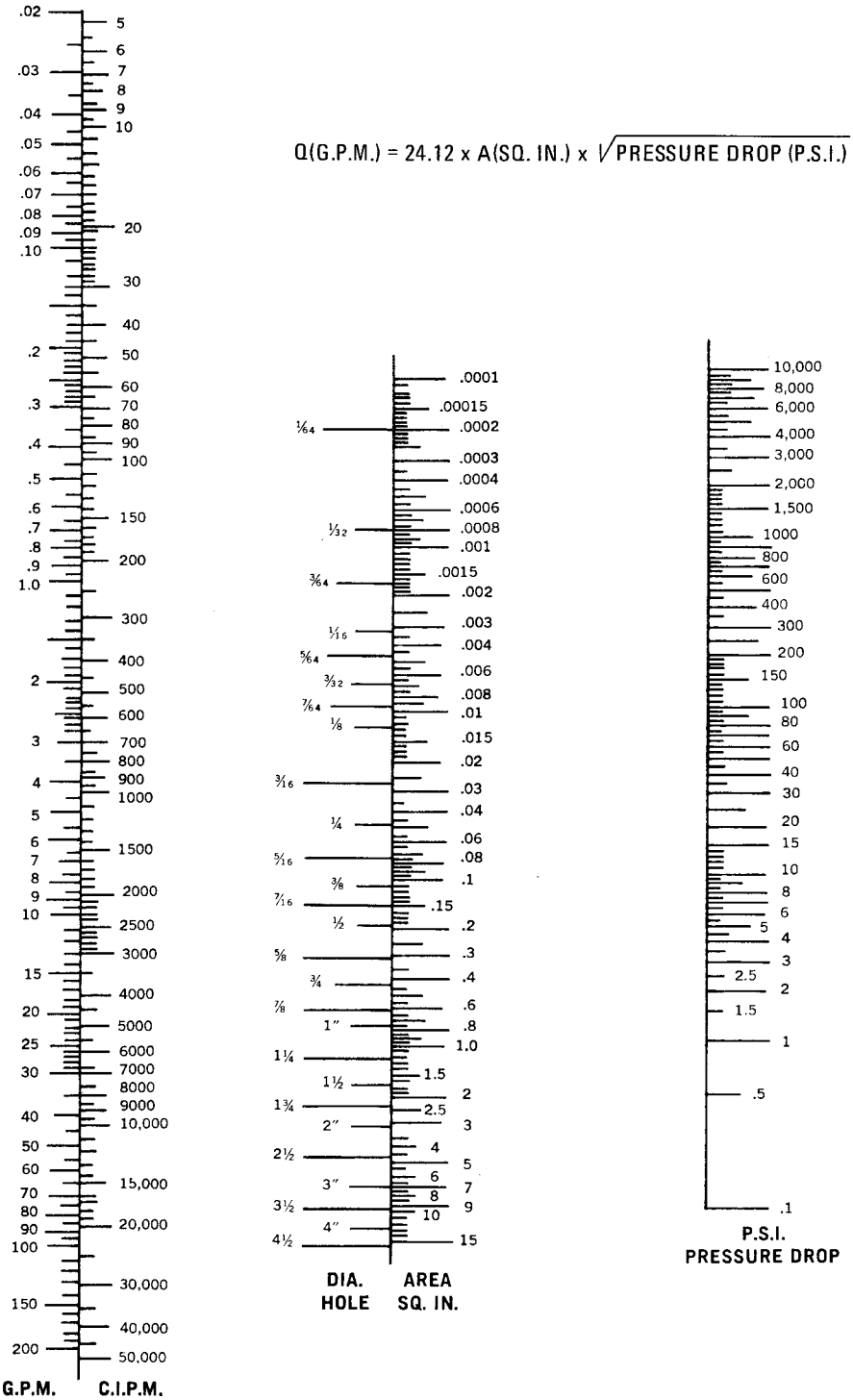
Pressure Loss (psi/Foot Length) In Pipes At Average Velocity (ft/sec)

Material						Pressure Loss (psi/foot length) in Pipes at Average Flow Velocity (ft/sec)														Equivalent Pipe Lengths (ft.) for Circuit Components					
Size (Inches)	Pipe Hose	O.D. Inches	I.D. Inches	Wall Inches	I.D. Area Sq. In.	5		7		10		15		20		25		30		Tee			Elbow		
						Loss	GPM	Loss	GPM	Loss	GPM	GPM	Loss	GPM	Loss	GPM	Loss	GPM	Loss						
1/8	PIPE-SCH 40	.405	.269	.068	.057	1.25	.89	1.79	1.24	2.60	1.75	3.16	2.67	5.47	3.56	6.20	4.45	7.07	5.34						
	PIPE-SCH 80	.405	.215	.095	.036	1.89	.56	3.05	.78	4.26	1.12	5.20	1.68	8.38	2.24	11.1	2.80	12.7	3.36						
	HOSE	–	.125	–	.012	5.96	.186	8.37	.260	11.9	.372	18.0	.558	24.0	.744	30.0	.930	35.7	1.11						
1/4	PIPE-SCH 40	.540	.364	.088	.104	.67	1.62	1.05	2.27	1.64	3.24	1.92	4.96	2.97	6.48	3.23	8.10	3.73	9.72						
	PIPE-SCH 80	.540	.302	.119	0.72	1.11	1.12	1.49	1.57	2.11	2.24	2.84	3.36	4.15	4.48	5.08	5.60	6.30	6.72						
	HOSE	–	.250	–	.049	1.57	.758	2.17	1.08	3.00	1.49	4.49	2.23	6.04	2.98	7.49	3.72	8.95	4.44						
3/8	PIPE-SCH 40	.675	.493	.091	.191	.39	2.98	.57	4.18	.86	5.96	1.05	8.94	1.69	11.92	4.27	14.9	5.78	16.9	2.7	.8	2.7	1.2	2.7	.6
	PIPE-SCH 80	.675	.423	.126	.140	.54	2.18	.74	3.06	1.10	4.36	1.34	6.54	1.97	8.72	5.19	10.9	7.20	13.1						
	HOSE	–	.375	–	.110	.685	1.71	.97	2.43	1.34	3.35	2.02	5.03	2.68	6.71	3.33	8.36	3.99	10.0						
1/2	PIPE-SCH 40	.840	.622	.109	.304	.24	4.74	.36	6.65	.49	9.48	.68	14.22	2.09	18.98	3.38	23.7	4.28	28.4	3.5	1.05	3.5	1.5	3.5	.75
	PIPE-SCH 80	.840	.147	.234	.30	3.65	.45	5.12	.71	7.30	.78	10.9	10.9	2.47	14.6	3.61	18.2	5.00	21.9	2.9	.9	2.9	1.4	2.9	.68
	PIPE-SCH XX	.840	.252	.294	.050	1.54	.78	2.19	1.09	3.08	1.56	3.65	2.34	6.13	3.12	7.48	3.90	9.55	4.68						
	HOSE	–	.500	–	.196	.387	3.03	.547	4.30	.755	5.94	1.13	8.90	2.4	11.9	3.15	15.3	4.5	17.7						
3/4	PIPE-SCH 40	1.050	.824	.113	.533	.14	8.32	.22	11.7	.27	16.6	.78	25.0	1.47	33.3	2.19	416	3.00	49.9	4.5	1.4	4.5	2.1	4.5	1.0
	PIPE-SCH 80	1.050	.742	.154	.432	.16	6.74	.26	9.45	.37	13.5	.87	20.2	1.71	27.0	2.48	33.7	3.52	40.4	4.0	1.2	4.0	1.6	4.0	.8
	PIPE-SCH XX	1.050	.434	.308	.148	.53	2.31	.67	3.24	1.05	4.62	1.31	6.93	1.94	9.24	5.06	11.6	7.02	13.9						
	HOSE	–	.750	–	.442	.171	6.82	.248	9.92	.336	13.4	.502	20.1	1.33	26.8	2.02	33.4	2.90	41.3						
1	PIPE-SCH 40	1.315	1.049	.133	.863	.10	13.5	.13	18.9	.34	26.9	.57	40.4	1.42	53.8	1.64	67.3	2.24	80.7	5.7	1.7	5.7	2.6	5.7	1.2
	PIPE-SCH 80	1.315	.957	.179	.719	.11	11.2	.15	15.7	.24	22.4	.62	33.6	1.23	44.8	1.84	56.1	2.93	67.3	5.2	1.6	5.2	2.5	5.2	1.1
	PIPE-SCH XX	1.315	.599	.358	.863	.26	4.39	.37	6.16	.53	8.78	.67	13.2	2.25	17.6	3.29	22.0	4.20	26.3	3.0	1.0	3.0	1.5	3.0	.75
	HOSE	–	1.00	–	.785	.097	12.2	.136	17.1	.194	24.4	.610	36.6	.987	48.8	1.51	61.2	2.02	73.4						
1-1/4	PIPE-SCH 40	1.660	1.380	.140	1.496	.05	23.4	.08	31.7	.25	46.7	.39	70.1	.78	93.4	1.18	117	1.47	140	7.5	2.4	7.5	3.7	7.5	1.6
	PIEP-SCH 80	1.660	1.278	.191	1.280	.07	20.0	.09	28.1	.26	39.9	.44	58.9	.85	79.8	1.27	99.8	1.80	120	7.0	2.1	7.0	3.5	7.0	1.5
	PIPE-SCH XX	1.660	.896	.382	.630	.13	9.83	.16	13.8	.24	19.7	.71	29.5	1.35	39.3	2.01	49.2	2.76	59.0	4.9	1.5	4.9	2.3	4.9	1.1
	HOSE	–	1.25	–	1.23	.062	19.1	.087	26.8	.125	38.2	.436	57.3	.738	76.4	1.08	95.5	1.52	115						
1-1/2	PIPE-SCH 40	1.900	1.610	.145	2.046	.04	31.8	.06	44.5	.19	63.5	.33	95.3	.64	127	.96	159	1.26	191	9.0	2.8	9.0	4.3	9.0	2.0
	PIPE-SCH 80	1.900	1.500	.200	1.767	.04	27.6	.06	38.6	.21	55.1	.42	82.7	.71	110	1.06	138	1.36	166	8.2	2.6	8.2	4.2	8.2	1.8
	PIPE-SCH XX	1.900	1.100	.400	.950	.09	14.8	.09	20.8	.32	29.6	.51	44.4	1.05	59.2	1.51	74.1	2.14	88.9	6.5	2.0	6.5	3.0	6.5	1.4
	HOSE	–	1.50	–	1.77	.044	27.7	.061	38.6	.180	55.1	.353	82.7	.59	110	.86	138	1.21	166						
2	PIPE-SCH 40	2.375	2.067	.154	3.355	.03	52.3	.08	73.4	.14	105	.24	159	.48	209	.69	262	.85	324	11.0	3.5	11.0	5.5	11.0	2.5
	PIPE-SCH 80	2.375	1.939	.218	2.953	.03	46.0	.09	64.6	.15	92.0	.26	138	.52	184	.73	230	.98	275	10.8	3.4	10.8	5.0	10.8	2.4
	PIPE-SCH XX	2.375	1.503	.436	1.773	.04	27.7	.12	38.8	.21	55.3	.36	82.9	.72	111	1.34	138	1.36	166	8.2	2.6	8.2	4.0	8.2	1.8
	HOSE	–	2.00	–	3.14	.024	48.9	.034	68.6	.123	97.8	.256	147	.41	196	.60	245	.80	293						
2-1/2	PIPE-SCH 40	2.875	2.469	.203	4.788	.03	74.8	.07	105	.11	149	.20	224	.37	299	.53	374	.72	449	14.0	4.2	14.0	6.5	14.0	3.0
	PIPE-SCH 80	2.875	2.323	.276	4.238	.03	66.1	.07	92.6	.12	132	.21	198	.39	264	.57	331	.87	397	13.0	4.0	13.0	6.1	13.0	2.9
	PIPE-SCH XX	2.875	1.771	.552	2.464	.03	38.5	.10	53.4	.17	76.9	.30	115	.59	154	.79	193	1.15	231	10.3	3.1	10.3	4.8	10.3	2.2
	HOSE	–	2.50	–	4.91	.016	76.5	.045	107	.09	153	.18	229	.30	306	.43	382	.617	459						

Orifice Pressure Drop

Approximate data. Based on specific gravity = 0.9, viscosity = 100 SSU.

$$Q(G.P.M.) = 24.12 \times A(SQ.\ IN.) \times \sqrt{PRESSURE\ DROP\ (P.S.I.)}$$



Pressure Conversion Table

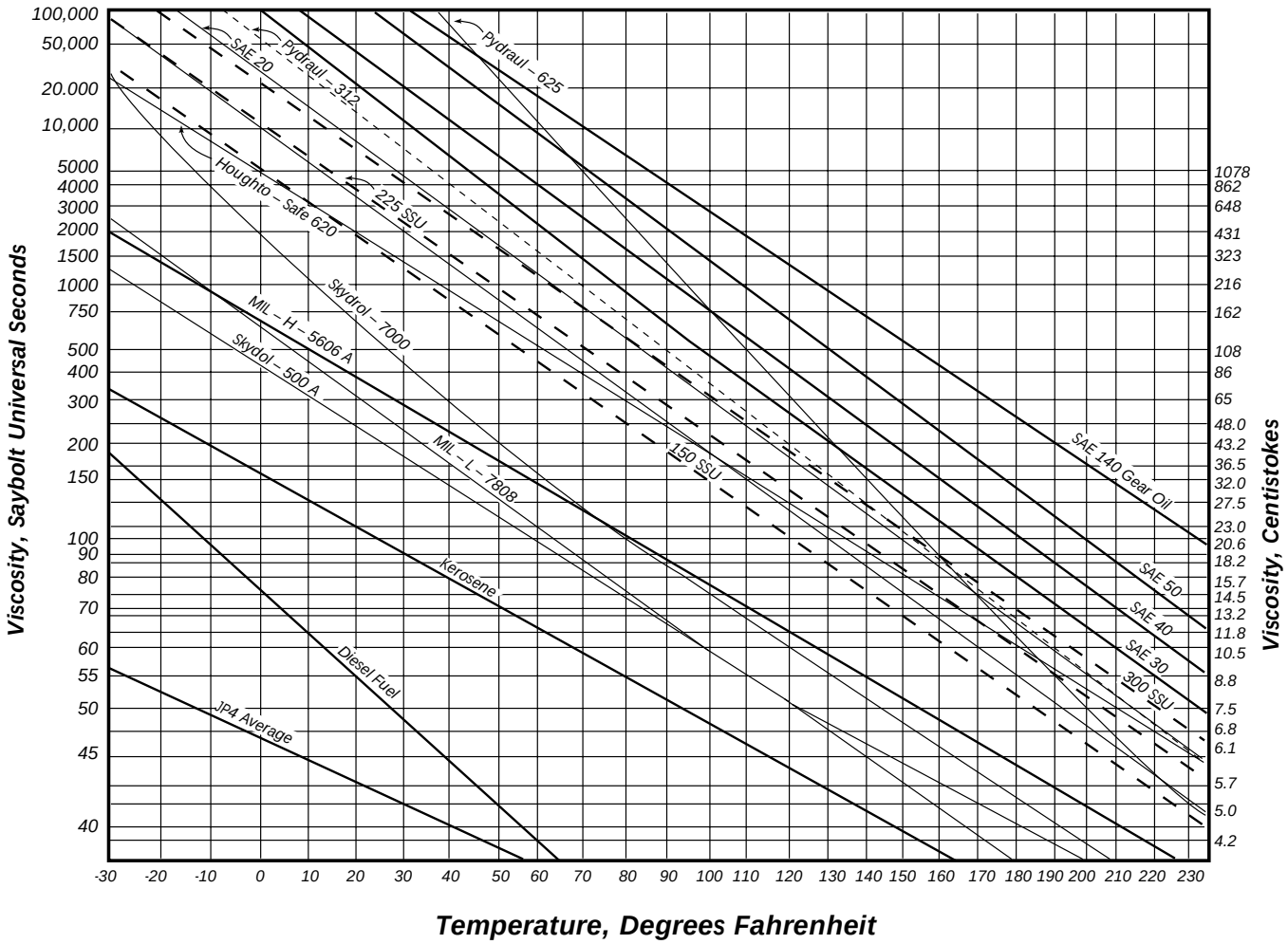
Multiply no. of ➡ by / to obtain ⬇	Atmospheres	Bars	Dynes/ cm^2	In. of Hg (0°C)	In. of H^2O(4°C)	kg/m^2	(psi)	Lb/in^2 Lb/ft^2	(torr)	mm of Hg Microns	Pascals
Atmospheres		9.86923 $X10^{-1}$	9.86923 X^{10-7}	3.34207 $X10^{-2}$	2.458 $X10^{-3}$	9.678 $X10^{-5}$	.068046	4.7254 $X10^{-4}$	1.316 $X10^{-3}$	1.316 $X10^{6}$	9.869 $X10^{6}$
Bars	1.01325		10^{-6} $X10^{-2}$	3.3864 $X10^{-3}$	2.491 $X10^{-5}$	9.8067	6.8948 $X10^{-2}$	4.788 $X10^{-4}$	1.333 $X10^{3}$	1.333 $X10^{6}$	10^{5}
Dyns/ cm^2	1.01325 X106	10^{6}		3.386 $X10^{4}$	2.491 $X10^{3}$	98.067	6.8948	478.8 $X10^{4}$	1.333	1.333 $X10^{3}$	10
In. of (0°C)	29.9213	29.53	2.953 $X10^{-5}$		7.355 $X10^{-2}$	2.896 $X10^{-3}$	2.036	.014139	3.937 $X10^{2}$	3.937 $X10^{5}$	2.953 $X10^{4}$
In. of H_20(4°C)	406.8	401.48	4.0148 $X10^{-4}$	13.60		3.937 $X10^{-2}$	27.68	.1922	.5354	5.354 $X10^{4}$	4.014 $X10^{3}$
kg/m^2	1.033227 $X10^{4}$	1.0197 $X10^{4}$	1.0197 $X10^{-2}$	345.3	25.40		7.0306 $X10^{2}$	4.882	13.59	13.59 $X10^{3}$	1.019 $X10^{1}$
Lb/in.2 (psi)	14.695595	14.4504	1.4504 $X10^{-5}$	.4912	3.6126 $X10^{-2}$	1.423 $X10^{-3}$		6.9444 $X10^{-3}$	1.934 $X10^{-2}$	1.934 $X10^{5}$	1.450 $X10^{4}$
Lb/f^{t2}	2116.22	2088.5	2.0885 $X10^{-3}$	70.726	5.202	.2048	144.0		2.7844	2.7844 $X10^{3}$	2.089 $X10^{2}$
mm of Hg (torr)	760	750.06	7.5006 $X10^{-4}$	25.400	1.868	7.3558 $X10^{-2}$	51.715	0.35913		10^{3}	7.502 $X10^{3}$
Microns	760 $X10^{3}$	750.06 $X10^{3}$	.75006	2.54 $X10^{4}$	1.868 $X10^{3}$	73.558	51.715 $X10^{3}$	359.1	$1X10^{3}$		7 502
Pascals	1.01325 $X10^{5}$	$1X10^{5}$	10^{-1}	3.386 $X10^{3}$	2.491 $X10^{2}$	9.8067	6.8948 $X10^{3}$	4.788 $X10^{1}$	1.333 $X10^{2}$	1.333 $X10^{1}$	

Screen Micron and Mesh Ratings

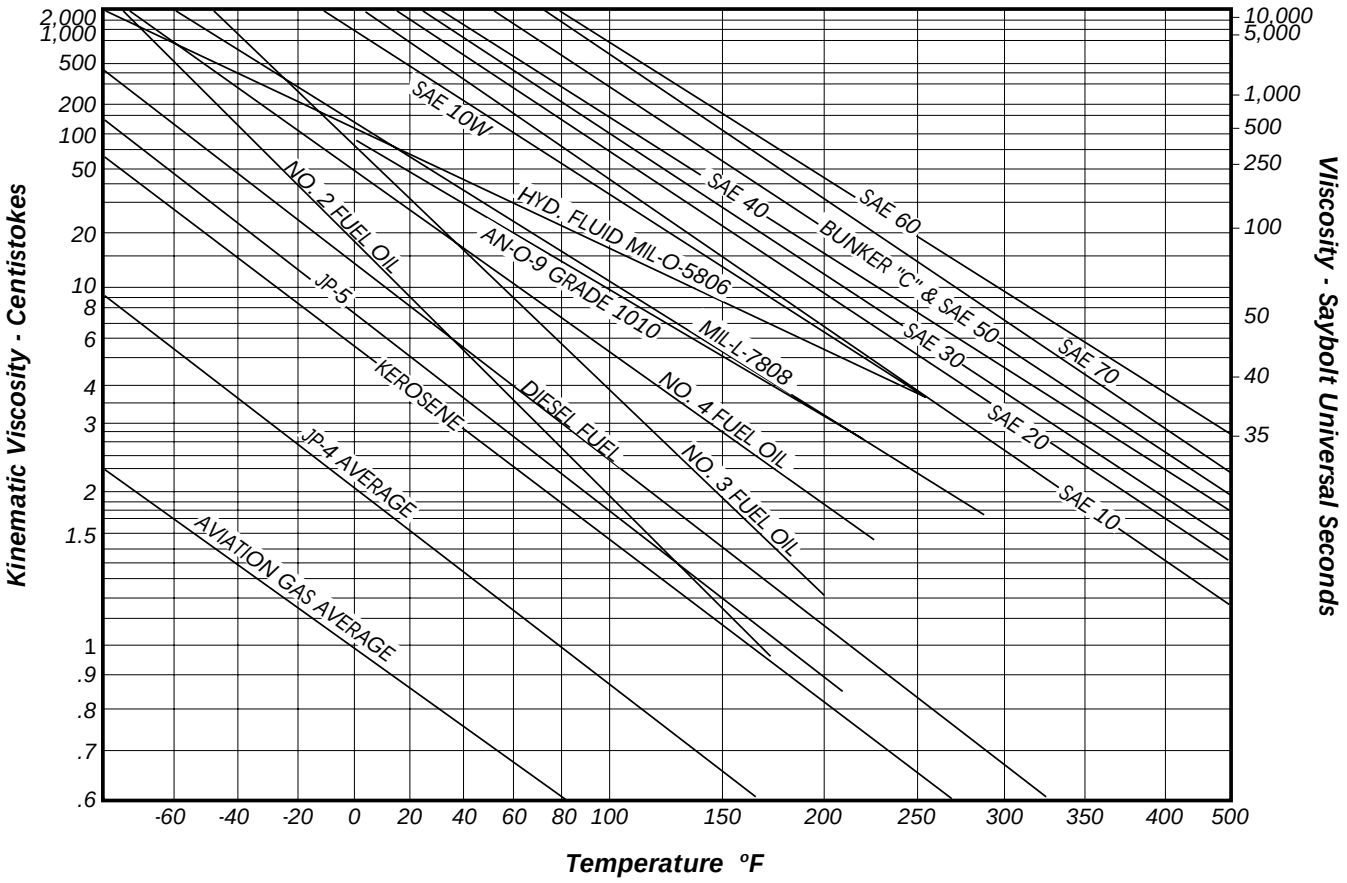
MICRON or MESH RATING	***ROSEDALE** MESH USED*	*MIN. BUBBLE POINT IN INCHES (H_2O)*
2 MICRON	*325X2300DT**	*12.0*
5 MICRON	*200X1400DT*	*9.5*
10 MICRON	*165X1400DT*	*6.0*
20 MICRON	*165X800DT*	*4.8*
40 MICRON	*80X700DT*	*3.5*
200 MESH	*200P***	-
150 MESH	*150P*	-
100 MESH	*100P*	-
80 MESH	*80P*	-
60 MESH	*60P*	-
40 MESH	*40P*	-

** DT = Dutch Twilled Weave **P = Plain Weave*

A.S.T.M. Standard Viscosity-Temperatures For Liquid Petroleum Products (D341-43)



Viscosity vs. Temperature

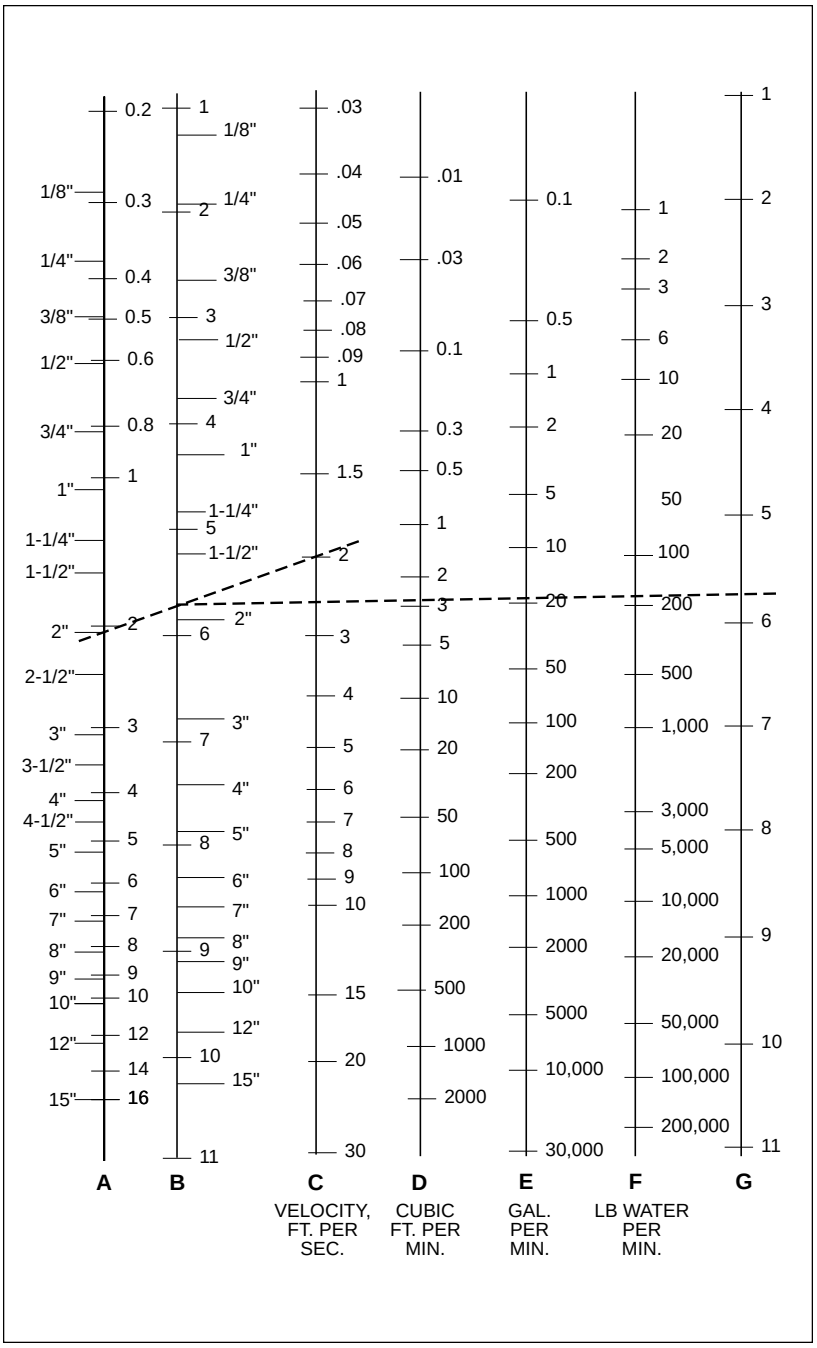


Flow Conversion Chart

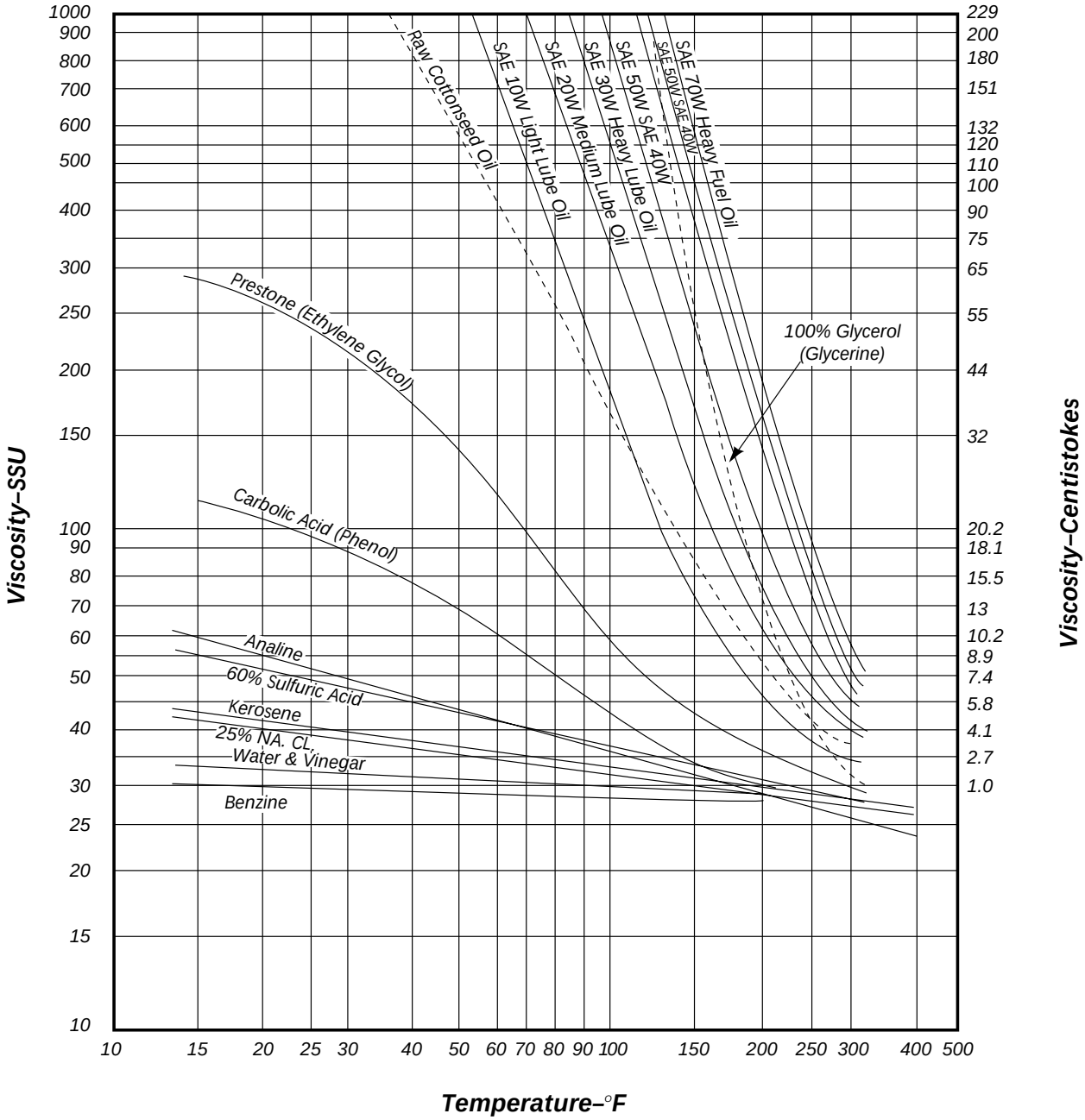
This Nomograph/Chart provides flow rate data in cubic feet per minute (column D), gallons per minute (column E). Or pounds of water per minute (column F) for inside pipe diameters from 0.2 to 16 inches for velocities from 0.03 to 30 feet per second (column C). Similarly, velocities may be determined from flow rates.

An example is shown for 2 inch standard pipe (2.07" ID) at 2 feet per second. A line is drawn connecting these two values in columns A and C. At it's intersection with column B a line is drawn horizontally using columns H1 and H2 for guidance. Flow rates are now seen in columns D, E, and F.

A second example uses 4 inch extra heavy pipe at 10 feet per second. A horizontal line is drawn to the left from column B to column A and this intersection is connected to the 10 feet per second location on column C. At the intersection of this slanting line with column B a horizontal line is drawn to show the flow rates resulting.

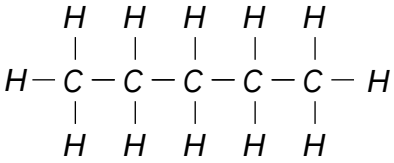


Viscosity vs. Temperature



Hydrophilic and Hydrophobic Materials

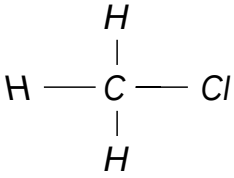
A hydrophobic compound, material, or molecule has no internal electron shift, so there is no point on the surface of the material which has an electrical charge. Many organic compounds are hydrophobic, or nonpolar. A good example: Pentane (a compound in gasoline)



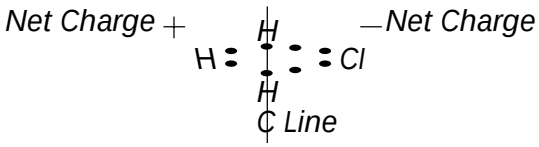
There is no electron shift from side-to-side or end-to-end. It is inert electrically.

As a consequence, it is not electrically attracted to another material. Polypropylene is electrically inert, and is a strongly hydrophobic material.

A hydrophilic material, compound, or molecule is one where there is a permanent electron shift within the composite. It is caused by certain atoms having a strong attraction of electrons. In a compound, Chlorine is a strong attractor of electrons, for example:



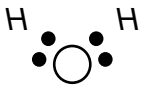
The actual electrons in this molecule bond are:



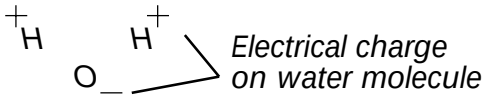
As you can see, the Cl (chloride) side of the molecule has a negative charge, and the other side has a positive charge. That's because chlorine has a stronger affinity for electrons than the hydrogen.

The minus side of the molecule will be attracted to any other material which has a plus location point. Vice versa for the plus hydrogen side.

Water, the commonest, and most important material in most systems, is polar:

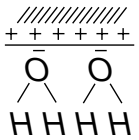


The electrons which make up the bond are more strongly attracted to the O (oxygen) atom, so there is a charge on the water molecule.

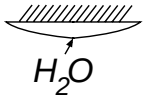


Since water is of fundamental importance, and is polar, other polar materials are attracted to it, and are called hydrophilic (water loving or attracting). Hydrophobic (water hating or repelling) materials are not attracted to water.

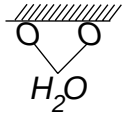
Water wets (spreads over the surface) of a hydrophilic material. The electrical attraction causes the work of adhesion to be greater than surface tension force:



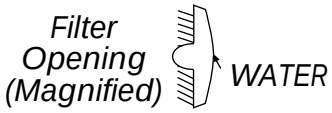
Hydrophilic surface:



On a hydrophobic surface:



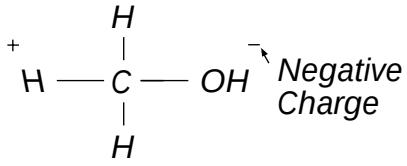
On a hydrophilic filter media surface, the attracting electrical charge wets the filter media and the water passes through easier.



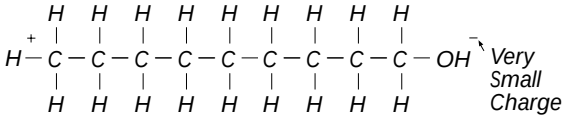
Materials (particles) suspended in the water are filtered with less distortion of the filter openings (or passages) and the filter removes smaller particles, easier.

"Polar" and "non-polar" varies from one extreme to the other. Polypropylene is very non-polar, a cotton bag is somewhat polar. Non-polar materials are less degraded (longer lived) by agreous materials. Polypropylene is more inert in most applications, but does not wet.

Methyl alcohol is fairly polar:



Caprillic alcohol less so:



MINUTES CONVERTED TO DECIMALS OF A DEGREE

MINUTE	DEGREE
1	.0166
2	.0333
3	.055
4	.0666
5	.0833
6	.1000
7	.1166
8	.1333
9	.1500
10	.1666
11	.1833
12	.2000
13	.2166
14	.2333
15	.2500
16	.2666
17	.2833
18	.3000
19	.3166
20	.3333
21	.3500
22	.3666
23	.3833
24	.4000
25	.4166
26	.4333
27	.4500
28	.4666
29	.4833
30	.5000
31	.5166
32	.5333
33	.5500
34	.5666
35	.5833
36	.6000
37	.6166
38	.6333
39	.6500
40	.666
41	.6833
42	.7000
43	.7166
44	.7333
45	.7500
46	.7666
47	.7833
48	.8000
49	.8166
50	.8333
51	.8500
52	.8666
53	.8833
54	.9000
55	.9166
56	.9333
57	.9500
58	.9666
59	.9833
60	1.0000

DECIMAL EQUIVALENTS OF FRACTIONS

INCHES	DECIMAL
1/64	.015625
1/32	.03125
3/64	.046875
1/20	.05
1/16	.0625
1/13	.0769
5/64	.078125
1/12	.0833
1/11	.0909
3/32	.09375
1/10	.10
7/64	.109375
1/9	.111
1/8	.125
9/64	.140625
1/7	.1429
5/32	.15625
1/6	.1667
11/64	.171875
3/16	.1875
1/5	.2
13/64	.203125
7/32	.21875
15/64	.234375
1/4	.25
17/64	.265625
9/32	.28125
19/64	.296875
5/16	.3125
21/64	.328125
1/3	.333
11/32	.34375
23/64	.359375
3/8	.375
25/64	.390625
13/32	.40625
27/64	.421875
7/16	.4375
29/64	.453125
15/32	.46875
31/64	.484375
1/2	.5
33/64	.515625
17/32	.53125
35/64	.546875
9/16	.5625
37/64	.578125
19/32	.59375
39/64	.609375
5/8	.625
41/64	.640625
21/32	.65625
43/64	.671875
11/16	.6875
45/64	.703125
23/32	.71875
47/64	.734375
3/4	.75
49/64	.765625
25/32	.78125
51/64	.796875
13/16	.8125
53/64	.828125
27/32	.84375
55/64	.859375
7/8	.875
57/64	.890625
29/32	.90625
59/64	.921875
15/16	.9375
61/64	.953125
31/32	.96875
63/64	.984375
1	1.

WATER PRESSURE (PSI) TO FEET OF HEAD

POUNDS PER SQUARE INCH	FEET HEAD
1	2.31
2	4.62
3	6.93
4	9.24
5	11.54
6	13.85
7	16.16
8	18.47
9	20.78
10	23.09
15	34.63
20	46.18
25	57.72
30	69.27
40	92.36
50	115.45
60	138.54
70	161.63
80	184.72
90	207.81
100	230.90
110	253.98
120	277.07
130	300.16
140	323.25
150	346.34
160	369.43
170	392.52
180	415.61
200	461.78
250	577.24
300	692.69
350	808.13
400	922.58
500	1154.48
600	1385.39
700	1616.30
800	1847.20
900	2078.10
1000	2309.00

Note: *One pound of pressure per sq. inch of water equals 2.309 feet of water at 62° F. To find the feet head of water for any pressure not given in the table, multiply the pressure pounds per sq. inch by 2.309*

WATER FEET OF HEAD TO PSI

FEET HEAD	POUNDS PER SQUARE INCH
1	.43
2	.87
3	1.30
4	1.73
5	2.17
6	2.60
7	3.03
8	3.46
9	3.90
10	4.33
15	6.50
20	8.66
25	10.83
30	12.99
40	17.32
50	21.65
60	25.99
70	30.32
80	34.65
90	39.98
100	43.31
110	47.64
120	51.97
130	56.30
140	60.63
150	64.96
160	69.29
170	73.63
180	77.96
200	86.62
250	108.27
300	129.93
350	151.58
400	173.24
500	216.55
600	259.85
700	303.16
800	346.47
900	389.78
1000	433.00

Note: *One foot of water at 62° F equals .433 pound pressure per sq. inch. To find the pressure per sq. inch for any feet head not given in the table, multiply the feet head by .433*

Rosedale Filter Vessel Data

MODEL	PRESSURE RATING PSI	WALL THK. inches	** VOLUME ENTIRE HOUSING inches³		VOLUME ABOVE BASKET TOP inches³		VOLUME BELOW BASKET TOP inches³	NO. OF LUG ASSY	NO. OF LUGS	LUG SIZE
4-6	200, 300, 500	.110, .120	151	-	58	=	93	1	3	1/2-13
4-12	200, 300, 500	.110, .120	237	-	58	=	179	1	3	1/2-13
6-12	150, 300	.109	498	-	131	=	367	1	3	5/8-11
6-18	150, 300	.109	656	-	131	=	525	1	3	5/8-11
6-30	150, 300	.109	970	-	131	=	839	1	3	5/8-11
	100, 125								N/A	N/A
8-15	100, 125, 150, 300	.109	1298	-	277	=	1021	1	3	5/8-11
8-30	100, 125, 150, 300	.109	2131	-	277	=	1854	1	3	5/8-11
	300								6	5/8-11
16-30	150	.188	6567	-	666	=	5901	2	5	7/8-9
18-30	150	.188	8508	-	1448	=	7060	3	5	7/8-9

Above this line vessels are "UM" stamp. Below this line vessels are "U" stamp unless specified otherwise or by special requirements.

"UM" Vessels not to exceed the following

1. 5 CU. FT. (FT^3) IN VOLUME AND 250 PSI DESIGN PRESSURE

OR

2. 1.5 CU. FT. (FT^3) IN VOLUME AND 600 PSI DESIGN PRESSURE

22-30	150	.188	13298	-	2425	=	10873	4	8	7/8-9
24-30	150	.188	16165	-	3041	=	13124	6	8	7/8-9
30-30	150	.250	26543	-	5411	=	21132	8	12	7/8-9
32-30	150	.250	30708	-	6392	=	24316	9	12	7/8-9
36-30	150	.313	40092	-	8743	=	31349	12	14	1-8
42-30	150	.313	57535	-	13305	=	44230	17	20	1-8
48-30	150	.375	78468	-	19069	=	59399	*24	24	1-8
60-30	150	.500		-		=		*35	24	1-1/4-7

** SPECIAL*

*** DOES NOT INCLUDE FLUID CAPACITY OF IN-OUT NOZZLES (ELBOWS, FLANGES, ETC).*

CONVERSION FORMULAS:

CAPACITY IN CUBIC FEET (ft^3) = 1728 in^3
CAPACITY IN GALLONS = 231 in^3
CAPACITY IN CUBIC FEET (ft^3) = GAL. x .1337
CAPACITY IN GALLON = ft^3 x 7.48
1 GALLON = 8.34 lb. x SPECIFIC GRAVITY
1 ft^3 = 62.4 lb. x SPECIFIC GRAVITY

Enclosure Types for Non-Hazardous Locations

Type	NEMA National Electrical Manufacturers Association (Nema Standard 250) and Electrical and Electronic Manufacturers Association of Canada (EEMAC) NEMA	Underwriters Laboratories Inc. (UL 50 and UL 508)	Canadian Standards Association (Standard C22.2 No. 94)
1	Enclosures are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment or locations where unusual service conditions do not exist.	Indoor use primarily to provide protection against contact with the enclosed equipment and against a limited amount of falling dirt.	General purpose enclosure. Protects against accidental contact with live parts.
2	Enclosures are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.	Indoor use to provide a degree of protection against limited amounts of falling water and dirt.	Indoor use to provide a degree of protection against dripping and light splashing of noncorrosive liquids and falling dirt.
3	Enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, and sleet; undamaged by the formation of ice on the enclosure.	Outdoor use to provide a degree of protection against windblown dust and windblown rain; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use provides a degree of protection against rain, snow, and windblown dust; undamaged by the external formation of ice on the enclosure.
3R	Enclosures are intended for outdoor use primarily to provide a degree of protection against falling rain and sleet; undamaged by the formation of ice on the enclosure.	Outdoor use to provide a degree of protection against falling rain; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use provides a degree of protection against rain and snow; undamaged by the external formation of ice on the enclosure.
4	Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose directed water; undamaged by the formation of ice on the enclosure.	Either indoor or outdoor use to provide a degree of protection against falling rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.	Indoor or outdoor use, provides a degree of protection against rain, snow, wind-blown dust, splashing and hose-directed water; undamaged by the external formation of ice on the enclosure.
4X	Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.	Either indoor or outdoor use to provide a degree of protection against falling rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure: resists corrosion.	Indoor or outdoor use provides a degree of protection against rain, snow, wind-blown dust, splashing and hose-directed water; undamaged by the external formation of ice on the enclosure: resist corrosion.
6	Enclosures are intended for use indoors or outdoors where occasional submersion is encountered.	Indoor or outdoor use to provide a degree of protection against entry of water during temporary submersion of a limited depth undamaged by the formation of ice on the enclosure.	Indoor or outdoor use provides a degree of protection against the entry of water during temporary submersion at a limited depth, undamaged by the external formation of ice on the enclosure, resists corrosion.
12	Enclosures are intended for use primarily to provide a degree of protection against dust, falling dirt and dripping noncorrosive liquids.	Indoor use to provide a degree of protection against dust, dirt, flying fibers, dripping water and external condensation of noncorrosive liquids.	Indoor use a degree of protection against circulating dust, lint, fibers and flyings. dripping and light splashing of noncorrosive liquids, not provided with knockouts.
13	Enclosures are intended for indoor use primarily to provide a degree of protection against dust, spraying of water, oil and noncorrosive coolant.	Indoor use to provide a degree of protection against lint, dust seepage, external condensation and spraying of water, oil and noncorrosive liquids.	Indoor use provides a degree of protection against circulation dust, lint, fibers and flyings, seepage and spraying of noncorrosive liquids, including oils and coolants.
	This material is reproduced with permission from NEMA. The preceding descriptions, however, are not intended to be complete representations of National Electrical Manufacturers Association standards for enclosures nor those of the Electrical and Electronic Manufacturers Association of Canada.	This material is reproduced with permission from Underwriters Laboratories Inc. Standard for Safety fir Cabinets and Boxes, UL 50, Copyright 1985 and Industrial Control Equipment, UL 508, Copyright 1984 by Underwriters Laboratories Inc. Underwriters Laboratories Inc. (UL) shall not be responsible to anyone for the use of or reliance upon a UL Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or connection with the use, interpretation of or reliance upon a UL Standard.	This material is reproduced with permission from the Canadian Standards Association.

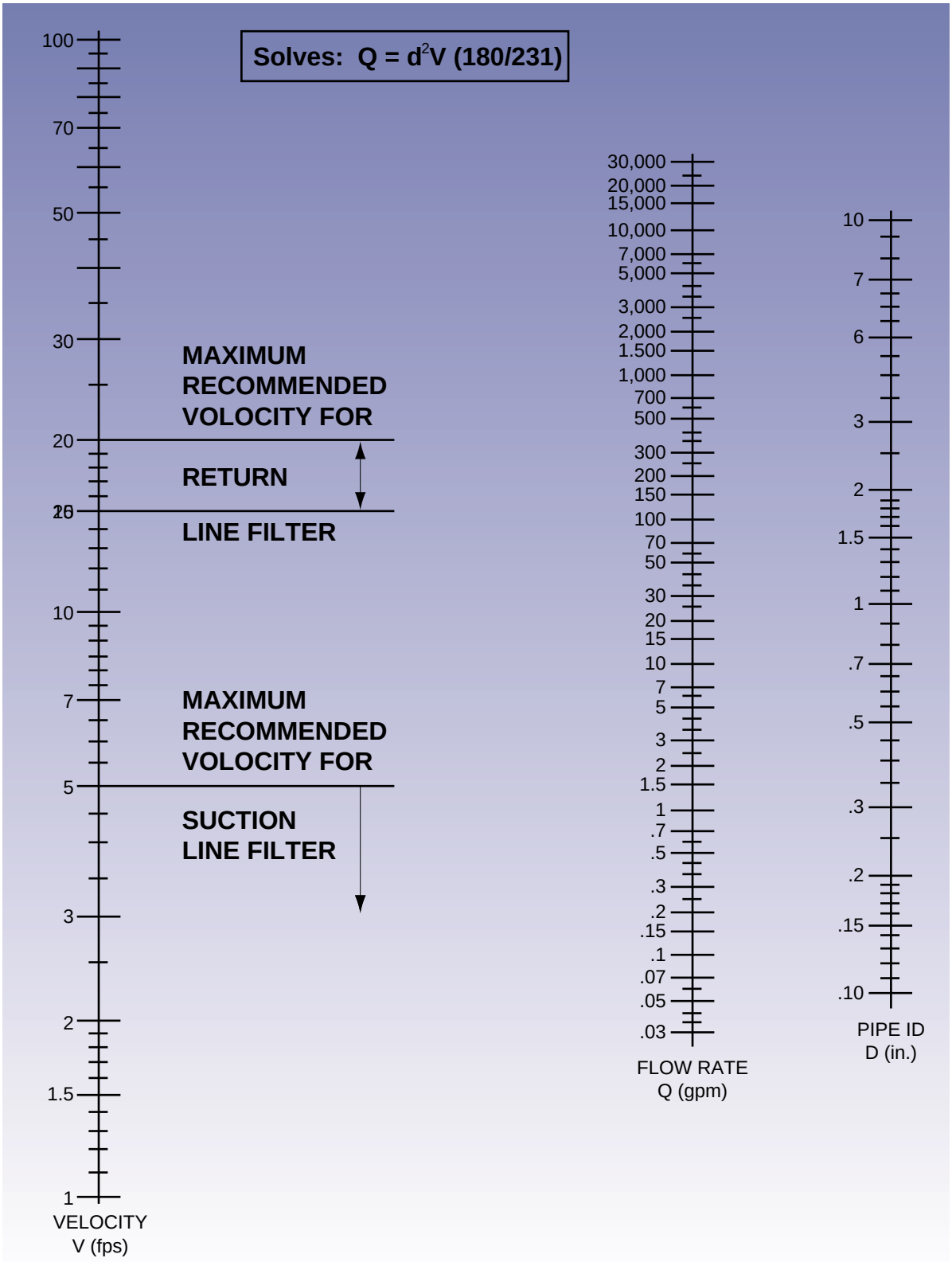
Comparison of Specific Non-Hazardous Applications

Indoor Locations

Provides a Degree of Protection Against the Following Environmental Conditions	Type of Enclosure 1*	2*	4	4X	5	6	6P	11	12	12K	13
Incidental contact with enclosed equipment	•	•	•	•	•	•	•	•	•	•	•
Falling dirt	•	•	•	•	•	•	•	•	•	•	•
Falling liquids and light splashing		•	•	•	•		•	•	•	•	•
Dust, lint, fibers, and flyings †			•	•	•	•	•		•	•	•
Hosedown and splashing water			•	•		•	•				
Oil and coolant seepage								•	•	•	
Oil or coolant spraying and splashing										•	
Corrosive agents				•			•	•			
Occasional temporary submersion						•	•				
Occasional prolonged submersion							•				

• These enclosures may be ventilated. However, Type I may not provide protection against small particles of falling dirt when ventilation is provided in the enclosure top. Consult Hoffman Engineering for more information. † These fibers and flyings are non-hazardous materials and are not considered Class III type ignitable fibers or combustible flyings. For Class III type ignitable fibers or combustible flyings see the National Electrical Code, Section 500-6(a).

Flow Rate in Pipe



ASME Coded Vessels

1. Full Vacuum: *All filter vessels are designed with Full Vacuum as a design condition. If the customer requires this, it can be documented. It is typically not stated on the ASME nameplate that the vessel is designed for Full Vacuum.*

2. Jacketed housings: *All standard filter vessels are designed with consideration of a jacket rated at 1/2 vessel pressure (ex. 150 psi vessel, 75 psi jacket) without modifying the body shell. This condition is valid for a body shell jacket only; any other type of jacket or pressure ratings may not meet the code requirements (ex. full jacket, head & body), please consult Engineering.*

3. Canadian Registry: *We hold several "CRN" (Canadian Registration Number) registration numbers for our vessels in Ontario and British Columbia. Please consult Engineering for this list. To obtain a "CRN", each province has its own requirements and timetable, consult Engineering.*

4. Closure Assemblies: *Our standard closure assembly for all of our products conform to ASME specification (rod end and clevis pins meet SA-193-B7, eyenuts meet SA-194-2H). Some of our customers request different materials. The only other available material is a 304 stainless steel closure, which is available in all sizes.*

5. Welded Attachments: *Welded attachments to 316 S.S. vessels (legs, lugs, davit arm bracket, lifting rod, nameplate bracket, etc.) are typically 304 series stainless steel unless specified by customer.*

Rosedale Products Basket Data

BASKET STYLE	STRAINER BASKET AREA ft^2	FILTER BAG BASKET AREA ft^2	STRAINER BASKET VOLUME GAL.	FILTER BAG BASKET VOLUME GAL.
4-6 4-12	.5 1.0	.5 1.0	.30 .60	.30 .60
6-12 6-18 6-30	1.4 2.0 3.3	1.4 2.0 3.3	.97 1.50 2.54	.97 1.50 2.54
8-15 8-30	1.7 4.4	2.0 4.2	1.87 4.71	2.31 4.63
MULTI	4.4	4.2	4.56	4.49
LCO	5.6	5.6	6.0	6.0

CONVERSION FORMULAS:

CAPACITY IN CUBIC FEET (ft^3) = in. 3/1728
CAPACITY IN CUBIC FEET (ft^3) = GAL. x .1337
CAPACITY IN GALLONS = in^3/231
CAPACITY IN GALLONS = ft^3 x 7.48
1 GALLON = 8.34 lb. x SPECIFIC GRAVITY
1 ft^3 = 62.4 lb. x SPECIFIC GRAVITY

Temperature Data

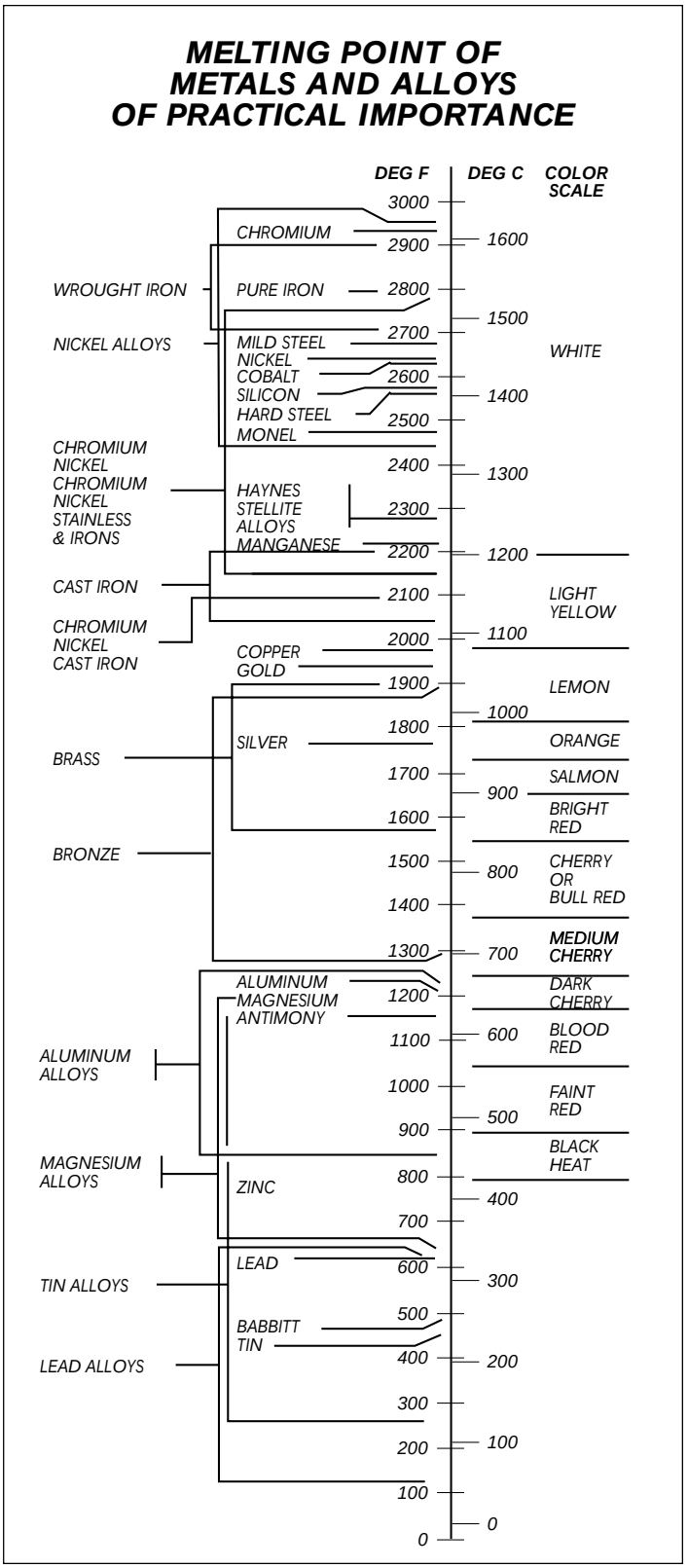
The accompanying chart not only lists the melting points of various alloys and metals but also serves as a convenient means for conversion between Centigrade and Fahrenheit temperature scales. In addition, on the far right of the scale are shown the color designations that are commonly used in judging the temperatures of hot metal by color.

Melting Points

This chart should prove useful to all welding operators for it contains basic information on working with metals at elevated temperatures. Reference to the chart, for instance, shows why aluminum and aluminum alloys, because of their low melting points, give little or no indication by change in color when they approach welding heat. On the other hand, the high melting point of wrought iron explains why considerably more heat is required to weld this metal than is required for cast iron, for instance.

Temperature Color Scale

Another use for the chart is in estimating the temperature by color. For instance, instructions may require that the part be preheated to 1,100 deg. F. before welding. If you are without a thermocouple or other means for accurately measuring high temperatures, reference to the chart shows the part, at 1,100 deg. F. would have a blood-red color. With a little experience, you can estimate this fairly closely by eye. In this connection, it should be mentioned that the color scale is for observations made in a fairly



dark place and without welding goggles. As the light increases, the color groups on the scale will apply to higher temperatures.

Conversion Data

Finally, the chart is a ready means for converting Fahrenheit to Centigrade, and vice versa. Suppose you are familiar with the Fahrenheit scale, yet instructions call for the quenching of a welded part from 900 deg. C. Reference to the chart shows this to be approximately 1,650 deg. F.

(Stuff You Probably Know)

1. PASCAL'S LAW: Pressure exerted on a confined fluid is transmitted undiminished in all directions and acts with equal force on all equal areas and at right angles to them.

2. Hydraulics is a means of power transmission.

3. Work is force acting through a distance.
WORK = FORCE X DISTANCE.
***Example:** Work (in. lbs.) = Force (lbs.) x Distance (in.)*

4. Power is the rate of doing work.

$$\text{Power} = \frac{\text{Work}}{\text{Time}} = \frac{\text{Force x Distance}}{\text{Time}}$$

5. The force (pounds) exerted by a piston can be determined by multiplying the piston area (square inches) by the pressure applied. (PSI)

$$\text{Force} = \text{Pressure x Area}$$

(To find the area, square the diameter and multiply by .7854) $A = D^2 \times .7854$ or

$$\text{Area} = \text{Diameter}^2 \times .7854$$

6. To determine the volume (cubic inches) required to move a piston a given distance, multiply the piston cross sectional area (sq. Inches) by the stroke required (inches).

Volume = Area x L

7. Hydraulic oil serves as a lubricant and is practically non-compressible. It will compress approximately .4 of 1% at 1000 PSI and 1.1% at 3000PSI. at 120°F.

8. The weight of hydraulic oil may vary with a change in viscosity, however, 55 to 58 lbs. per cubic foot covers the viscosity range from 150 SSU to 900 SSU at 100°F.

9. Pressure at the bottom of a one foot column of oil will be approximately 0.4 PSI. To find the approximate pressure in psi at the bottom of any column of oil, multiply the height in feet by 0.4.

10. Atmospheric pressure equals 14.7 PSIA at sea level. ΔP means pressure difference.

11. Gage readings do not include atmospheric pressure unless marked PSIA.

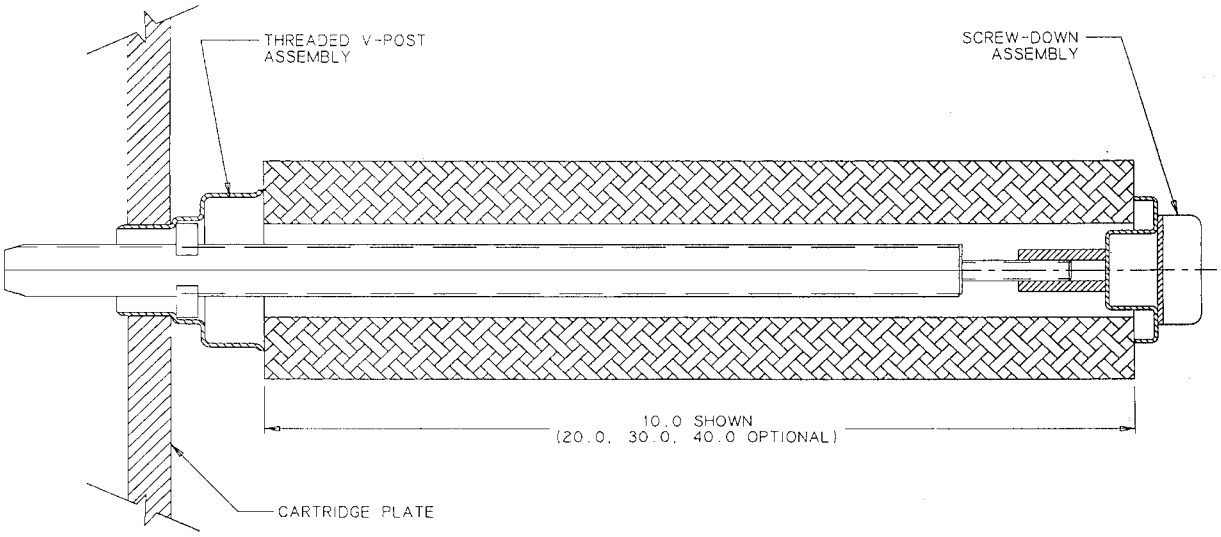
12. There must be a pressure drop (pressure difference) across an orifice or restriction to cause flow through it. Conversely, if there is no flow there will be no pressure drop.
$F = P \times A$

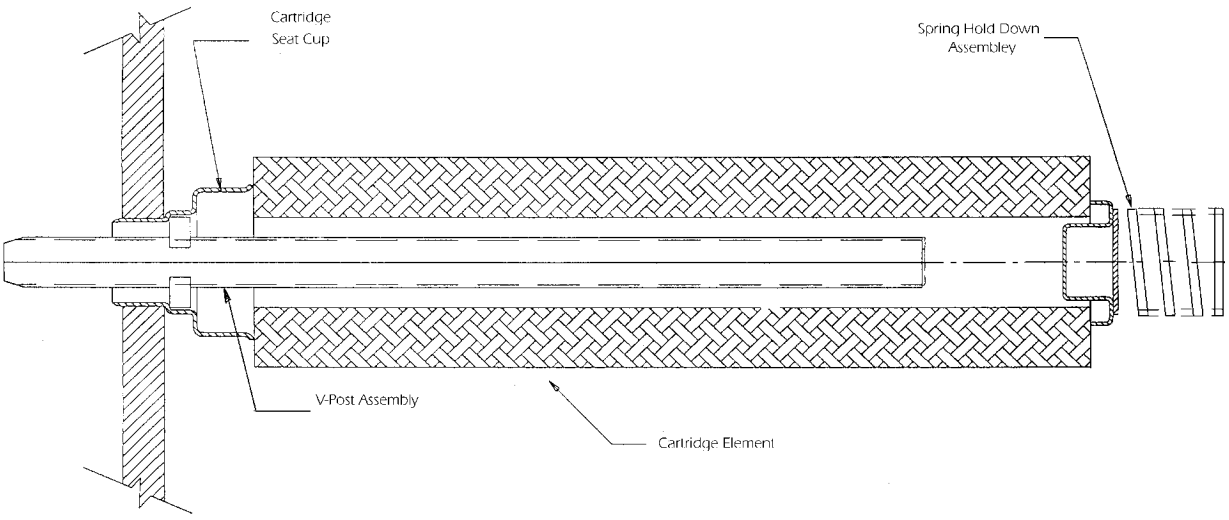
13. A fluid is pushed, not drawn, into a pump. If pumping from an open reservoir, atmospheric pressure pushes the fluid into the pump. Some pumps are used specifically to create pressure, any resulting flow is incidental.

14. A pump does not pump pressure; its purpose is to create flow. Pumps used to transmit power are usually positive displacement type.

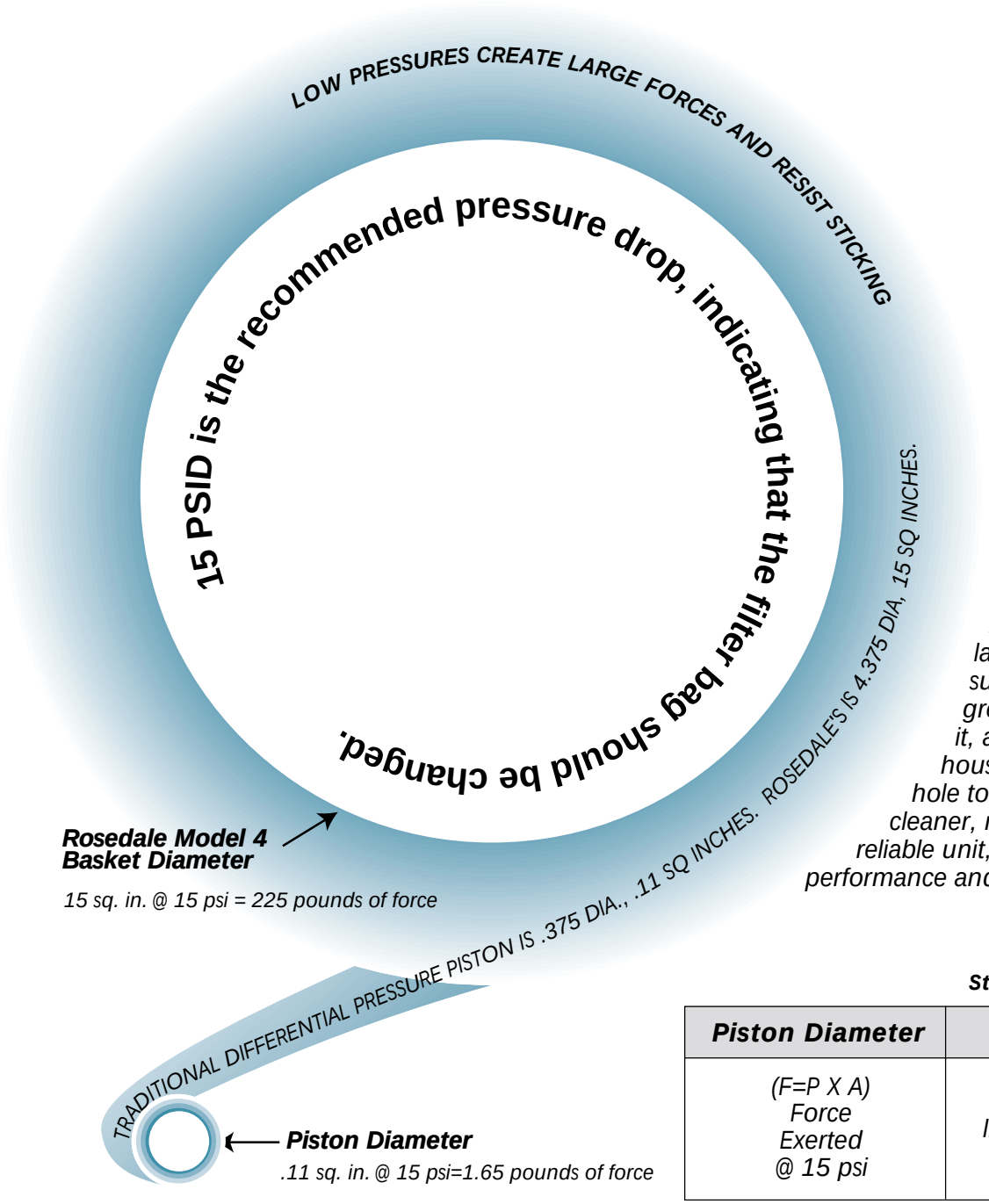
15. Pressure is caused by resistance to flow. A pressure gage indicates the pressure in some unit as psi.

Rosedale Cartridge Sealing Options For Standard Vessels





Force Equals Pressure Times Area



Most differential pressure indicators use a small piston connected through a small hole in the side of the filter. This hole could clog, or the small piston could easily be blocked or restricted. Rosedale's piston is much larger in diameter and surface area, requiring a greater blockage to restrict it, and since it is inside the housing, there is no outside hole to clog. It produces a cleaner, more accurate and reliable unit, providing excellent performance and value.

	Standard	Rosedale Model 4
Piston Diameter	**.38**	**4.38**
(F=P X A) Force Exerted @ 15 psi	*1.65 lbs. of force*	*225.00 lbs. of force*

Properties of American National Standard Schedule 40 and 80 Welded and Seamless Wrought Steel Pipe

Properties of American National Standard Schedule 40 Welded and Seamless Wrought Steel Pipe

Diameter, Inches			Wall Thickness (Inches)	Cross-Sectional Area of Metal	Weight per Foot, Pounds		Capacity per Foot of Length		Length of Pipe in Feet to Contain		Properties of Sections		
Nominal	Actual Inside	Actual Outside			Of Pipe	Of Water in Pipe	In Cubic Inches	In Gallons	One Cubic Foot	One Gallon	Moment Of Inertia	Radius of Gyration	Section Modulus
1/8	0.269	0.405	0.068	0.072	0.24	0.025	0.682	0.003	2532.	338.7	0.00106	0.122	0.00525
1/4	0.364	0.540	0.088	0.125	0.42	0.045	1.249	0.005	1384.	185.0	0.00331	0.163	0.01227
3/8	0.493	0.675	0.091	0.167	0.57	0.083	2.291	0.010	754.4	100.8	0.00729	0.209	0.02160
1/2	0.622	0.840	0.109	0.250	0.85	0.123	3.646	0.016	473.9	63.35	0.01709	0.261	0.04070
3/4	0.824	1.050	0.113	0.333	1.13	0.231	6.399	0.028	270.0	36.10	0.03704	0.334	0.07055
1	1.049	1.315	0.133	0.494	1.68	0.374	10.37	0.045	166.6	22.27	0.08734	0.421	0.1328
1-1/4	1.380	1.660	0.140	0.669	2.27	0.648	17.95	0.078	96.28	12.87	0.1947	0.539	0.2346
1-1/2	1.610	1.900	0.145	0.799	2.72	0.882	24.43	0.106	70.73	9.456	0.3099	0.623	0.3262
2	2.067	2.375	0.154	1.075	3.65	1.454	40.27	0.174	42.91	5.737	0.6658	0.787	0.5607
2-1/2	2.469	2.875	0.203	1.704	5.79	2.074	57.45	0.249	30.08	4.021	1.530	0.947	1.064
3	3.068	3.500	0.216	2.228	7.58	3.202	88.71	0.384	19.48	2.604	3.017	1.163	1.724
3-1/2	3.548	4.000	0.226	2.680	9.11	4.283	118.6	0.514	14.56	1.947	4.788	1.337	2.394
4	4.026	4.500	0.237	3.174	10.79	5.515	152.8	0.661	11.31	1.512	7.233	1.510	3.215
5	5.047	5.563	0.258	4.300	14.62	8.666	240.1	1.04	7.198	0.9622	15.16	1.878	5.451
6	6.065	6.625	0.280	5.581	18.97	12.52	346.7	1.50	4.984	0.6663	28.14	2.245	8.496
8	7.981	8.625	0.322	8.399	28.55	21.67	600.3	2.60	2.878	0.3848	72.49	2.938	16.81
10	10.020	10.750	0.365	11.91	40.48	34.16	946.3	4.10	1.826	0.2441	160.7	3.674	29.91
12	11.938	12.750	0.406	15.74	53.52	48.49	1343.	5.81	1.286	0.1720	300.2	4.364	47.09
16	15.000	16.000	0.500	24.35	82.77	76.55	2121.	9.18	0.8149	0.1089	732.0	5.484	91.50
18	16.876	18.000	0.562	30.79	104.7	96.90	2684.	11.62	0.6438	0.0861	1172.	6.168	130.2
20	18.812	20.000	0.594	36.21	123.1	120.4	3335.	14.44	0.5181	0.0693	1706.	6.864	170.6
24	22.624	24.000	0.688	50.39	171.3	174.1	4824.	20.88	0.3582	0.0479	3426.	8.246	285.5
32	30.624	32.000	0.688	67.68	230.1	319.1	8839.	38.26	0.1955	0.0261	8299.	11.07	518.7

Note: Torsional Section Modulus Equals Twice Section Modulus.

Properties of American National Standard Schedule 80 Welded and Seamless Wrought Steel Pipe

Diameter, Inches			Wall Thickness (Inches)	Cross-Sectional Area of Metal	Weight per Foot, Pounds		Capacity per Foot of Length		Length of Pipe in Feet to Contain		Properties of Sections		
Nominal	Actual Inside	Actual Outside			Of Pipe	Of Water in Pipe	In Cubic Inches	In Gallons	One Cubic Foot	One Gallon	Moment Of Inertia	Radius of Gyration	Section Modulus
1/8	0.215	0.405	0.095	0.093	0.315	0.016	0.436	0.0019	3966.	530.2	0.00122	0.115	0.00600
1/4	0.302	0.540	0.119	0.157	0.537	0.031	0.860	0.0037	2010.	268.7	0.00377	0.155	0.01395
3/8	0.423	0.675	0.126	0.217	0.739	0.061	1.686	0.0073	1025.	137.0	0.00862	0.199	0.02554
1/2	0.546	0.840	0.147	0.320	1.088	0.101	2.810	0.0122	615.0	82.22	0.02008	0.250	0.04780
3/4	0.742	1.050	0.154	0.433	1.474	0.187	5.189	0.0225	333.0	44.52	0.04479	0.321	0.08531
1	0.957	1.315	0.179	0.639	2.172	0.312	8.632	0.0374	200.2	26.76	0.1056	0.407	0.1606
1-1/4	1.278	1.660	0.191	0.881	2.997	0.556	15.39	0.0667	112.3	15.01	0.2418	0.524	0.2913
1-1/2	1.500	1.900	0.200	1.068	3.631	0.766	21.21	0.0918	81.49	10.89	0.3912	0.605	0.4118
2	1.939	2.375	0.218	1.477	5.022	1.279	35.43	0.1534	48.77	6.519	0.8680	0.766	0.7309
2-1/2	2.323	2.875	0.276	2.254	7.661	1.836	50.86	0.2202	33.98	4.542	1.924	0.924	1.339
3	2.900	3.500	0.300	3.016	10.25	2.861	79.26	0.3431	21.80	2.914	3.895	1.136	2.225
3-1/2	3.364	4.000	0.318	3.678	12.50	3.850	106.7	0.4617	16.20	2.166	6.280	1.307	3.140
4	3.826	4.500	0.337	4.407	14.98	4.980	138.0	0.5972	12.53	1.674	9.611	1.477	4.272
5	4.813	5.563	0.375	6.112	20.78	7.882	218.3	0.9451	7.915	1.058	20.67	1.839	7.432
6	5.761	6.625	0.432	8.405	28.57	11.29	312.8	1.354	5.524	0.738	40.49	2.195	12.22
8	7.625	8.625	0.500	12.76	43.39	19.78	548.0	2.372	3.153	0.422	105.7	2.878	24.52
10	9.562	10.750	0.594	18.95	64.42	31.11	861.7	3.730	2.005	0.268	245.2	3.597	45.62
12	11.374	12.750	0.688	26.07	88.63	44.02	1219.	5.278	1.417	0.189	475.7	4.271	74.62
14	12.500	14.000	0.750	31.22	106.1	53.16	1473.	6.375	1.173	0.157	687.4	4.692	98.19
16	14.312	16.000	0.844	40.19	136.6	69.69	1931.	8.357	0.895	0.120	1158.	5.366	144.7
18	16.124	18.000	0.938	50.28	170.9	88.46	2450.	10.61	0.705	0.094	1835.	6.041	203.9
20	17.938	20.000	1.031	61.44	208.9	109.5	3033.	13.13	0.570	0.076	2772.	6.716	277.2
22	19.750	22.000	1.125	73.78	250.8	132.7	3676.	15.91	0.470	0.063	4031.	7.391	366.4

Note: Torsional Section Modulus Equals Twice Section Modulus.

Hardness-Tensile Strength Conversion Chart For Steels

Hardness Number								Tensile Strength,
Vickers[a]	Brinell[b]		Rockwell				Shore	
	Steel Ball	WC Ball	A[c]	B[d]	C[e]	D[f]		
680	. . .	638	80.8	. . .	59.2	70.1	80	329
640	. . .	601	79.8	. . .	57.3	68.7	77	309
600	. . .	564	78.6	. . .	55.2	67.0	74	289
550	505	517	77.0	. . .	52.3	64.8	. . .	264
500	465	471	75.3	. . .	49.1	62.2	66	240
480	448	452	74.5	. . .	47.7	61.3	64	230
460	433	433	73.6	. . .	46.1	60.0	62	220
440	415	415	72.8	. . .	44.5	58.8	59	210
420	397	397	71.8	. . .	42.7	57.5	57	200
400	379	379	70.8	. . .	40.8	56.0	55	190
390	369	369	70.3	. . .	39.8	55.2	. . .	185
380	360	360	69.8	(110.0)	38.8	54.4	52	180
370	350	350	69.2	. . .	37.7	53.6	. . .	175
360	341	341	68.7	(109.0)	36.6	52.8	50	170
350	331	331	68.1	. . .	35.5	51.9	. . .	166
340	322	322	67.6	(108.0)	34.4	51.1	47	161
330	313	313	67.0	. . .	33.3	50.2	. . .	156
320	303	303	66.4	(107.0)	32.2	49.4	45151	
310	294	294	65.8	. . .	31.0	48.4	. . .	146
300	284	284	65.2	(105.5)	29.8	47.5	42	141
295	280	280	64.8	. . .	29.2	47.1	. . .	139
290	275	275	64.5	(104.5)	28.5	46.5	41	136
285	270	270	64.2	. . .	27.8	46.0	. . .	134
280	265	265	63.8	(103.5)	27.1	45.3	40	131
275	261	261	63.5	. . .	26.4	44.9	. . .	129
270	256	256	63.1	(120.0)	25.6	44.3	38	126
265	252	252	62.7	. . .	24.8	43.7	. . .	124
260	247	247	62.4	(101.0)	24.0	43.1	37	121
255	243	243	62.0	. . .	23.1	42.2	. . .	119
250	238	238	61.6	99.5	22.2	41.7	36	116
245	233	233	61.2	. . .	21.3	41.1	. . .	114
240	228	228	60.7	98.1	20.3	40.3	34	111
230	219	219	. . .	96.7	(18.0)	. . .	33	106
220	209	. . .	95.0	(15.7)	. . .	32	101	
210	200	200	. . .	93.4	(13.4)	. . .	30	97
200	190	190	. . .	91.5	(11.0)	. . .	29	92
190	181	181	. . .	89.5	(8.5)	. . .	28	88
180	171	171	. . .	(6.0)	. . .	26	84	
170	162	162	. . .	85.0	(3.0)	. . .	25	79
160	152	152	. . .	81.7	(0.0)	. . .	24	75
150	143	143	. . .	78.7	. . .	. . .	22	71
140	133	133	. . .	75.0	. . .	. . .	21	66
130	124	124	. . .	71.2	. . .	. . .	20	62
120	114	114	. . .	66.7	. . .	. . .	. . .	57
110	105	105	. . .	62.3	. . .	. . .	. . .	. . .
100	95	95	. . .	56.2	. . .	. . .	. . .	. . .
95	90	90	. . .	52.0	. . .	. . .	. . .	. . .
90	86	86	. . .	48.0	. . .	. . .	. . .	. . .
85	81	81	. . .	41.0	. . .	. . .	. . .	. . .

a. Diamond pyramid indenter; 5-120 kg load. b. 10mm diameter ball, hardened steel or tungsten carbide; 3,000 kg load. c. Brale (diamond cone) indenter; 60 kg load. d. 1/16-inch diameter steel ball; 100 kg load. e. Brale (diamond cone) indenter; 150 kg load. f. Brale (diamond cone) indenter; 100 kg load. g. Sclerosope; Diamond-tipped hammer.

Note: Vickers, Brinell, and Rockwell tests indicate hardness by indentation measurements; Shore test indicates hardness by height of rebond. Values in parentheses are approximate. Reference: ASM Metals Handbook, 8th Edition, Vol 11, Nondestructive Inspection and Quality Control.

Recommended Maximum ΔP for Standard Rosedale Baskets

The recommended maximum operating ΔP for standard Rosedale Baskets is 15-20 psid. The baskets should not fail catastrophically until they reach a ΔP of 60-70 psid. We must consider the fact that there is a rapid rise in ΔP once the differential pressure reaches 30 psid. The time required for the ΔP to increase from 30 psid to 60-70 psid is very short (the actual time depends on many factors, dirt load, viscosity, etc.), this is why it is recommended that the filter basket be serviced at a differential of 15-20 psid.

If cyclical loadings or pulses must be considered, a reduction in the recommended maximum ΔP should be taken (reduction dependent on severity of pulse, viscosity, etc.). These pressure spikes will adversely affect the integrity of the filter basket.

The above information is for filter baskets only. If a filter bag is utilized, it is critical that the ΔP never exceeds 15 psid. A filter bag can not withstand a high differential pressure.

Radiography

Radiography is one of the methods of NDE (Non Destructive Examination) tools utilized in the fabrication of pressure vessels (i.e., Rosedale Filter Vessels). Radiography is a tool used to verify that the welds of the pressure vessel are within allowable quality limits.

The "ASME Code Section VIII, Division 1 Pressure Vessels" gives guidelines for the use of radiography. Radiography is required in Code fabrication for vessels used to contain lethal substances (Lethal Service), when weld joints exceed thickness limits and in unfired steam boilers. For all of Rosedale's standard filter vessels, radiography is not a Code requirement.

When designing a pressure vessel, joint efficiencies are established based on the degree of radiographic examination (Full, Spot or None). Higher joint efficiencies are assigned to higher degrees of examination. Determining the joint efficiency is one design parameter that is critical to optimizing the design of a pressure vessel. This optimization allows for the most economical and efficient usage of components to fabricate the pressure vessel. Therefore, Rosedale can provide a competitively priced filter vessel based on your requirements.

The ASME Code defines several levels of examination. These defined below:

RT-1 Full Radiography

When the complete vessel satisfies the full radiography requirements of UW-11(a) and when the spot radiography provisions of UW-11(a)(5) have not been applied.

RT-2 Full Radiography

When the complete vessel satisfies the full radiography requirements of UW-11(a)(5) and when the spot radiography provisions of UW-11(a)(5)(b) have been applied.

RT-3 Spot Radiography

When the complete vessel satisfies the spot radiography requirements of UW-11(b).

RT-4 Radiography by Designer

When only part of the vessel has satisfied the radiographic requirements of UW-11(a) or when none of the markings RT-1, RT-2, or RT-3 are applicable.

The implications of each of the above levels of radiography can vary depending on the design of your filter vessel. The interpretation of what is required should be determined by Rosedale's engineering staff.

These definitions can also be misleading because of changes in definitions over the years by ASME, misinterpretation of "Full" vs. "Spot" radiography requirements, and customer defined radiography requirements.

Often customers, engineering firms, or end users will specify radiography or other NDE requirements beyond what is specified by the ASME Code. Rosedale can ensure compliance with the requirements of the ASME Code or customers specifications.

Glossary

A

ABRASION: *Migration of foreign material which enters the fluid stream from system components that wear from close tolerances, vibration, or shock.*

ABRASIVE: *Any solid material, such as grit, with erosive properties.*

ABRASIVES: *Hard structurally strong solid.*

ABSOLUTE: *An arbitrary term used to describe or define a degree of filtration. The filtration industry uses various methods of determining absolute ratings which are not necessarily interchangeable. Generally absolute references 100% removal of solids (glass beads) above a specified micron rating on a single pass basis. See nominal.*

ABSOLUTE: *The sum of gage pressure and atmospheric pressure.*

ABSORB: *To take up by cohesive, chemical or molecular action.*

ABSORBENT: *A filter medium that holds contaminants by mechanical means. When one substance soaks completely through another, sometimes undergoing a chemical change.*

ACIDITY: *The quality, state, or degree of being acid. In lubricating oils, acidity denotes the presence of acid-type constituents whose concentration is usually defined in terms of a neutralization number. The constituents vary in nature and may or may not markedly influence the behavior of the fluid.*

ADDITIVE: *A material, usually chemical, added to a product to impart new or unusual characteristics or to improve existing characteristics.*

ADSORB: *To take up by adhesion of molecules of gases or dissolved substances to the surface of solid bodies, resulting in high concentration of the gas or solution at place of contact. Gas or solution is condensed on the surface of the adsorbent, while in adsorption, the material absorbed penetrates throughout the mass of absorbent.*

ADSORBATE: *The material which is adsorbed; i.e., the gas, vapor, or liquid which adheres or is chemically attracted to the surface of the solid.*

ADSORBENT: *A material which adsorbs; i.e., the solid which attracts and holds on its surface the gas, vapor, or liquid. Also materials added to liquors to decolorize or purify by adsorbing the color or impurity. Fuller's earth, activated carbon, activate alumina, etc. are all adsorbents.*

ADSORBENT: *A filter medium primarily intended to hold soluble and insoluble contaminants on its surface by molecular adhesion - no chemical change.*

ADSORPTION: *The natural phenomenon of a gas, vapor, or liquid being attracted to and held on the surface of a solid. To some extent adsorption takes place on any solid surface, but certain materials have sufficient adsorbent capacity because of the finely divided material to make them useful in such industrial applications as the purification and separation of gases and liquids.*

AGGLOMERATE: *A group of two or more particles combined, joined, or clustered, by any means.*

AGGREGATE: *A relatively stable assembly of dry particles formed under the influence of physical forces.*

AMBIENT: *Surrounding. For example, ambient operating temperatures of a vessel is temperature essentially the same as that surrounding the vessel.*

ASME: *American Society of Mechanical Engineers.*

ASPHALTINE: *Product of partial oxidation of oil.*

ATMOSPHERIC PRESSURE: *The force exerted on a unit area by the weight of the atmosphere.*

ATOM: *Smallest particle of an element which retains properties of the element. Example: Carbon atom (C).*

AUTOCLAVE: *Sterilizing apparatus which uses steam at high pressure.*

B

BACK PRESSURE: *In filter use, resistance offered by filter, usually measured in PSI.*

BACKWASH: *To clean a filter element by reversing the direction of flow through it.*

BASKET STRAINER: *Vessel for the removal of coarse bulk solids from liquid, air, or gas; element is a basket covered with a screen of a given mesh.*

BED (CAKE): *Mass of impurities which form on a filter element.*

BETA RATIO: *An accurate indication of how the filter performs throughout the life of the filter. The Beta Ratio is an average filtration rating.*

BLEEDER: *A system in which part of the fluid from the main flow is diverted.*

BLOTTER TEST: *A visible means of checking oil clarity; one drop on a blotter will concentrate dirt or foreign matter in the center of the ring.*

BLOWBACK: *To reverse flow air, steam, or fluid through the media to effect solids removal. Sometimes referred to as backwash.*

BRIDGING: *A condition of filter element loading in which contaminant spans the space between adjacent sections of a filter element thus blocking a portion of the useful filtration area.*

BUNA N: *Gasket material. A synthetic rubber frequently used for vessel closures, flanges, and filter elements.*

BURST: *An outward structural failure of the filter element caused by excessive differential pressure.*

BY-PASS: *Condition resulting from the product flowing through a vessel other than through the media. Also a filtering system which filters only part of the stream on a continuous basis.*

BY-PASS INSTALLATION: *A system where part of the main flow is diverted to pass through a filter.*

BY-PASS VALVE: *Valve to pass the flow around the media or the vessel, usually activated at a given differential pressure setting.*

C

CAKE: *Solids deposited on the filter medium*

CENTIPOISE: *One one-hundredth of a poise. A poise is the unit of viscosity expressed as one dyne per second per square centimeter.*

CENTISTOKE: *One one-hundredth of a stoke. A stoke is equal to the viscosity in poises times the density of the fluid in grams per cubic centimeter.*

CHANNEL: *To cut grooves or lines in or through the solids deposited on the media, or through the media itself. Also may be described as a break-through in the media which would result in a by-pass.*

CLEANER BLADES: *Stationary blades located between stacked discs of a metallic self cleaning filter cartridge to comb out dirt particles as the cartridge is rotated.*

CLOUD POINT: *Temperature of a petroleum oil at which paraffin, wax or other solid substances begin to crystallize out or separate from solution when the oil is chilled under definite prescribed conditions.*

COAGULANT: *That which produces agglomeration of suspended solids.*

COALESCER: *A mechanical device which unites discrete droplets of one phase prior to being separated from a second phase. Can be accomplished only when both phases are immiscible. Requires a tight media which is preferentially wettable and, by its nature of being tight, the media is also a good filtering material. Good coalescing permits gravity separation of the discontinuous phase. Coalescing may be accomplished by only a coalescer cartridge when the specific gravities of the two phases are widely separated. As the gravities difference become less, the two stage principle is generally required where finely coalesced discontinuous droplets are repelled by the second stage separator cartridge.*

COALESCING: *The action of uniting of small droplets of one liquid preparatory to its being separated from another liquid.*

COLLAPSE PRESSURE: *The pressure impressed across a filter element (cartridge), sufficient to cause collapse of the element.*

COMBINATION: *A filter medium composed of two or more types, grade or arrangements of filter*

media to provide proportion which are not available in a single filter medium.

CONTAMINANT: *Anything in the fluid that should not be there.*

CONTAMINATE: *The foreign matter in a fluid which is accumulated from various sources such as system dirt, residue from wear of moving parts, atmospheric solids which settle in an open system. Contaminates tend to discolor a liquid, cause additional wear on moving parts, cause system upsets in process stream, or reduce the efficiency of a fluid. Water as well as solid may be considered a contaminate when the presence of water causes adverse results. The presence of contaminates, whether liquid or solid, is the basis on which the use of filters or separator/filters are sought.*

CORE: *Material used for the center of an element, generally of the wound design. May also be called a center tube when used in the coalescer, separator, or other type filter element.*

CORROSION: *The conversion of metals into oxides, hydrated oxides, carbonates, or other compounds due to the action of air or water, or both. Salts and sulphur are also important sources of corrosion. Removal of solids and water reduces the effect or speed of corrosion in many cases; and in other cases, corrosion inhibitors are used to reduce the effect of corrosion.*

CP: *A section of less dense material in the media which allow a cold liquid to flow through the element controlling pressure drop below bypass opening.*

D

DEGRADATION: *Wearing down, or reduction in the efficiency, of a media.*

DEGREE OF FILTRATION: *Fineness of a filter medium-size of the smallest particles filtered out.*

DELTA "P": *A Symbol (P) designating pressure drop. The difference in pressure between two points, generally measured at the inlet and outlet of a filter, separator/filter, etc. Normally measured in pounds per square inch (psi), inches of mercury (In. Hg.), or inches of water (In. H20).*

DENSITY: *The weight per unit volume of a substance (specific weight).*

DEPTH: *A filter medium which primarily retains contaminants within the tortuous passages within the thickness of the element wall.*

DEPTH TYPE FILTRATION: *Filtration accomplished by flowing a fluid through a mass filter media providing a tortuous path with many entrapments to stop the contaminates. Flow may be cross flow such as from the outside to inside and then down the center of an element, or from end to end. Certain types of solids, or combinations of solids, do not lend to surface filtration and depth type filtration is found to be more suitable.*

DETERGENT OILS: *Lubricating oils possessing special sludge dispersing properties commonly used in internal combustion engines. These properties are incorporated in the oil by the use of special additives.*

DIELECTRIC: *A substance which will not conduct electricity.*

DIFFERENTIAL PRESSURE: *The difference in pressure between two given points of a filter, separator/filter, etc.*

DILATANT: *A flow condition where certain liquids will show an increase in viscosity as the rate of shear or flow volume is increased.*

DIRT HOLDING PRESSURE: *The volume of contaminate an element can hold before reaching the maximum allowable pressure drop. Volume will vary depending on the size and design of the element and the density of the solid particles. Usually reported by weight such as grams or pounds per element. Also called solids retention or solids holding capacity.*

DISCHARGE: *Flow rate through a filter.*

DISPOSABLE: *Describes element which is to be discarded after use and replaced with an identical element. Same as replaceable. Opposite of reusable.*

DUAL DENSITY: *A depth element that is constructed of two different medias not blended into a homogeneous mixture but remaining as two different distinctive medias.*

DROP: *The quantity of fluid which falls into one spherical mass; a liquid globule. May also be described as several to many droplets.*

DROPLET: *A minute drop which mates to form larger drops capable of falling by gravity.*

E

EDGE FILTER: *Filter using shearing edges to separate solids from a liquid by shearing the oil film surrounding the particles (solid particles).*

EDGE TYPE: *Applies to liquid filters constructed of metal or paper discs, or specially constructed wire wound cylinders; contaminants are entrapped at the edges of the medium. Generally used to remove small quantities of very fine particles. Some have knife or blade cleaners to remove the accumulated solids.*

EFFECTIVE AREA: *The area of a medium that is exposed to flow and usable for its intended purpose: coalescing, filtering, or separating. Opposite of blind spots or dead area.*

EFFECTIVE OPEN AREA: *Area of the filtering medium through which the fluid may flow.*

EFFICIENCY: *Degree to which element will perform in removing solids and/or liquids. Output divided by input.*

ELEMENT: *Medium used in vessel to perform the function of coalescing, filtering, or separating. Also referred to as a cartridge, repack, etc. The porous device which performs the actual process of filtration.*

ELEMENT BY-PASS VALVE: *A valve within a filter to limit the differential pressure which can be impressed across the filter element.*

EMULSIFICATION: *A dispersion of one substance in the form of minute drops within another substance.*

EMULSION: *A dispersion of fine liquid particles in a liquid stream which do not necessarily dissolve in each other but are held in suspension. Many emulsions may be broken by coalescing if the liquids are immiscible. Emulsion stabilizers modify the surface tension of the droplets which makes coalescing difficult, if not impossible.*

ENTRAINED WATER: *Discrete water droplets carried by a continuous liquid or gas phase when water is immiscible with the liquid. May be separated from the continuous phase by coalescing and gravity separation. Usually picked up in a system by condensation or a water washing used in process.*

ENTRAINMENT: *Mist, fog, or droplets of a liquid which is usually considered to be a contaminate when used in the filtration industry.*

EXTENDED AREA: *Principal of shaping the element to give it more effective area than a simple cylinder of the same size.*

F

FELTED ELEMENT: *Constructed by random layer of fibers, usually strengthened by a resin binder.*

FIBER: *Flexible material with two relatively small dimensions and one long dimension.*

FILTER: *A term generally applied to a device used to remove solid contaminate from a liquid or gas, or separate one liquid from another liquid or gas. A filter, as referred to in the industry today, is a device which removes contaminates. If a device is used to remove solids and liquids contaminates, it is referred to in general terms as a separator, separator/filter, or entrainment separator. A filter may be one of a number of such types as replaceable cartridge, cyclone, edge, leaf, baffle, plate and frame, pre-coat, and centrifuge. The term filter is sometimes erroneously used to describe the media used inside the vessel or filter case, but the correct use should be filter element, cartridge, etc.*

FILTER/COALESCER: *Single stage vessel for coalescing and separating one immiscible fluid from another and the removal of solids. Generally recommended for use where continuous phase has light gravity. Available with various efficiencies.*

FILTER EFFICIENCY: *Expressed as a percent of contaminant introduced to the system, it is the ability of a filter to remove specified contaminants at a given contaminant concentration under specified test condition.*

FILTER ELEMENT LIFE: *Span of operation from clean unit to a predetermined pressure drop build up - usually measured in lapsed time.*

FILTER LIFE: *Span of operation from start to complete plugging usually measured in hours of operation.*

FILTER MEDIUM: *The porous material mounted on a plate or frame which separates the solids from the liquids in filtering. Also referred to as filter cloth, filter plate, or septum. The material that performs the actual process of filtration.*

FILTRATE: *Filtered fluid which flows out of a filter.*

FILTRATION RATING, ABSOLUTE: *The diameter of the largest hard spherical particle that will pass through a filter under specified test conditions. This is an indication of the largest opening in the filter medium.*

FILTRATION RATING, MEAN: *A measurement of the average size of the pores of the filter medium.*

FILTRATION RATING, NOMINAL MICRON: *An arbitrary micron value indicated by the manufacturer. Often defined: 95% of all particles this size, and larger, retained by the filter medium.*

KARL FISCHER: *Analytical method of determining amount of water present in a sample by titration.*

FLOW CHARACTERISTICS: *The nature of fluid movement as being turbulent, laminar, constant or variable rate to various degrees.*

FLOW RATE: *The rate at which a product is passed through a vessel or system; generally expressed as gallons per minute, barrels per hour, barrels per day, actual or standard cubic feet per minute, hour, day, etc.*

FLUID: *A liquid or gas which can be filtered by passing through a filter.*

FREE WATER: *Water entrained in a lubricating oil or fuel forming two distinct phases with the fluid and having a tendency to separate as a result of the differences in densities.*

FULL FLOW: *Product flow through the vessel at the rate for which the vessel is designed to operate. Also refers to all products passing through a medium. The opposite of a by-pass filter which is designed to filter only a portion of the stream on a continuous basis.*

FULL FLOW FILTRATION: *System which provides for filtering all the fluid which is pumped to or from wear surfaces or work stations each pass.*

G

GAGE PRESSURE: *All pressure greater than atmospheric pressure - as read on a pressure gage.*

GAS SCRUBBER: *A vessel designed to remove liquid and solid contaminates by impingement on a series of baffles or demister pads. Accomplished by drastic reduction of velocity as the gas enters the scrubber. Recent advances made in entrainment separation would expand the general use of the term to include mechanical cartridge type separators.*

GEL: *A semi-solid susceptible to pressure deformation. Has habit of sticking to surfaces.*

GRADUAL DENSITY: *A media of different densities. One media of a dense type packed around the center tube with a media of less density around the outside. Both medias are tapered at opposite directions. This allows high flow through the less dense media and tighter filtration through the dense media. Similar to the CP element in performance.*

GRAM LIFE: *Grams weight of contaminant introduced to a filter element at controlled rate to a determined differential pressure.*

GRAVIMETRIC EFFICIENCY: *Measure of efficiency in terms of weight.*

H

HOLDING CAPACITY: *In general usage refers to the amount of solids, particulate or foreign material one or more elements is capable of retaining up to the terminal or maximum differential pressure. Also can refer to volumetric holding capacity of either a solid or a liquid.*

HOUSING: *Container for a filter element (s).*

HYDRAULIC FILTER, DUAL: *A hydraulic filter having two filter elements in parallel.*

HYDRAULIC FILTER, DUPLEX: *An assembly of two hydraulic filters with valving for selection of either or both filters.*

HYDRAULIC FILTER, FULL FLOW: *A hydraulic filter, which under specified conditions filters all influent flow.*

HYDRAULIC FILTER, TWO STAGE: *A hydraulic filter having two filter elements in series.*

HYDRAULICS: *The study of fluids at rest or in motion.*

HYDROPHILIC: *Water accepting or water wetting. Having an affinity for water. Capable of uniting with or dissolving in water. Effective coalescing requires a media to have hydrophilic characteristics which cause free or entrained water to commingle into droplets which, when mated with other droplets, form into drops which separate by gravity. Opposite of hydrophobic.*

HYDROPHOBIC: *Non-water wetting. Having an antagonism for water. Not capable of uniting or mixing with water. Hydrophobic features are induced in the process of cellulose manufacture. Opposite of hydrophilic.*

HYDROSTATIC TEST: *A test conducted with either air, water, or other fluids at a given value over design pressure, to prove the structural integrity of a pressure vessel.*

I

IMMISCIBLE: *Incapable of being mixed; insoluble; opposite of miscible.*

IMPREGNATION: *Process of treating a coarse filter medium with resins.*

IMPURITY: *See "contaminant" - any undesirable material in the fluid.*

INDICATOR, BY-PASS: *An indicator which signals alternate flow.*

INDICATOR DIFFERENTIAL PRESSURE: *An indicator which signals the difference in pressure at two points.*

INITIAL PRESSURE DROP: *Loss in differential pressure between two points upon the start of flow through a vessel using new elements.*

IN-LINE: *Describes inlet and outlet connections which are positioned at the same height on opposite sides of a vessel so that an imaginary straight line can be drawn connecting one to the other. Also describes a small filtration unit that fits into a line and forms a similar image to the line, as in the case of a hose.*

INSOLUBLE: *Incapable of being dissolved in a fluid; opposite of soluble.*

INTERFACE: *Surface over which continuous phase and discontinuous phase are in contact.*

IMPINGEMENT: *The direct high velocity impact of the fluid flow upon or against an internal portion of the filter.*

K

KEROSENE: *A petroleum liquid used as a fuel for commercial jet powered aircraft, or for heating purposes.*

KNIFE EDGE PLEATS: *The sharply defined creases at the outer edge of a pleated element.*

L

LACQUER: *A natural or synthetic resin which is dissolved in a suitable solvent such as hydrocarbon oil rich in aromatics. When applied, the oil solvent evaporates, leaving behind a lacquer film.*

LINE SIZE: *The size of line used to carry the product in a system, such as a six-inch line.*

LUBRICATION: *Substituting fluid friction for solid friction by inserting oil between two moving parts.*

M

MAGNETIC SEPARATOR: *A separator that uses a magnetic field to attract and hold ferro magnetic particles.*

MATRIX: *The structural support yarn or twine in wound elements is usually wound in a diamond.*

MAXIMUM DIFFERENTIAL PRESSURE: *The highest pressure differential which an element is required to withstand without structural failure or collapse.*

MAXIMUM OPERATING PRESSURE: *The maximum pressure allowed in a system.*

MEDIA: *Plural of medium. Material of which elements are made.*

MEDIA (MEDIUM): *A porous or slotted mass in a filter element to separate solids from a fluid by difference in size of openings and contaminant.*

MEDIA MIGRATION: *Carry-over of fibers from filter, separator elements, or other filter material into the effluent. Less definitive than fiber migration and is quantitative.*

MEDIUM: *The principle component of an element. A material of controlled pore size or mass through which a product is passed to remove foreign particles held in suspension or to repel droplets of coalesced water; or material without controlled pore size such as glass fiber mats which*

contribute to filtration, coalescence, or separation of two immiscible liquids.

MEMBRANE: *In filtration the term membrane is used to describe the media through which the liquid stream is to be passed or exchanged. Membranes are normally associated with ion exchanged media such as dialysis, osmosis, diffusion, etc., although filter paper itself could be classed as a membrane.*

MERCAPTANS: *Unsaturated sulphurs.*

MICRON: *A short unit of length in the metric system. One millionth of a meter, 10-4 centimeter, 10-3 millimeter, or 0.000039 of one inch. Used as a criterion to evaluate the performance or efficiency of a filter media or to describe the condition of either the influent or effluent. Usually stated in terms of being either absolute or nominal. Nominal micron rating is generally taken to mean that 98% of all articles over a given micron value have been removed by a specific media or medium. Absolute micron rating is generally taken to mean that all particles over a given micron value have been removed. The naked eye can see a particle 40 microns or larger.*

MIGRATION: *Contaminant or media released to pass downstream from filter element.*

MMSCFD: *Million Standard Cubic Feet per Day.*

MMSCFH: *Million Standard Cubic Feet per Hour.*

MMSCFM: *Million Standard Cubic Feet per Minute.*

MODULAR: *A filter element which has no separate housing of its own, but whose housing is incorporated into the equipment which it services. It may also incorporate a suitable enclosure for the filter cavity.*

N

NEWTONIAN: *A liquid which does not change in viscosity with a change in rate of shear, agitation or flow rate.*

NPT: *National Pipe Thread Standard.*

NTP: *Normal conditions of temperature and pressure. Whenever this term is used, it refers to a gas measured at pressure one (1) atmosphere absolute (760 mm. of Hg.) and a temperature of 0°C. However, some sources use a different reference temperature to define NTP.*

O

OPEN AREA RATIO: *The ratio of pore area of a filter medium expressed as a percent of total area.*

OPERATING PRESSURE: *The normal pressure at which a system operates.*

OPERATING PRESSURE, CRITICAL: *Pressure above the normal or design limits which may cause damage or rupture.*

OPERATING PRESSURE, MAXIMUM: *The maximum pressure allowed in the system.*

OUTER SHELL: *Outer covering of element, usually perforated or screen.*

OUTER WRAP: *Outside covering of an element.*

OUTSIDE IN: *Flow of product from outside to inside of an element.*

P

PAPER: *Medium used in many elements. A very general term applied to resin impregnated cellulose. Many types of paper or cellulose are used as filter media made to specifications.*

PARTIAL FLOW: *See "by-pass installation" - a system that diverts part of the main flow and passes it through a filter.*

PARTICLE COUNT: *A practice of counting particles of solid matter in groups based on relative size. Frequently used in engineering, a filter to a specific task or to evaluate the performance of a filter under specific operating conditions. When used as data to engineer a filter, proper consideration can be given to the type of media to be used, expectant life of the media, and the true cost of operation.*

PARTICLE SIZE DISTRIBUTION: *A tabulation resulting from a particle count of solids grouped by specified micron sizes to determine the condition of either the influent or effluent stream. Usually expressed in percentage of total solids to the specific group. Example: 31% in the 6 to 10 micron group. See particle count.*

PERCENT FREE AREA: *Quantitatively, proportion of an element's surface area.*

PLAIN: *A filter element whose medium is not pleated or otherwise extended, and has the geometric shape of a cylinder, cone disc, plate, etc.*

PLEATED: *A filter element whose medium consists of a series of uniform folds and has the geometric shape of a cylinder, cone, disc, plate, etc.*

PLASTISOL: *A suspension of thermosetting plastic which can be molded into any desired shape. Used as a combination end cap and gasket on element.*

PLUGGED: *Condition of a filter when it has collected its full capacity of contaminants and will not pass any more fluid.*

POROSITY: *The ratio of void volume to total cake volume. Also describes filter media which may have larger pores than other media.*

POUR POINT: *The lowest temperature at which a liquid will pour or flow without disturbance under specified conditions.*

PRE-COAT: *A filter medium in loose powder form, such as Fuller's or Diatomaceous earth, introduced into the up-stream fluid to condition a filter element.*

PREFILTER: *Filter for removing gross contaminate before the product stream enters a separator/filter.*

PRESSURE: *The force exerted per unit area by a fluid.*

PRESSURE ABSOLUTE: *Gage pressure plus 14.7 psi.*

PRESSURE ATMOSPHERIC: *The force exerted by the atmosphere at sea level, which is equivalent to 14.7 psi.*

PRESSURE DIFFERENTIAL: *The difference in pressure between two points.*

PRESSURE DROP: *The difference in pressure between two points, generally at the inlet and outlet of a filter or a separator/filter. Measured in pounds per square inch gage, or inches of mercury.*

PRESSURE RATING, OPERATING: *The normal pressure at which a filter housing is capable of operating at specified operating conditions.*

PRESSURE RELIEF: *Valve which permits enough liquid or gas to escape from the vessel to prevent extreme pressure build up within the vessel.*

PSI: *Pounds per Square Inch.*

PSIA: *Pounds per Square Inch Absolute.*

PSID: *Pounds per Square Inch Differential.*

PSIG: *Pounds per Square Inch Gage.*

R

RATE OF FLOW: *The rate at which a product is passed through a vessel or system; generally expressed as gallons per minute, barrels per hour, barrels per day, actual or standard cubic feet per minute, hour, day, etc. Same as flow rate.*

RATED FLOW: *Normal operating flow rate at which a product is passed through a vessel; flow rate which a vessel and media are designed to accommodate.*

REPLACEABLE: *Describes element which is to be removed after use and replaced with an identical element.*

REPLACEMENT ELEMENT: *An element or a cartridge used to replace a disposable which has been loaded to its capacity with (cartridge) contaminants.*

REUSABLE: *Describes element which may be cleaned and used again. Opposite of disposable or replaceable.*

S

SAE: *Society of Automotive Engineers.*

SAE NUMBER: *A classification of lubricating oils for crankcase and transmissions in terms of viscosity as standardized by the Society of Automotive Engineers.*

SAYBOLD SECONDS UNIVERSAL (SSU): *Units of viscosity as measured by observing the time in seconds required for 60 ml. of a fluid to drain through a tubular orifice 0.483 inches long by 0.0695 inches in diameter at stated conditions of temperature, and pressure.*

SCFD: *Standard Cubic Feet per Day.*

SCFH: *Standard Cubic Feed per Hour.*

SCFM: *Standard Cubic Feet per Minute.*

SELF CLEANING: *A filter element designed to be cleaned without removing it from the filter assembly, or interrupting flow.*

SEPARATION: *The action of separating solids or liquids from fluids. May be accomplished by impingement, filtration, or by coalescing. The term "separation" is used in some circles when referring to the separation of liquids. Also used to describe the action in the second stage of two-stage separation.*

SEPARATOR: *A device whose primary function is to isolate contaminants by physical properties other than size.*

SEPARATOR/FILTER: *Vessel which removes solids and entrained liquids from another liquid or gas. Uses some combination of a baffle and/ or coalescer, filter, or separator element. May be single stage, two stage, or single or two stage with prefilter section for gross solids removal. Common application is the removal of water from gas or another immiscible liquid. General reference to term applies the equipment is capable of both separation and filtration to specific degrees of efficiencies.*

SERVICE LIFE: *The length of time an element operates before reaching the maximum allowable pressure drop.*

SHELL: *Outer wall of a vessel. Also referred to as body.*

SHUNT INSTALLATION: *A system with a filter paralleled by a metering device both in the main supply line.*

SINTERED: *Media, usually metallic, processed to cause diffusion bonds at all contacting points, retaining openings the passage of filtrate.*

SKID MOUNTED: *Describes one or more vessels with pump and motor, all mounted on a portable platform.*

SLOT AREA: *Sum of the area of all the fluid path openings in a metal - edge filter element.*

SLUDGE: *Dirt, carbon, water and chemical compounds as found in oils.*

SOLID SUSPENSION: *A mixture of solids suspended in a fluid.*

SOLIDS: *A mass, or matter, contained in a stream which is considered undesirable and should be removed.*

SOLUTION: *A single phase combination of liquid and non-liquid substances, or two or more liquids.*

SPACING: *The distance between adjacent surfaces of stacked discs, edge wound ribbons, or single layer filaments. This dimension determines the smallest dimension of solid particles to be retained.*

SPECIFIC GRAVITY: *Ratio of substance's weight to that of some standard substance. (Water for liquids and solids, air or hydrogen for gases)*

SURFACE: *A filter medium which primarily retains contaminant on the influent face.*

SURFACE AREA: *Total area of an element that is exposed to approaching flow. See "percent free area".*

SURFACTANTS: *Coined expression for surface active agents which are sometimes called emulsifiers or wetting agents. First appeared in hydrocarbons with the advent of the catalytic cracking process in refining. Caused by the forming of sodium sulfonate and sodium naphthanate molecules. Affects liquid/ liquid separation by reducing interfacial tension and forming into a slime which binds off the fibers used in coalescing media.*

SURGE: *The peak system pressure rise measured as a function of restricting or blocking fluid flow.*

SUSPENSION: *Solids or liquids held in other liquids.*

SUSPENDED SOLIDS: *Non-settled particles in fluid.*

SWING BOLT: *A type of vessel closure which reduces service time. Opposite of thru-bolt flange where studs and nuts are used, such as with ASA type flanges.*

T

THIXOTROPIC: *A liquid which shows a marked reduction in viscosity as the rate of shear, agitation, or flow rate is increased.*

TORTUOSITY: *The ratio of the average effective flow path length to minimum theoretical flow path length (thickness) of a filter medium.*

TURBID METRIC EFFICIENCY: *(Filter inlet turbidity - Outlet turbidity/by Inlet turbidity.*

TURBIDITY: *Stirred up sediment or contaminant in a fluid.*

TURN-OVER: *Number of times the contents of the system pass through a filter per unit time.*

U

ULTRAFILTER: *Membrane type to remove very fine suspended submicronic particles as well as some dissolved solids.*

UNLOADING: *Release downstream of trapped contaminate, due to change in flow rate, mechanical shock and vibration, or as excessive pressure builds up, or media failure.*

V

VACUUM: *Reference to pressure below atmospheric.*

VISCOSITY: *Degree of fluidity; property of fluid's molecular structure by virtue of which they resist flow. The resistance of flow exhibited by a liquid resulting from the combined effects of cohesion and adhesion. The units of measurement are the poise and the stoke. A liquid has a viscosity of one poise if a force of one dyne per square centimeter causes two parallel liquid surfaces one square centimeter in area and one centimeter apart to move past one another at a rate of one centimeter per second. There are a great many crude and empirical methods for measuring viscosity which generally involve measurement for the time of flow or movement of a ball, ring, or other object in a specially shaped or sized apparatus.*
The internal molecular friction of a liquid, or that property which resists any force tending to produce flow.

W

WOUND: *A filter medium comprised of two or more layers of helical wraps of a continuous strand or filament in a predetermined pattern.*

WOVEN: *A filter medium made from strands of fiber, thread, or wire interlaced into a cloth on a loom.*

Converting Air Flow to Liquid Flow Equivalents

You must first establish the gas flow rate in units of standard cubic feet per minute (SCFM). (A "standard cubic foot" of gas is measured at 14.7 psia (pounds per square inch, absolute) at 60^0 F.

$$\textbf{SCFM} = CFM \times \left(\frac{14.7 + PSIG}{14.7}\right) \times \left(\frac{530}{460 + F}\right)$$

SCFM = *Gas flow in standard cubic feet per min.*
CFM = *Actual gas flow in cubic feet per min.*
PSIG = *Actual gas pressure, pounds per square inch, gauge.*
F = *Actual gas temperature, F^o.*

Next we find the gallons-per-minute equivalent to your particular gas flow, temperature, and pressure:

$$\textbf{GPM} = \frac{SCFM}{4.1} \times \sqrt{\frac{14.7 + PSIG}{14.7}} \times \sqrt{\frac{460 + F}{530}} \times \sqrt{SG}$$

SG = *Specific Gravity of the gas, relative to air. (See chart below.)*

GAS	SG	GAS	SG
Air	1.00	Hellum	.14
Ammonia	.59	Nitric Oxide	1.03
Argon	1.38	Nitrogen	.97
Carbon Dioxide	1.52	Nitrous Oxide	.59
Chlorine	2.45	Sulphur Dioxide	2.21

Note: *Steam and explosive gases are not recommended.*

For Vacuum Applications:

Use the following formula for converting vacuum applications to GPM.

$$\textbf{GPM} = \frac{SCFM}{4.1} \times \sqrt{\frac{14.7 + PSIG}{14.7}} \times \sqrt{\frac{460 + F}{530}} \times \sqrt{SG}$$