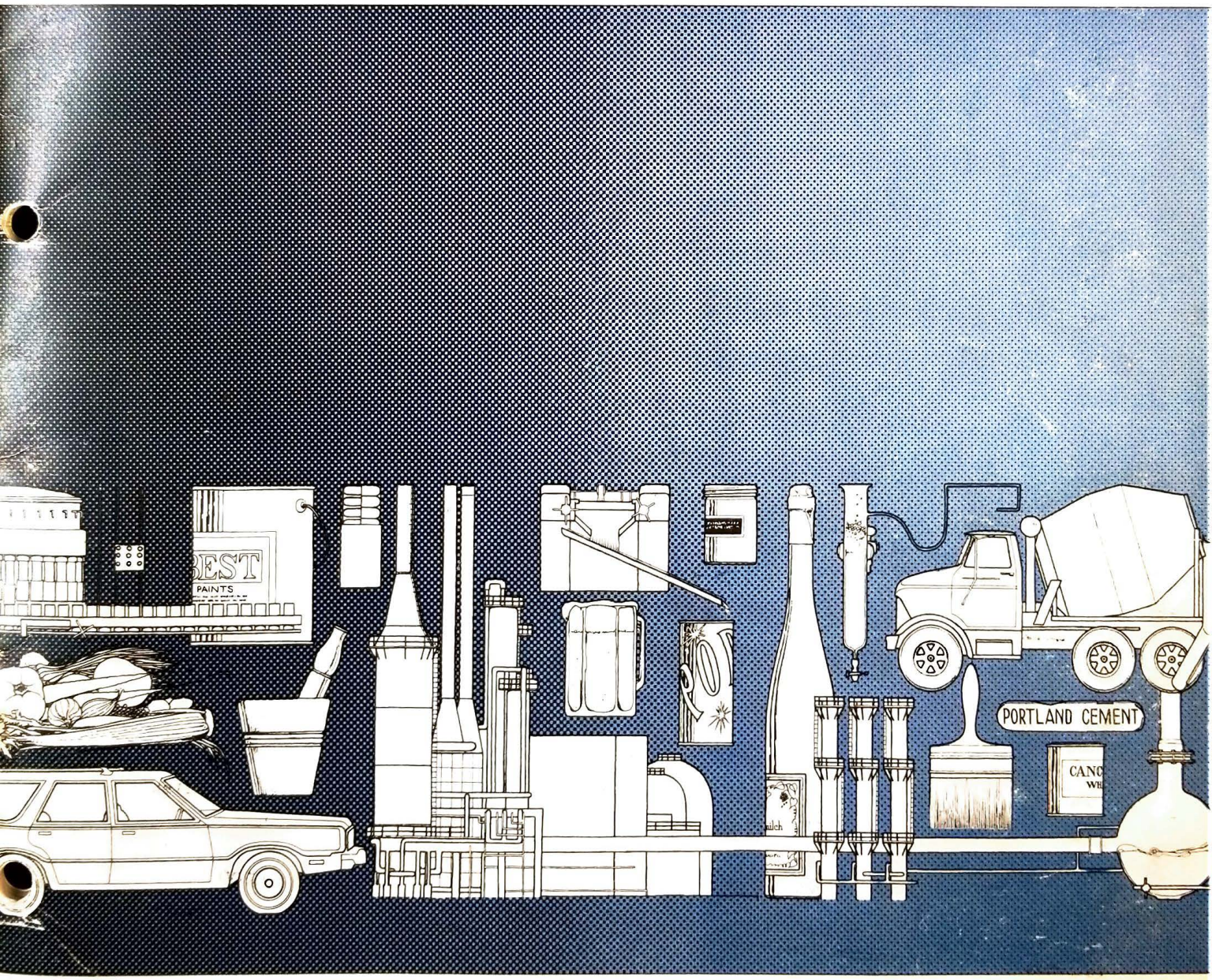
Engineering Filtration Data

GREAT LAKES FILTER
A MEMBER OF THE ACME GROUP



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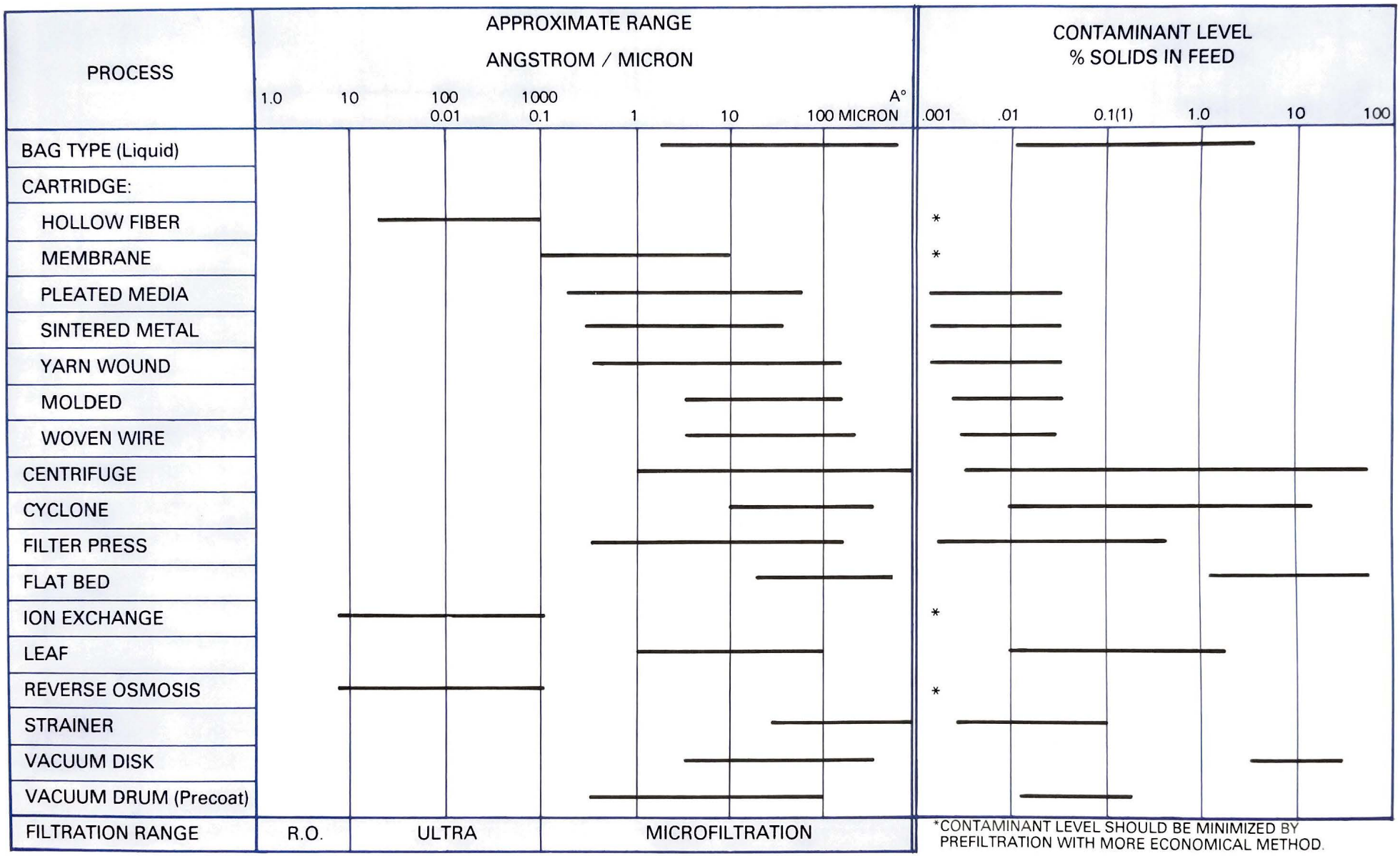
SELECTION OF SEPARATION PROCESS BY PARTICLE SIZE & CONTAMINATION LEVEL



*CONTAMINANT LEVEL SHOULD BE MINIMIZED BY PREFILTRATION WITH MORE ECONOMICAL METHOD.

(1) 0.1% = 1000 PPM

SELECTION OF GAS CLEANING EQUIPMENT

PROCESS	RANGE 0.01	0.1	1.0	10	100 micron
BAG TYPE COLLECTOR					
CENTRIFUGAL SEPARATOR					
COMMON AIR FILTER					
ELECTRONIC PRECIPITATOR					
HEPA FILTER					
IMPINGEMENT SEPARATOR					
LIQUID SCRUBBER					
MECHANICAL SEPARATOR					

SELECTION OF SEPARATION PROCESS FOR GAS APPLICATIONS

CONTAMINANT IN GAS STREAM	CONTAMINATION LEVEL	SEPARATOR CENTRIFUGE	CLEANABLE FILTER	PAPER OR FELT MEDIA	FILTER COALESCER	ACTIVATED CARBON
SOLIDS, SCALE & DUST	LOW	S	S	R		
	HIGH	P	P	R		
POLLENS & BACTERIA	LOW			P		R
WATER MIST	VARIOUS				R	
WATER & OIL VAPOR	LOW				P	R
OIL MIST	VARIOUS				R	S

SELECTION OF SEPARATION PROCESS FOR LIQUID APPLICATIONS

APPLICATION	CONTAMINATION LEVEL	FILTRATION	CENTRIFUGATION	ABSORPTION	ADSORPTION	COALESCENCE	VACUUM PROC.
SOLIDS IN OIL	LOW	R			S		
	HIGH		R		S		
SOLIDS IN FUEL	LOW	R					
	HIGH		R				
ACID IN OIL	VARIOUS				R		
SURFACTANTS IN FUEL	VARIOUS				R		
WATER IN OIL	LOW	P		R			S
	HIGH		R				S
WATER & SOLIDS IN INSULATING OIL	LOW	P		R			S
	HIGH	P					R
WATER & SOLIDS IN FUEL	LOW	P		S		R	
	HIGH		S			R	
SOLIDS IN LIQUIDS, GENERAL	LOW	R					
	HIGH		R				
OIL IN WATER	LOW					R	

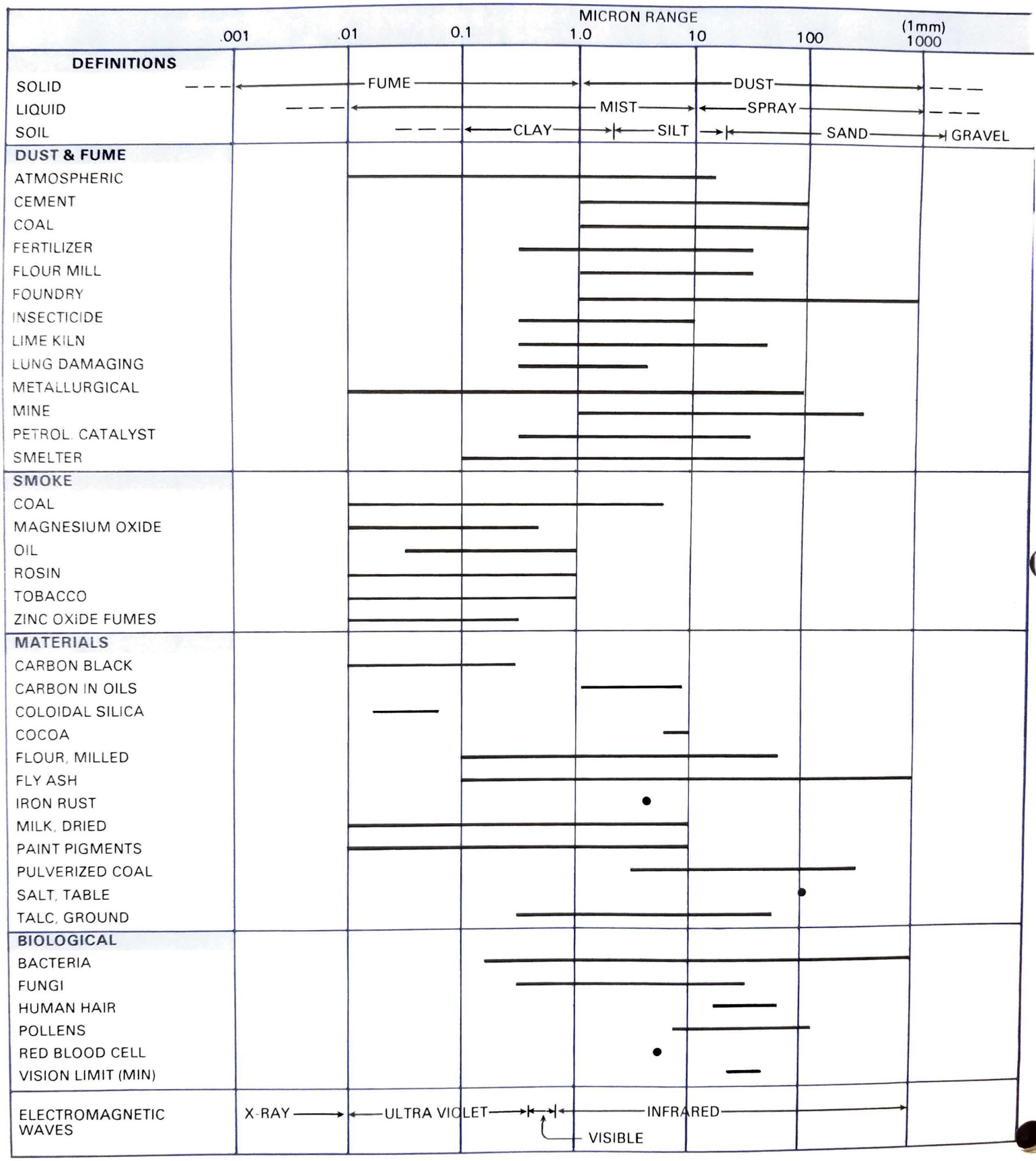
CODE: R — RECOMMENDED P — PREFILTRATION S — SATISFACTORY

CHARACTERISTICS OF PUMPS FOR FILTRATION APPLICATIONS

	CENTRIFUGAL	DIAPHRAGM	SINGLE SCREW	ROTARY LOBE
INITIAL COST	LOW	MEDIUM — HIGH	HIGH	MEDIUM
MAINTENANCE COST	LOW	MEDIUM — HIGH	HIGH	HIGH
ENERGY COST	MEDIUM, LOW VISCOSITIES HIGH, HIGH VISCOSITIES	LOW	MEDIUM	LOW
RELIABILITY	FEW MOVING PARTS, SIGNIFICANT WEAR WITH HIGHLY ABRASIVE SLURRIES	LIMITED LIFE OF DIAPHRAGM	FEW MOVING PARTS, LOW WEAR RESISTANCE	SEVERAL CLOSE FITTING PARTS, LOW WEAR RESISTANCE
SOLIDS DEGRADATION	CONTINGENT ON PROPER SIZING	LOW	LOW	LOW
HIGH VISCOSITY CAPACITY	EFFICIENCY FALLS OFF 3000 CPS, MAXIMUM	ACCEPTABLE	GOOD	GOOD, LOW SHEAR OF DELICATE MATERIALS
CAVITATION TENDENCY	MUST BE PROPERLY SIZED AND WELL MAINTAINED	LITTLE DIFFICULTY	PROPER MAINTENANCE REQUIRED	PROPER MAINTENANCE REQUIRED
LEAKAGE TENDENCY	HIGH WITH PACKED SEAL LOW, MECHANICAL SEAL	LOW	LOW WITH MECHANICAL SEAL	LOW WITH MECHANICAL SEAL
DOWNTIME LOSS	LOW	MEDIUM — HIGH	HIGH	HIGH
OPERATING CONSIDERATIONS	SEALS REQUIRE CARE	REQUIRES PROTECTION AGAINST OVER PRESSURIZATION	REQUIRES PROTECTION AGAINST DRY RUNNING AND OVER PRESSURIZATION	REQUIRES DRY RUNNING PROTECTION AND PRESSURE RELIEF
FLOW	CONTROL SYSTEMS NOT REQUIRED, CORRECT SIZING IMPORTANT	PRESSURE RELIEF AND CONTROL SYSTEMS FOR SOME APPLICATIONS	PRESSURE RELIEF AND CONTROL SYSTEMS FOR SOME APPLICATIONS	PRESSURE RELIEF AND CONTROL SYSTEMS FOR SOME APPLICATIONS
MAXIMUM SUCTION LIFT, WATER	USUAL 15 FT.	USUAL 14 FT.	USUAL 27 FT.	USUAL 22 FT.
AFFECT OF INCREASED HEAD ON: **CAPACITY** **POWER INPUT**	 DECREASE DEPENDS ON SPEED		 NONE INCREASE	 NONE INCREASE

NOTES ON PUMP APPLICATIONS:
RECIPROCATING PUMPS SELDOM USED IN FILTRATION SYSTEMS BECAUSE OF DESTRUCTIVE AFFECT OF SURGES ON FILTER MEDIA.
PUMP LIFE CAN BE PROLONGED SIGNIFICANTLY IF THE PUMP CAN BE NEUTRALIZED OR FLUSHED WITH CLEAR WATER AFTER EACH USE OR AT THE END OF EACH WORK DAY.
ABRASIVE OR HIGH VISCOSITY SLURRIES REQUIRE THAT PUMP SELECTION AND OPERATING SPEED BE GIVEN ADDED CONSIDERATION.

EXPECTED RANGE OF PARTICLE SIZES



APPROXIMATE PRESSURE CONVERSION

GAUGE VALUES

PSIG	FT. H_2O	IN. H_2O	IN. Hg	MM Hg
800				
700				
600				
500	1154			
400	923			
300	693			
200	462	FOR MORE PRECISE CALCULATIONS REFER TO CONVERSION FACTORS PAGE 8		
150	346			
100	231			
80	185		163	
70	162	1944	143	
60	139	1668	122	
50	115	1380	102	
40	92	1104	82	
30	69	828	61	
20	46	552	41	
15	35	420	31	787
10	23	276	20.4	518
8	18	216	16	406
7	16	192	14	356
6	14	168	12	305
5	11.5	138	10	254
4	9.2	110	8.2	208
3	6.9	83	6.1	155
2	4.6	55	4.1	104
1.5	3.5	42	3.1	79
1.0	2.3	28	2.04	52
0.8	1.8	22	1.6	41
0.7	1.6	19	1.4	36
0.6	1.4	17	1.2	30
0.5	1.15	14	1.0	25.4
0.4	.92	11	.82	20.8
0.3	.69	8	.61	15.5
0.2	.46	5.5	.41	10.4
0.1	.23	2.8	.204	5.2
0 / 14.7	0 / 33.9	0 / 407	0 / 29.9	0
	ATMOSPHERIC PRESSURE (SEA LEVEL)			
—1.0	—2.3	—28	—2.04	—52
—2	—4.6	—55	—4.1	—104
—3	—6.9	—83	—6.1	—155
—4	—9.2	—110	—8.2	—208
—5	—11.5	—138	—10	—254
—6	—14	—168	—12	—305
—7	—16	—192	—14	—356
—8	—18	—216	—16	—406
—10	—23	—276	—20	—518
—14.7 / 0	—33.9 / 0	—407 / 0	—29.9 / 0	—760

ATMOSPHERIC ZERO

STANDARD SCREEN & PARTICLE SIZE

U.S. MESH	INCHES	MICRONS	MILLIMETERS	U.S. MESH	INCHES	MICRONS	MILLIMETERS
3	.265	6730	6.73	40	.0165	420	.42
3½	.223	5660	5.66	45	.0138	354	.35
4	.187	4760	4.76	50	.0117	297	.297
5	.157	4000	4.00	60	.0098	250	.250
6	.132	3360	3.36	70	.0083	210	.210
7	.111	2830	2.83	80	.0070	177	.177
8	.0937	2380	2.38	100	.0059	149	.149
10	.0787	2000	2.00	120	.0049	125	.125
12	.0661	1680	1.68	140	.0041	105	.105
14	.0555	1410	1.41	170	.0035	88	.088
16	.0469	1190	1.19	200	.0029	74	.074
18	.0394	1000	1.00	230	.0024	63	.063
20	.0331	841	.84	270	.0021	53	.053
25	.0280	707	.71	325	.0017	44	.044
30	.0232	595	.59	400	.0015	37	.037
35	.0197	500	.50	800			.019

FINENESS DATA

HEGMAN(NS) SCALE	PRODUCTION CLUB SCALE	DEPTH OF WELLS MILS	DEPTH OF WELLS MICRONS	CLOSEST U.S. MESH SIZE
0	0.00	4.0	100.00	140
1	1.25	3.50	87.50	170
2	2.50	3.00	75.00	200
3	3.75	2.50	62.00	230
4	5.00	2.00	50.00	325
5	6.25	1.50	37.50	—
6	7.50	1.00	25.00	400
7	8.75	0.50	12.50	—
7½		0.25	6.25	—
8	10.00	0.00	0.00	—

CONVERSION FACTORS

MULTIPLY	BY	TO OBTAIN
Atmospheres	14.7	psi
Atmospheres	33.9	feet of water
Atmospheres	29.9	inches of mercury
Atmospheres	760	mm mercury
Bar	0.9869	atmosphere
Bar	14.504	psi
Barrels of Oil	42.00	gallons
Barrels of Oil	35.0	imperial gallons
Cubic Centimeters	0.061	cubic inches
Cubic Feet	7.48	gallons
Cubic Feet	1728	cubic inches
Cubic Feet	28.32	liters
Cubic Feet Water	62.4	pounds
Cubic Inches	16.39	cubic centimeters
Cubic Meters	264	gallons
Cubic Meters	35.31	cubic feet
Drams (Fluid)	3.7	milliliters (cc)
Feet	30.48	centimeters
Feet of Water	0.433	psi
Feet of Water	0.884	inches of mercury
Feet per minute	0.01136	miles per hour
Gallons (US)	0.833	imperial gallons
Gallons (Imperial)	1.2	gallons
Gallons	3.785	liters
Gallons	0.1337	cubic feet
Gallons	8.33	pounds of water
Grains	.0023	ounces
Grains Per US Gallon	17.1	ppm
Grams	.0353	ounces
Inches	2.54	centimeters
Inches of Mercury	0.489	psi
Inches of Water	0.074	inches of mercury
Inches of Water	0.036	psi
Kilograms	2.2046	pounds (avdp)
Kilograms/Sq. Cm.	14.23	psi
Liters	1000	cubic centimeters
Liters	0.264	gallons
Liters	33.8	ounces (fluid)
Meters	39.37	inches
Milliliters (CC)	0.061	cubic inches
Ounces (Fluid)	1.805	cubic inches
Ounces (Mass)	28.35	grams
Pounds	7000	grains
Pounds	16	ounces
Pounds of Water	0.12	gallons
PSI	2.31	feet of water
PSI	2.04	inches of mercury
Square Inches	6.45	square centimeters

APPROXIMATE VISCOSITY CONVERSION TABLE

Seconds Saybolt Universal	Seconds Saybolt Furol	Engler Degrees	Engler Time	Barbey	Redwood Std.	Approx. Secs. #4 Ford Cup	Centistokes
35		1.2	60	2800	32		2.6
50		1.6	82	880	44		7.4
75		2.3	102	460	65		14.1
100	15	3.0	153	320	88	10	20.2
150	19	4.4	230	205	128	12	31.8
200	23	5.9	305	148	170	21	43.1
250	28	7.6	375	118	212	24	54.3
300	33	8.9	450	98	254	27	65.1
400	42	11.8	550	72	338	32	87.6
500	52	14.5	750	59	423	37	110
600	61	17.5	900	48	518	44	132
700	71	20.6	1050	41	592	51	154
800	81	23	1200	36.5	677	54	176
900	91	27	1300	32	762	57	198
1000	100	29	1500	29.5	846	63	220
1500	150	42	2300	19.5	1270	79	330
2000	200	59	3000	14.5	1695	95	440
2500	250	73	3750	11.5	2120		550
3000	300	87	4500	9.6	2540		660
4000	400	117	6000	7.4	3380		880
5000	500	145	7500	6.0	4230		1100
6000	600	175	9000	5.2	5080		1320
7000	700	205	10500	4.1	5925		1540
8000	800	230	12000	3.7	6770		1700
9000	900	260	13500	3.2	7620		1900
10000	1000	290	15000	2.9	8450		2200
20000	2000	590	30000	1.4	16920		4400
40000	4000	1170	60000		33850		8800
60000	6000	1750	90000		50800		13200
80000	8000	2300	120000		67700		17600

VISCOSITY CONVERSION FACTORS

$$\text{Centistokes} = \frac{\text{Centipoise}}{\text{Specific Gravity}}$$

SSU* = Centistokes x 4.55
Degrees Engler* = Centistokes x 0.132
Seconds Redwood = Centistokes x 4.05
*Where Centistokes are greater than 50

STANDARD PIPE DATA (SCHEDULE 40)

Size Inches	Diameters		Thickness
	External Inches	Internal Inches	Inches
1/8	.405	.269	.068
1/4	.540	.364	.088
3/8	.675	.493	.091
1/2	.840	.622	.109
3/4	1.050	.824	.113
1	1.315	1.049	.133
1 1/4	1.660	1.380	.140
1 1/2	1.900	1.610	.145
2	2.375	2.067	.154
2 1/2	2.875	2.469	.203
3	3.500	3.068	.216
4	4.500	4.026	.237
5	5.563	5.047	.258
6	6.625	6.065	.280
8	8.625	7.981	.322
10	10.750	10.020	.365

METRIC/ENGLISH PRESSURE EQUIVALENTS

Kilograms Per Square Centimeter	Pounds Per Square Inch
0.1	1.42
0.2	2.85
0.3	4.27
0.4	5.69
0.5	7.11
0.6	8.54
0.7	9.96
0.8	11.38
0.9	12.81
1.0	14.2
1.5	21.3
2	28.5
3	42.7
4	56.9
5	71.1
6	85.4
7	99.6
8	114
9	128
10	142
15	213
20	285
30	427
40	569
50	712
100	1423

PARTICLE SIZING TECHNIQUES

METHOD	SIZE RANGE MICRONS	DETERMINATION
SEDIMENTATION	1-50	QUANTITY & WEIGHT
CENTRIFUGE	0.1-5	
WIRE MESH	40-800	SIZE LIMITS & WEIGHT
MICROSIEVE	5-40	
COULTER COUNTER	1-100	SIZE & QUANTITY
HIAC	2-1000	
ROYCO	2-5	
OPTICAL MICROSCOPE	0.5-200	NUMBER SIZE & SURFACE EXAMINATION
ELECTRON MICROSCOPE	0.001-2	

DEGREES FAHRENHEIT TO CENTIGRADE

°F	°C	°F	°C	°F	°C
—60	—51	85	29.3	290	143
—50	—46	90	32.1	300	149
—40	—40	95	34.9	310	154
—30	—34	100	38	320	160
—20	—29	110	43	330	165
—10	—23	120	49	340	171
0	—17.7	130	54	350	177
5	—15.0	140	60	360	182
10	—12.2	150	65	370	188
15	— 9.4	160	71	380	193
20	— 6.6	170	76	390	199
25	— 3.9	180	83	400	204
30	— 1.1	190	88	410	210
35	1.6	200	93	420	215
40	4.4	210	99	430	221
45	7.1	212	100	440	226
50	9.9	220	104	450	232
55	12.6	230	110	460	238
60	15.6	240	115	470	243
65	18.2	250	121	480	249
70	21.0	260	127	490	254
75	23.8	270	132	500	260
80	26.8	280	138	510	265

ATMOSPHERIC PRESSURE AT DIFFERENT ALTITUDES

Altitude Above Sea Level—Feet	Atmospheric Pressure Pounds Per Square Inch
0	14.7
1000	14.2
2000	13.6
3000	13.1
4000	12.6
5000	12.1
6000	11.7
7000	11.2
8000	10.8
9000	10.4
10000	10.0

LIQUID MEASURE EQUIVALENTS

	U.S. GALLON	CUBIC INCH	CUBIC FOOT	CUBIC METER	LITER	POUNDS OF WATER
U.S. GALLON	1	231	0.1337	0.00378	3.785	8.33
CUBIC INCH	0.0043	1	0.00057	0.000016	0.0163	0.0358
CUBIC FOOT	7.48	1728	1	0.02827	28.312	62.355
CUBIC METER	264.17	61023	35.319	1	1000	2200.54
LITER	0.26417	61.023	0.0353	0.001	1	2.2005
POUNDS OF WATER	0.12	27.72	0.016	0.00045	0.454	1

DISSOLVED SOLIDS
WATER RESISTIVITY/CONDUCTIVITY TABLE

Conductivity Micromhos/cc @25°C	Resistivity Ohms/cc @25°C	Dissolved Solids Parts per Million (ppm)	Approximate Grains/Gallon (GPG) as $CaCo_3$
0.056	18,000,000	0.0277	0.00164
0.059	17,000,000	0.0294	0.00170
0.063	16,000,000	0.0313	0.00181
0.067	15,000,000	0.0333	0.00193
0.072	14,000,000	0.0357	0.00211
0.077	13,000,000	0.0384	0.00222
0.084	12,000,000	0.0417	0.00240
0.091	11,000,000	0.0455	0.00263
0.100	10,000,000	0.0500	0.00292
0.111	9,000,000	0.0556	0.00322
0.125	8,000,000	0.0625	0.00368
0.143	7,000,000	0.0714	0.00415
0.167	6,000,000	0.0833	0.00485
0.200	5,000,000	0.100	0.00585
0.250	4,000,000	0.125	0.00731
0.333	3,000,000	0.167	0.00971
0.500	2,000,000	0.250	0.0146
1.00	1,000,000	0.500	0.0292
1.11	900,000	0.556	0.0322
1.25	800,000	0.625	0.0368
1.43	700,000	0.714	0.0415
1.67	600,000	0.833	0.0485
2.00	500,000	1.00	0.0585
2.50	400,000	1.25	0.0731
3.33	300,000	1.67	0.0971
5.00	200,000	2.50	0.146
10.0	100,000	5.00	0.292
11.1	90,000	5.56	0.322
12.5	80,000	6.25	0.368
14.3	70,000	7.14	0.415
16.7	60,000	8.33	0.485
20.0	50,000	10.0	0.585
25.0	40,000	12.5	0.731
33.3	30,000	16.7	0.971
50.0	20,000	25.0	1.46
100.0	10,000	50.0	2.92
111	9,000	55.6	3.22
125	8,000	62.5	3.68
143	7,000	71.4	4.15
167	6,000	83.3	4.85
200	5,000	100	5.85
250	4,000	125	7.31
333	3,000	167	9.71
500	2,000	250	14.6
1,000	1,000	500	29.2
1,110	900	556	32.2
1,250	800	625	36.8
1,430	700	714	41.5
1,670	600	833	48.5
2,000	500	1,000	58.5
2,500	400	1,250	73.1
3,330.	300	1,670	97.1
5,000	200	2,500	146
10,000	100	5,000	292

RESISTANCE OF TEXTILE FIBERS
TO PLATING SOLUTIONS

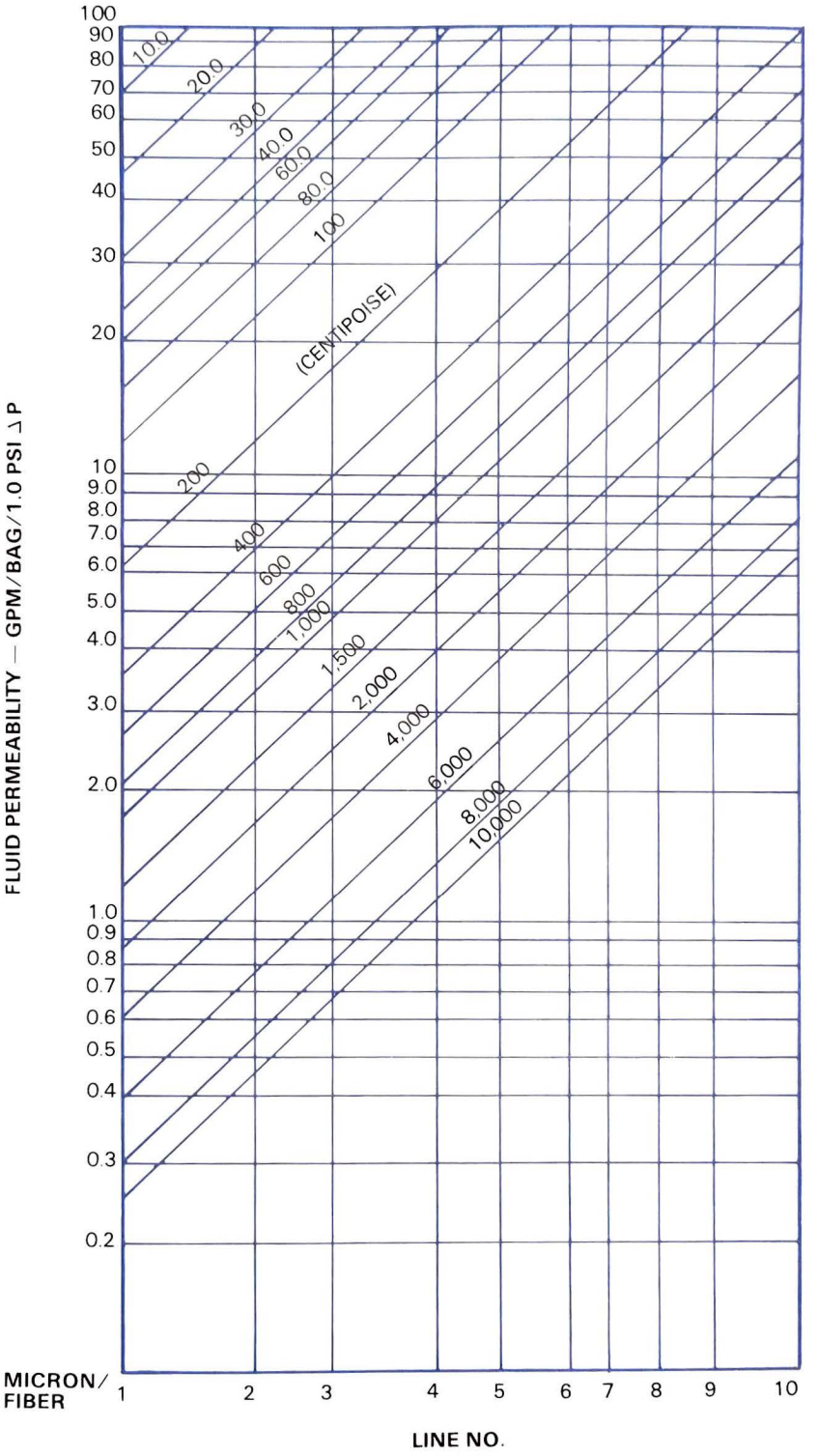
PLATING SOLUTION	TEMPERATURE, DEGREES F	ACRYLIC	COTTON	MODACRYLIC	NYLON	POLYESTER	POLYPROPYLENE	RAYON
ANTIMONY	125	R	S	R	N		R	
ARSENIC	150	N	N	R	R		R	R
BRASS CYANIDE	140	N	R	R	R		R	R
BRONZE, COPPER-CADMIUM	75	N	S	R	R		R	
BRONZE, COPPER-TIN	150	N	N	R	R		R	
BRONZE, COPPER-ZINC	100	N	S	R	R		R	
CADMIUM, CYANIDE	140	N	R	R	R	N	R	R
CADMIUM, FLUOBORATE	100	R	R	R		R	R	R
CHROMIUM, CHROMIC-SULFURIC	125	R	N	S	N		R	
CHROMIUM, FLUORIDE	125	R	N	S	N		R	
CHROMIUM, FLUOSILICATE	100	R	N	R	N		R	
COPPER, CYANIDE	140		R				R	R
COPPER, FLUOBORATE	170	R	N	R	N	R	R	
COPPER, PYROPHOSPHATE	125	N	S	R	R	R	R	
COPPER, SULFATE	75	R	N	R	N	R	R	
GOLD, CYANIDE	140	N	R	R	R		R	R
GOLD, FLUOBORATE	150					R	R	
INDIUM, ALKALINE	80	R	R	R	N		R	
INDIUM, FLUOBORATE	80	R	R	R	N	R	R	
IRON, CHLORIDE	140	R	N	R	N	R	R	
IRON, FLUOBORATE	150	R	N	R	N	R	R	
IRON, SULFATE	140	R	N	R	N	R	R	
IRON, SULFATE CHLORIDE	150	R	N	R	N	R	R	
IRON, SULFAMATE	140	R	N	R	N	R	R	
LEAD, ALKALAI	190			R	R		R	
LEAD, FLUOBORATE	100	R	N	R	N	R	R	
NICKEL, BRIGHT CHLORIDE	125	R	S	R	N	N	R	R
NICKEL, DULL CHLORIDE	170	R	R	R	N	N	R	R
NICKEL, FLUOBORATE	140	R	N	R	N	R		R
NICKEL, SULFAMATE	125	R	N	R	R	R	R	R
PHOSGENE	80	R				R		
PLATINUM	190		R				R	
RHODIUM	100	R	N	R	N		R	
SILVER	80	R	R	R	R		R	R
TIN, ACID	100			R		R	R	
TIN, FLUOBORATE	130	R	N	R	N		R	
ZINC, CHLORIDE	140	N	N	R	N	R	R	
ZINC, CYANIDE	140	N	R	R	R		R	R
ZINC, FLUOBORATE	130	R	N	R	N	R	R	
ZINC, SULFATE	140	R	N	R	N	R	R	

CODE:
R — RECOMMENDED
S — SATISFACTORY
N — NOT SATISFACTORY
BLANK — INSUFFICIENT INFORMATION

FLOW RATES OF LIQUID FILTER BAGS

NOTES

1. NO. 1 SIZE BAG NOT TO EXCEED 90 GPM.
2. FOR OTHER THAN NO. 1 SIZE BAG MULTIPLY BY 0.5 X SURFACE AREA.



Line 1	1, 3 AP 1, 3 SP
Line 2	5 AP 5 SP
Line 3	10 AP 10 SP
Line 4	15 AP 25 SP 50 SP
Line 5	25 AP 50 AP
Line 6	75 AP 100 AP 100 SP
Line 7	200 AP
Line 8	150 thru 250 Mesh
Line 9	300 thru 500 Mesh
Line 10	600 thru 800 Mesh

DESCRIPTION	BAG SIZES			
BAG SIZE NUMBER	1	2	3	4
SURFACE AREA PER BAG - Sq. Ft.	2.0	4.4	0.5	1.0
VOLUME PER BAG - gal.*	2.1	4.6	.37	.67
BAG DIAMETER - inch	7	7	4	4
BAG LENGTH - inch	16.5	32	9	15

*1 Gal. = 0.1337 cu. feet

RESISTANCE OF FIBERS TO CHEMICAL REAGENTS

CHEMICAL	ACRYLIC 275° F	NYLON 250° F	NOMEX 400° F	POLYESTER 300° F	POLYPROPYLENE 225° F	POLYETHYLENE 160/235° F *	FIBERGLASS 750° F	COTTON 240° F
ACETALDEHYDE	R	N	R	R	S	S	R	R
ACETANILIDE	R	R		R	R	R		
ACETIC ACID	R	R	S	R	R	R	R	R
ACETONE	R	R	R	R	S	R	R	R
ACETYL CHLORIDE	S	N		S	S	S		
ACETYLENE		R		R	R			R
ACROLEIN	S	N		S	S	S		
ACRYLIC ACID	S	N		R	R	R		
ALUMINUM CHLORIDE	R	N		R	R	R	R	
ALUMINUM HYDROXIDE	N	R	S	S	R	R	S	S
ALUMINUM SULFATE	R	S		R	R	R		
AMMONIA VAPOUR	S	S			R	S	N	N
AMMONIUM CARBONATE	S	R		R	R	R		
AMMONIUM CHLORIDE	S	N	N	S	R	R	R	
AMMONIUM HYDROXIDE	N	R	S	S	R	R	S	S
AMMONIUM NITRATE	R	N			R	N	R	N
AMYL ACETATE	S	S	R	R	S	S	R	R
AMYL ALCOHOL	R	R		R	R	R		
ANILINE	N	S		R	S	S		R
ANTIMONY TRICHLORIDE	R	S		R	R	R		
AQUA REGIA	S	N	N	S	R	R	N	N
BARIUM CARBONATE	R	R		R	R	R		
BARIUM CHLORIDE	R	R		R	R	R		
BENZALDEHYDE	R	R	R	R	R	R	R	R
BENZENE	R	R	R	R	S	N	R	R
BENZENE SULFONIC ACID	N	N		R	R	N		
BENZOIC ACID	R	S	S	S	R	R		N
BENZOYL CHLORIDE	R	N		S	S	S		
BENZYL ACETATE	R	R		R	R	R		
BISMUTH ACETATE	R	R		R	R	R		
BISMUTH SUBACRBONATE	R	R		R	R	R		
BROMINE	N	N	N	S	N	N	R	S
BROMOACETIC ACID	R	N		R	S	S		
BROMOBENZENE	R	R		R	S	S		
BUTANE	R	R		R			R	R
BUTYL ACETATE	R	R		R	R	R	R	R
BUTYRIC ACID	R	N		R	N	N		S
CADMIUM CHLORIDE	R	R		R	R	R		
CALCIUM ACETATE	R	S		R	R	R		
CALCIUM CARBONATE	R	R		R	R	R		
CALCIUM CHLORIDE	S	N	S	R	R	R	S	R
CALCIUM HYDROXIDE	S	R	R	S	R	R	S	R
CALCIUM OXALATE	R	N		R	R	R		
CAPRYLIC ACID	R	R		R	S	S		
CARBOLIC ACID/PHENOL	N	N	N	N	R	N	R	R
CARBON BISULFIDE	R	R	R	S	N		R	R
CARBON DISULPHIDE	R	R			S	N	R	S
CARBON TETRACHLORIDE	R	R	R	R	N	N	R	R
CARBONIC ACID	S	S					R	R
CATECHOL	R	N		S	R	R		
CETYL ALCOHOL	R	R		R	R	R		

CHEMICAL	ACRYLIC 275° F	NYLON 250° F	NOMEX 400° F	POLYESTER 300° F	POLYPROPYLENE 225° F	POLYETHYLENE 160/235° F *	FIBERGLASS 750° F	COTTON 240° F
CHLORINE	S	N		S	R		R	S
CHLOROACETIC ACID	R	N		S	R	R		
CHLOROBENZENE	R	R		R	S	S	R	R
CHLOROFORM	R	R	R	R	S	N	R	R
CHROMIC ACID	R	N			S	N	R	N
CHROMIC CHLORIDE	R	N		S	R	R		
CHROMIUM TRIOXIDE	N	N		N	N	N		
CINNAMYLIC ACID	R	R		R	S	S		
CITRIC ACID	R	R	R	R	R	R	R	R
COPPER AMMONIA HYDROXIDE	N	R		S	R	N	N	N
COPPER SULPHATE	R	N		R	R	N	R	N
CRESYLIC ACID	R	N		R	N	N		
CUPRIC CARBONATE	R	R		R	R	R		
CUPRIC CHLORIDE	R	N		R	R	R		
CUPRIC SULFATE	S	S		R	R	R		
CYCLOHEXANONE	R	R	R	R	N	N	R	S
CYCLOPENTANONE	R	R		R	N	N		
CYMENE	R	R		R	S	N		
DEXTRIN	R	R		R	R	R		
DIACETIN	R	R		R	R	R		
DIALLYPHTHALATE	R	R		R	N	N		
DIBENZYL KETONE	R	R		R	R	S		
DIBENZYLAMINE	R	R		R	N	S		
DIBROMOBENZENE	R	R		R	S	S		
DICHLOROACETIC ACID	S	N		S	S	S		
DICHLOROBENZENE	R	R		R	N	N		
DIESEL FUEL	R	R		R	S		R	R
DIETHANOLAMINE	R	R		R	R	R		S
DIETHYLENE GLYCOL	R	R	R	R	R	R	R	S
DIMETHYL PHTHALATE	R	R		R	S	S		
DINITROBENZENE	R	R		R	S	N		
DIPHENYL	N	S		N	N	N		
DIPHENYLACETIC ACID	R	S		R	R	R		
DIPHENYLAMINE	R	R		R	N	N		
DISUTYLAMINE	R	R		R	S	S		
EPICHLOROHYDRIN	R	R		R	S	S		S
ETHER	R	S			S	N	R	N
ETHYL ACETATE	R	R	R	R	S	S	R	R
ETHYL ALCOHOL	R	R	R	R	R	R	R	R
ETHYL BENZENE	R	R		R	N	N		
ETHYL BENZOATE	R	S		R	R	R		
ETHYL CARBAMATE	R	R		R	S	S		
ETHYL CARBONATE	R	R		R	R	R		
ETHYL CHLORIDE	R	R		R	S	N		S
ETHYL CHLOROACETATE	R	R		R	R	R		
ETHYL ETHER	R	R		R	N	N		
ETHYL PHENYLACETATE	R	S		R	R	R		
ETHYL PROPIONATE	R	R		R	S	S		
ETHYLENE BROMIDE	R	R		R	S	S		
ETHYLENE GLYCOL	R	N			S	N	R	R

Continued

TEXTILE FIBER/MAXIMUM OPERATING TEMPERATURE

R—RECOMMENDED FOR MOST CONDITIONS
S—SATISFACTORY FOR LOW CONCENTRATIONS AND TEMPERATURES
N—NOT RECOMMENDED

□—INSUFFICIENT DATA
* LOW DENSITY 160° F
* HIGH DENSITY 235° F

RESISTANCE OF FIBERS TO CHEMICAL REAGENTS

CHEMICAL	TEXTILE FIBER/MAXIMUM OPERATING TEMPERATURE								CHEMICAL								
	ACRYLIC 275° F	NYLON 250° F	NOMEX 400° F	POLYESTER 300° F	POLYPROPYLENE 225° F	POLYETHYLENE 160/235° F*	FIBERGLASS 750° F	COTTON 240° F		ACRYLIC 275° F	NYLON 250° F	NOMEX 400° F	POLYESTER 300° F	POLYPROPYLENE 225° F	POLYETHYLENE 160/235° F*	FIBERGLASS 750° F	COTTON 240° F
FERRIC AMMONIUM SULFATE	S	N		R	R	R			PHENOXYACETIC ACID	R	S		R	R	R		
FERRIC CHLORIDE	R	S	S	R	R	R	N	N	PHOSPHORIC ACID	R	S	R	R	R	R	R	S
FERRIC SULFATE	R	N		S	R	R		S	PHOSPHOROUS TRICHLORIDE	R	N		R	R	R		
FERROUS CHLORIDE	R	N		R	R	R			PHTHALIC ACID	R	S		R	R	R		
FLUORINE	S	N		S	R		N	N	POTASSIUM BISULFATE	R	S		R	R	R	R	N
FORMALDEHYDE	R	R		R	R	R	R	R	POTASSIUM CHLORITE	R	S	S	R	R		R	S
FORMIC ACID	S	N	S	R	R	R	R	R	POTASSIUM CYANIDE					R	N	R	
FREON 11, 12, 22	R	S		R			R	R	POTASSIUM DICHROMATE	R	N		R	S	S		
FURFURAL	R	R		R	S	S	R	S	POTASSIUM HYDROXIDE	N	S	S	S	S	R	N	R
GALLIC ACID	R	S		R	R	R			POTASSIUM PERMANGANATE	N	N		S	N	N	R	N
GASOLINE	R	R		R	S	N			PROPIONIC ACID	R	R		R	S	S		S
GLYCERINE	R	R	R	R	R	R	R	R	PROPYLENE GLYCOL	R	R	R	N	R		R	
GLYCOL	R	R	R	N	R		R	R	PYRIDINE	N	S		R	S	S		S
HEXACHLOROBENZENE	R	N		R	S	S			RESORCINOL	N	S		R	S	S		
HEXANE	R	R		R	N	N	R	R	SALICYLIC ACID	R	N	S	R	R	R	R	N
HYDROBROMIC ACID	S	N		R	R	R			SILVER NITRITE	R				R	N	R	N
HYDROCHLORIC ACID	R	N	S	R	R	R	R	N	SODIUM ACETATE	R	R	S	R	R		S	R
HYDROFLUORIC ACID	N	N	N	N	R	R	N	N	SODIUM BENZOATE	R	S	S	R	R		S	R
HYDROGEN PEROXIDE	R	S		R	R	S	R	S	SODIUM BISULFATE	S	N		R	R	R		N
IODINE	R	N		R	R		R	R	SODIUM BISULFITE	N	S	S	R	R		R	R
ISOPROPYL ALCOHOL				S	R		R	R	SODIUM BROMIDE	R	R	R	R	R		N	R
LACTIC ACID	R	S	S	R	R	R	R	R	SODIUM CARBONATE	S	R		S	R	N		N
LAQUER THINNER		R			S			R	SODIUM CHLORATE					S		R	R
LEAD ACETATE	R	R		R	R	R			SODIUM CHLORIDE	R	R	R	R	R		N	R
LITHIUM CHLORIDE	R	R		R	R	R		R	SODIUM CYANIDE	R	S	S	R	R		S	R
MAGNESIUM CHLORIDE	R	R		R	R	R		S	SODIUM DICHROMATE	R				S	N	R	
METHANOL	R	R	R	R	R		R	R	SODIUM HYDROXIDE	N	R		N	R	R	N	R
METHYL ACETATE	R	R		R	S	S			SODIUM HYPOCHLORITE	S	N		S	N	S	N	N
METHYL ALCOHOL	R	R		R	R	R	R	R	SODIUM NITRATE	R	S	S	R	R		S	R
METHYL BROMOACETATE	R	R		R	R	R			SODIUM PERBORATE	R	R		R	R	S	R	S
METHYL ETHYL KETONE	R	R	R	R	S	S	R	R	SODIUM SULFATE	R	R	R	R	R	R	S	R
METHYL UREA	R	R		R	R	R			SODIUM SULFIDE	R	R	R	R	R		S	R
MINERAL OIL	R	R	R	R	R		R	R	STEAM	S	S			R		N	R
MONOACETIN	R	S		R	S	S			STODDARD SOLVENT	R	S		S	S	N	R	R
NAPHTHYLAMINE	R	R		R	N	N			SUCCINIC ACID	R	S		R	S	S		
NAPTHA	R	R	R	R	S		R	R	SULFAMIC ACID	N	N		N	R	R		
NICKEL CHLORIDE	R	N		N	R	N	R	N	SULFURIC ACID	S	N	S	S	R	R	R	N
NICKEL SULFATE	R	R		R	R	R	R	N	SULPHUR DIOXIDE	S	N			R	R	R	S
NITRIC ACID	S	N	S	S	R	R	R	N	TETRACHLOROETHYLENE	R	R	R	R	S	S	R	R
NITROBENZENE	R	R	R	R	N	N	R	R	THIOCARBAMIDE	R	R		R	S	S		
NITROBENZOIC ACID	R	N		R	S	S			TOLUENE/TOLUOL	R	R	R	R	N	N	R	R
NITROTOLUENE	R	R		R	R	N			TRI—CRESYL PHOSPHATE	R	R	R	R			R	
OCTYL ALCOHOL	R	R		R	R	R			TRIBROMOBENZENE	R	S		R	S	S		
OLEIC ACID	R	R		R	N	N	R	N	TRICHLOROACETIC ACID	R	N		R	R	R		
OXALIC ACID	R	N	N	R	S	R	R	R	TRICHLOROETHYLENE	R	R		R	S	N	R	R
OZONE	R			R	S		R		VALERALDEHYDE	R	N		R	N	N		
PARALDEHYDE	R	R		R	R	R			VARNISH	R	R			N		R	R
PENTAERYTHRITOL	R	R		R	R	R			WHISKEY	N	N			S		N	R
PERCHLORETHYLENE	R	S		R	N	N	R	S	WINE	N	N			S		N	R
PETROLEUM ETHER	R	R		R	S	N			XYLENE/XYLOL	R	R	R	R	N	N	R	R
PHENOL ETHER	R	R		R	N	N			ZINC CHLORIDE	N	N	N	R	R	R	N	N
Continued									ZINC SULFATE	S	N		R	R	R	R	N

R—RECOMMENDED FOR MOST CONDITIONS
S—SATISFACTORY FOR LOW CONCENTRATIONS AND TEMPERATURES
N—NOT RECOMMENDED

□—INSUFFICIENT DATA
*LOW DENSITY 160° F
*HIGH DENSITY 235° F

PROPERTIES OF INDUSTRIAL GRADE FILTER PAPERS

	1 GRADE	2 BASIS WEIGHT	3 POUNDS PER 1000 SQ. FT.	4 THICKNESS INCHES	5 COLOR & TEXTURE	6 FLOW RATE	7 WET STRENGTH	8 PARTICLE RETENTION
MEDIUM WET STRENGTH	101	85	61	.030	WS	75	30	7
	101	140	101	.052	WS	65	30	3
	113	20	14	.006	WS	70		10
	115	20	14	.010	WC	250		16
	117	35	25	.017	WC	350	40	25
	123	70	51	.026	WS	175	45	12
	123	78	56	.030	WS	150	45	11
	123	95	69	.038	WS	130	45	10
	127	65	47	.023	WS	100	40	11
	127	75	54	.028	WS	140	45	9
	128	85	61	.031	TS	70	50	7
	133	70	51	.038	WC	425	40	16
	134	54	39	.032	WC	425		19
	138	75	54	.039	TC	100	60	11
	140	44	32	.025	WC	425	40	17
	143	60	43	.034	WC	650	40	
	154	84	111	.044	WC	80	60	15
HIGH WET STRENGTH RECOMMENDED FOR AQUEOUS SOLUTIONS	205	34	25	.011	WS	200	200	
	209	20	14	.006	WS	70	250	12
	209	28	20	.008	WS	50	300	11
	215	20	14	.010	WC	250	150	16
	223	70	51	.026	WS	175	250	12
	234	54	39	.032	WC	425	150	19
	237	20	14	.011	WC	700	120	19
	237	28	20	.013	WC	700	120	19
	238	25	18	.014	TC	175	150	
	238	55	40	.031	TC	170	500	11
	238	75	54	.039	TC	100	550	
	250	25	18	.008	WS	50	300	10
	253	15	11	.007	WC	250	150	17
NON-WOVENS						AIR FLOW 9		
	550	12	9	.006	WS	220	600	50
	850	19	13	.009	WS	130	900	40
	1250	28	20	.017	WS	70	1900	30

VALUES ABOVE REPRESENT AVERAGE READINGS AND SHOULD NOT BE USED FOR PRECISE CALCULATIONS.

EXPLANATION OF ABOVE COLUMN HEADINGS

1 GREAT LAKES FILTER GRADE NUMBER

2 WEIGHT IN POUNDS PER REAM, 500 SHEETS 20 IN. x 20 IN.

5 W — WHITE
T — TAN
S — SMOOTH SURFACE
C — CREPED SURFACE

6 MILLILITERS OF WATER PER MINUTE PASSED THROUGH 1" DIAMETER SAMPLE WITH CONSTANT 2" HEAD

7 HEAD IN INCHES WATER COLUMN REQUIRED TO BURST 1" DIAMETER SAMPLE

8 LARGEST SIZE, IN MICRONS, SPHERICAL GLASS BEADS THAT PAPER WILL PASS UNDER STANDARD LABORATORY CONDITIONS

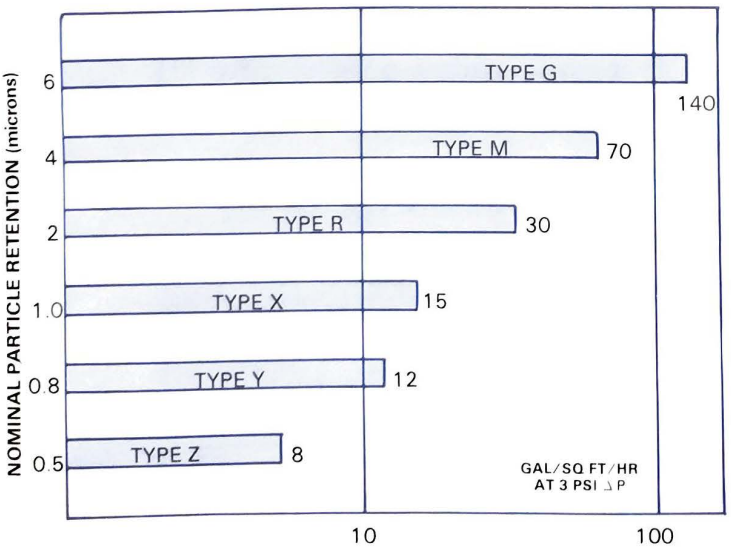
9 AIR FLOW MEASURED IN CFM AT ½" WATER COLUMN ON FRAZIER PERMEOMETER

FILTER PAPER APPLICATION CHART

APPLICATION	GRADE
ALCOHOLIC BEVERAGES	
Beer	117, 123, 127, 133
Liqueurs	101, 133
Wines	123, 133
Whiskey	101, 133
CHEMICALS	
Alcohols	101
Bleaches	123, 127, 250
Dyes	117, 123, 133, 134
Electroplating*	133, 138, 117, 123
Emulsions	115, 117, 134, 133
Fatty Acids	127, 128, 138
Formaldehyde	133, 134
Insecticides	101, 128, 138
Photographic Chemicals	113
Zinc Pigments	127
DRUGS AND TOILET PREPARATIONS	
Cod Liver Oils	115, 133, 134
Drugs, Extracts	113, 123, 134
Cough Syrups	117, 133, 123
Medicinal Oils	113, 115, 134
Penicillin	209, 250
Perfumes	134
Pharmaceuticals	113, 117, 134, 123
Toilet Preparations	101, 123

APPLICATION	GRADE
PAINT and VARNISH	
Lacquers	127, 128, 133
Resins	117, 134, 128
Shellac	117, 134, 133
Varnish	117, 127, 128, 133
FOOD and BEVERAGES	
Beverage Syrups	117, 134, 133
Cider	123, 127, 133
Cocoa Butter	134, 154
Coffee	234, 237, 253
Food Colors	115, 117, 133, 134
Ginger Ale Extract	123
Honey	123, 127, 128, 133
Jellies	115, 117, 134, 133
Lard, Shortening	117, 134, 133, 154
Malt Syrups	117, 134, 133
Soft Drinks	101, 123, 127
Sugar	113, 115
Vinegar	123, 127
Yeast	115, 237
OILS, FATS, SOAPS	
Cocoanut	115, 117, 123
Corn	115, 117
Fish, Linseed, Soy	134, 133
Tung & Vegetable Oils	128, 138, 154
PETROLEUM PRODUCTS	
Light Oils	127, 128, 138
Transformer Oils	127, 128
Wax	117, 133, 134
Wax, Removal From Oil	127, 128, 138

RELATIVE FLOW RATE TABLE CELLULOSE FILTER PADS



PROPERTIES OF PADS COMPARED TO PAPERS
- SUPERIOR PARTICLE RETENTION
- HIGHER FLOW RATES
- GREATER DIRT HOLDING
- MORE COSTLY

*HIGH WET STRENGTH PAPERS SHOULD BE AVOIDED. CERTAIN NON-WOVENS CAN PROVIDE ADEQUATE BACK-UP.

Grades Should Not Be Considered As Specific Recommendations But Only As A Guide to Selection.

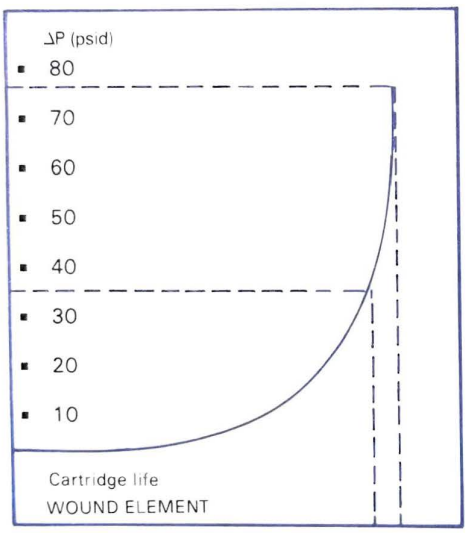
PERFORMANCE CHARACTERISTICS OF FILTER CARTRIDGES

WHEN TO USE CARTRIDGE FILTRATION

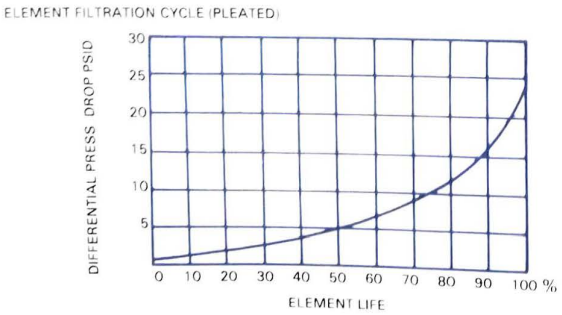
CARTRIDGE FILTERS CAN BE USED WITH LIQUIDS OR GASES OVER A WIDE RANGE OF PROCESSING CONDITIONS. PROPER CARTRIDGE APPLICATION CONDITIONS GENERALLY INCLUDE:

- REMOVAL RATINGS FROM .2 TO 500 MICRONS.
- SYSTEM PRESSURES FROM A NEAR VACUUM TO SEVERAL THOUSAND PSI.
- VISCOSITIES TO 100,000cps.
- TEMPERATURES FROM NEAR ABSOLUTE ZERO TO 1000°F.
- FLOW RATES TO SEVERAL THOUSAND GPM OR SCFM.

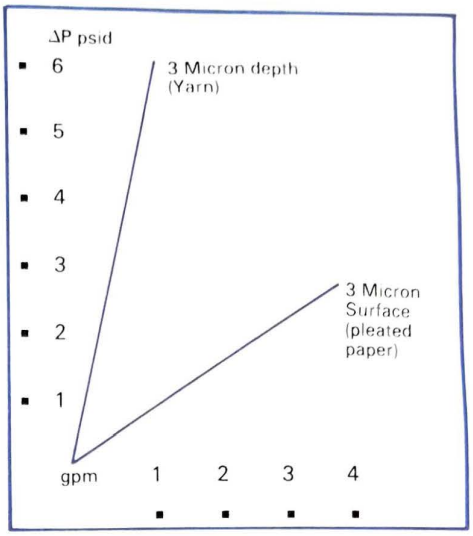
WHEN TO CHANGE CARTRIDGES*



LITTLE ADDITIONAL USEFUL LIFE IS ACHIEVED BY OPERATING CARTRIDGES BEYOND ΔP=35. DISADVANTAGE OF EXCEEDING ΔP=35 IS POSSIBLE CONTAMINATION OF FILTRATE.

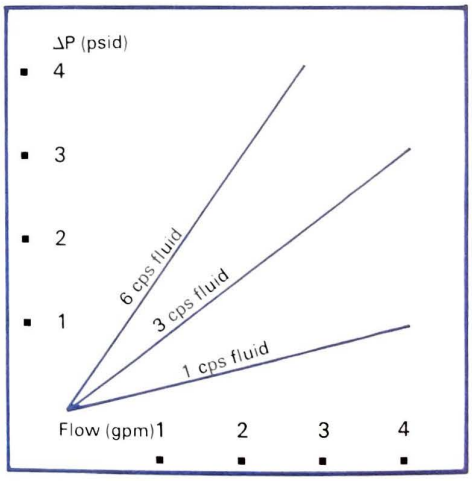


SURFACE VERSUS DEPTH FILTRATION



COMPARISON OF FLOW RATE VS. PRESSURE DROP FOR DEPTH AND SURFACE ELEMENTS.

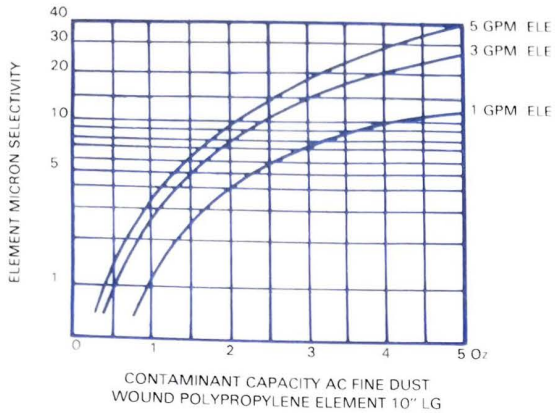
PRESSURE LOSS DUE TO VISCOSITY



CARTRIDGE PRESSURE DROP VARIES LINEARLY WITH FLOW RATE AND VISCOSITY.

IMPORTANCE OF LOW INITIAL PRESSURE DROP

APPROXIMATELY ½ OF THE USEFUL LIFE OF A FILTER ELEMENT IS LOST BY SELECTING A SYSTEM WITH AN INITIAL PRESSURE DROP OF 5 PSIG AS COMPARED TO 1-2 PSIG.



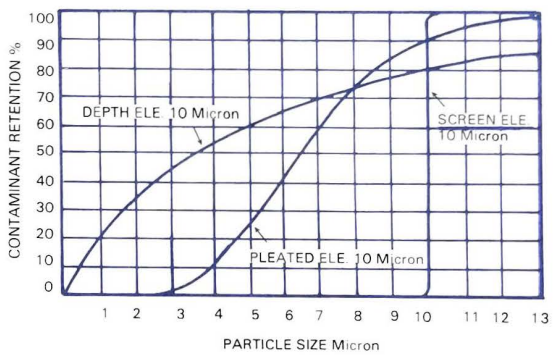
DIRT HOLDING CAPACITY

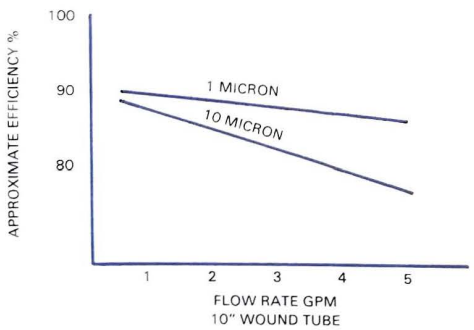
DIRT HOLDING CAPACITY IS GREATER FOR HIGHER MICRON RATED ELEMENTS THAN FOR THOSE OF TIGHTER SELECTIVITY.

CURVES ALSO ILLUSTRATE THAT ELEMENTS WILL CAPTURE MORE DIRT AT LOWER FLOW RATES.

PARTICLE RETENTION EFFICIENCY

COMPARISION OF THE THREE TYPES OF MEDIA INDICATES THE DIFFERENT CUT OFF CHARACTERISTICS. THE DEPTH ELEMENT RETAINS MORE PARTICULATE SMALLER THAN ITS RATED SIZE WHILE ALLOWING PASSAGE OF SOME LARGER PARTICLES.





FLOW RATE AFFECTS PERFORMANCE

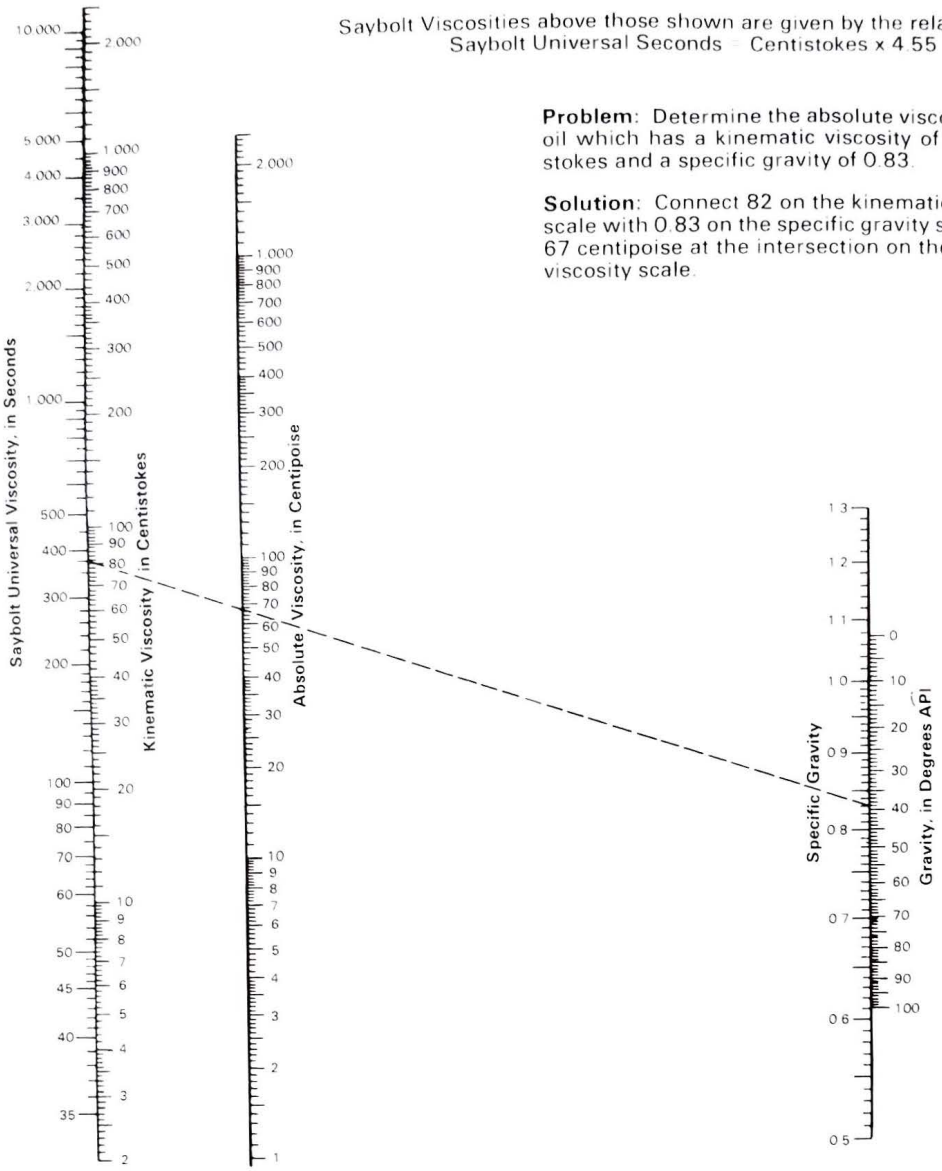
PERFORMANCE OF A CARTRIDGE IS INFLUENCED BY FILTRATION VELOCITY, EFFICIENCY TENDING TO FALL OFF AS THE FLOW RATE INCREASES.

AFFECT IS GREATER FOR HIGHER MICRON RATED TUBES.

*SUGGESTED REPLACEMENT PRESSURE DROP

PLEATED PAPER ELEMENTS	20-25 PSID
WOUND ELEMENTS (UNRESINATED)	30-35 PSID
WOUND ELEMENTS (RESINATED)	50-70 PSID
AIR ELEMENTS	12-15 PSID
COALESCER ELEMENTS	15-20 PSID

EQUIVALENTS OF KINEMATIC, SAYBOLT UNIVERAL AND ABSOLUTE VISCOSITY



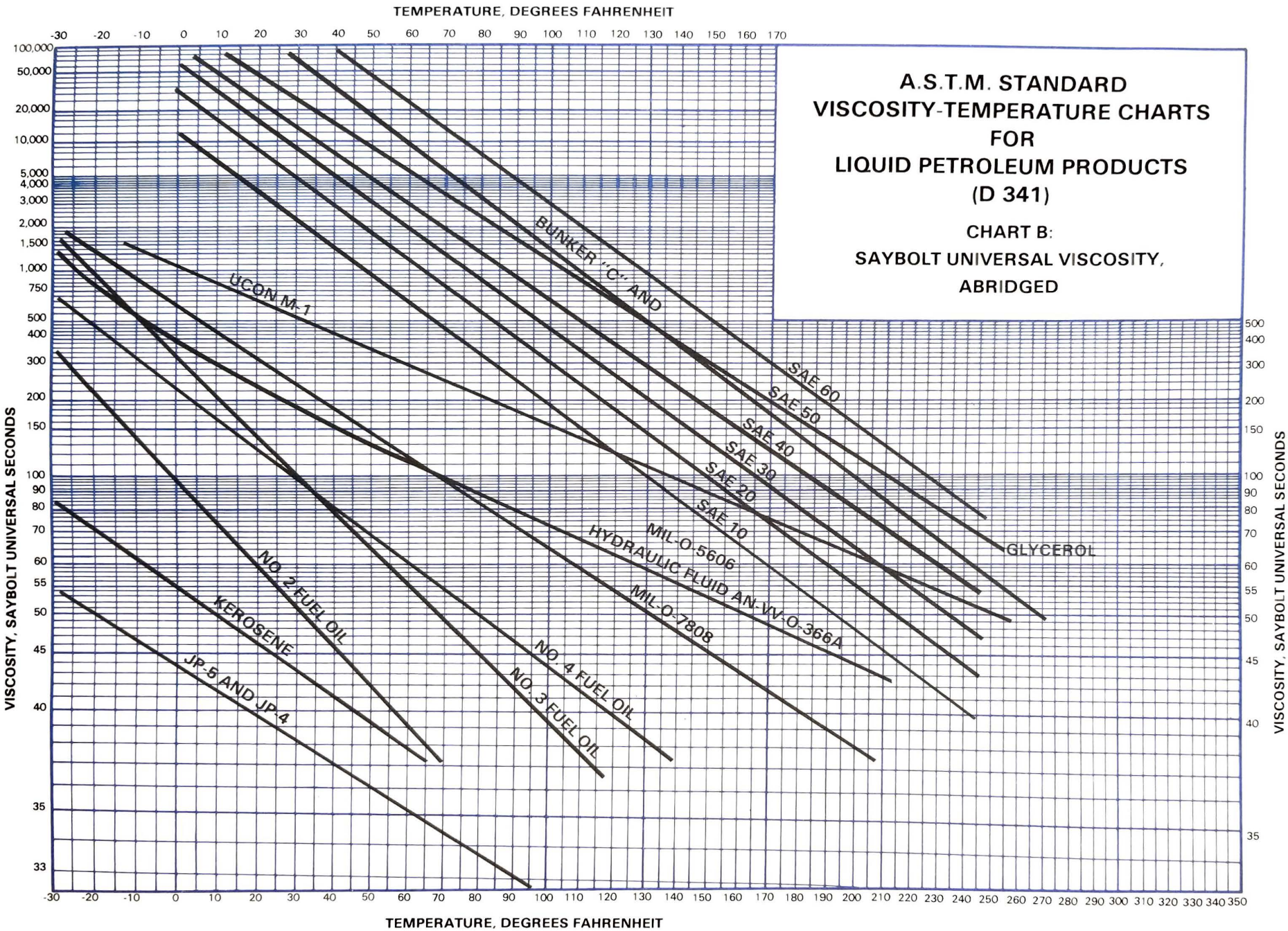
Saybolt Viscosities above those shown are given by the relationships:
Saybolt Universal Seconds = Centistokes x 4.55

Problem: Determine the absolute viscosity of an oil which has a kinematic viscosity of 82 centistokes and a specific gravity of 0.83.

Solution: Connect 82 on the kinematic viscosity scale with 0.83 on the specific gravity scale; read 67 centipoise at the intersection on the absolute viscosity scale.

PHYSICAL PROPERTIES OF TEXTILE FIBERS (APPROXIMATE VALUES)

FIBER	MAXIMUM TEMPERATURE F°		SPECIFIC GRAVITY	WATER ABSORBENCY %	BREAK STRENGTH GM/DENIER	ELONGATION AT BREAK %	WEAR RESISTANCE
	WATER	OTHER					
ACRYLIC	240	275	1.1	4	2.0-3.5	20-40	GOOD
COTTON - DRY		240	1.6	—	3-5	3-7	FAIR
COTTON - WET	220	240	1.6	20	3.3-6.4	7-9	FAIR
FIBERGLASS	550	750	2.5-3.5	NIL	6.3-6.9	3-4	POOR
MODACRYLIC		170	1.3	2	2.4-3	33-53	FAIR
NYLON 66	220	250	1.1	7	4.6-5.9	26-32	EXCELLENT
POLYESTER	250	300	1.2-1.4	NIL	4.4-7.8	19-30	GOOD
POLYETHYLENE, LOW DENSITY HIGH DENSITY		160 235	0.9 1.0	NIL NIL	1-3 5-7	20-80 10-20	GOOD GOOD
POLYPROPYLENE	200	225	0.9	NIL	4.8-7.0	25-40	GOOD
RAYON	220	270	1.5	24	1.5-2.4	15-30	POOR
TEFLON	450	450	2.1	NIL	2	19	FAIR


TEMPERATURE, DEGREES FAHRENHEIT
-30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170
100,000
50,000
20,000
10,000
5,000
4,000
3,000
2,000
1,500
1,000
750
500
400
300
200
150
100
90
80
70
60
55
50
45
40
35
33
VISCOSITY, SAYBOLT UNIVERSAL SECONDS
A.S.T.M. STANDARD
VISCOSITY-TEMPERATURE CHARTS
FOR
LIQUID PETROLEUM PRODUCTS
(D 341)
CHART B:
SAYBOLT UNIVERSAL VISCOSITY,
ABRIDGED
BUNKER "C" AND
UCON M-1
SAE 60
SAE 50
SAE 40
SAE 30
SAE 20
SAE 10
MIL-O-5606
HYDRAULIC FLUID AN-VV-O-366A
MIL-O-7808
GLYCEROL
NO. 2 FUEL OIL
KEROSENE
JP-5 AND JP-4
NO. 4 FUEL OIL
NO. 3 FUEL OIL
-30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350
TEMPERATURE, DEGREES FAHRENHEIT

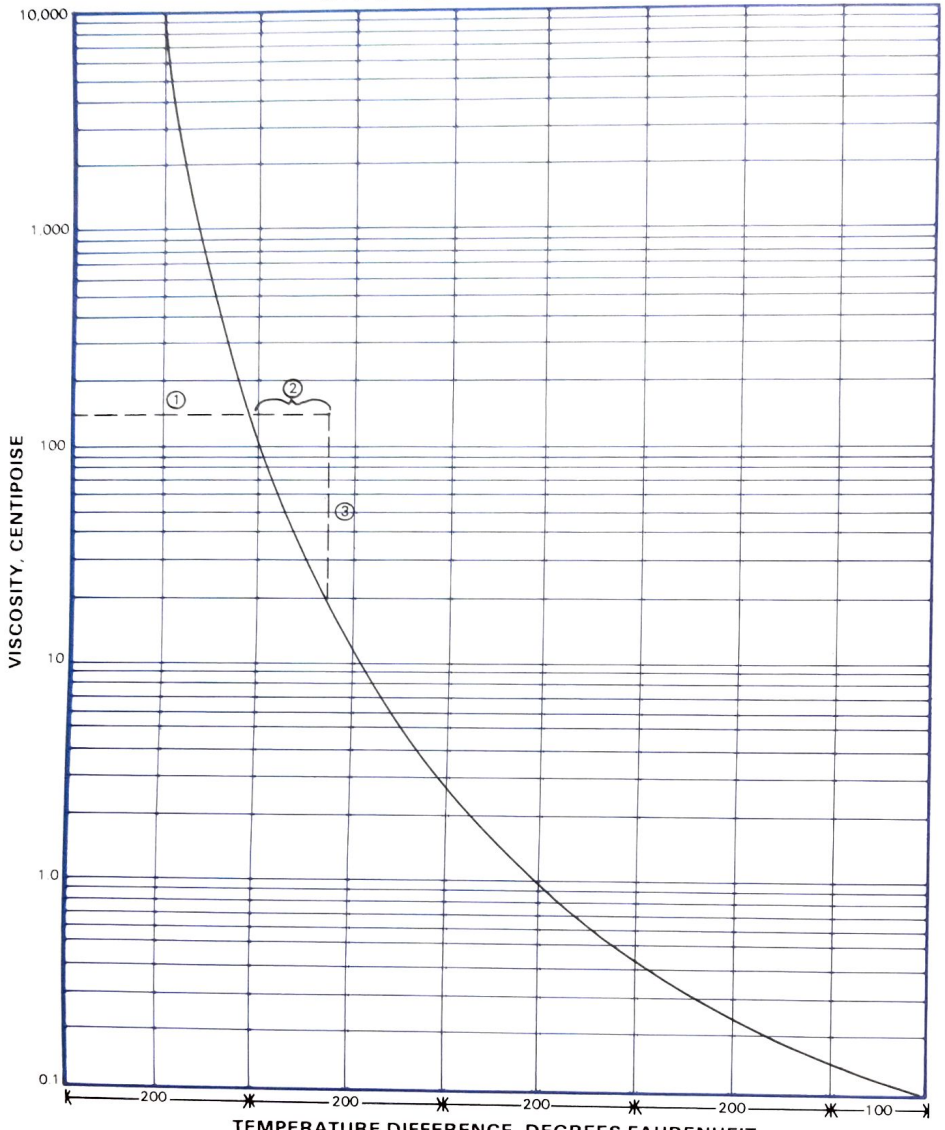
APPROXIMATE VISCOSITIES OF LIQUIDS AT 68°F/20°C

LIQUID	CENTIPOISE (CPS)	CENTISTOKES (CKS)
ACETALDEHYDE	0.23	0.29
ACETIC ACID, 100 PERCENT	1.30	1.20
ACETIC ACID, 70 PERCENT	2.60	2.40
ACETIC ANHYDRIDE	0.95	0.88
ACETONE, 100 PERCENT	0.34	0.43
ACETONE, 35 PERCENT	0.40	
ACETONITRILE	0.34	0.43
ACETOPHENONE	1.70	1.65
ACRYLIC ACID	1.20	1.10
ALLYL ALCOHOL	1.40	1.60
ALLYL BROMIDE	0.50	0.36
ALLYL CHLORIDE	0.33	0.35
ALLYL IODIDE	0.75	
AMYL ETHER	1.20	
AMMONIA, 26 PERCENT	1.20	1.30
AMYL ACETATE	0.90	1.02
AMYL ALCOHOL	4.30	5.30
ANILINE	4.30	4.60
ANISOLE	1.30	
ARSENIC TRICHLORIDE	1.30	
BENZALDEHYDE	1.40	1.10
BENZENE	0.65	0.74
BENZONITRILE	1.20	1.20
BENZYL ALCOHOL	5.80	5.60
BENZYL ETHER	5.30	5.10
BENZYLAMINE	1.60	1.60
BROMINE	1.00	0.32
BROMOANILENE, META	6.80	
BROMOBENZENE	1.20	0.80
BROMOFORM	1.90	0.66
BROMOTOLUENE	1.40	
BUTYL ACETATE	0.65	
BUTYL ACRYLATE	0.90	
BUTYL ALCOHOL	2.90	3.60
BUTYRIC ACID	1.60	1.70
CALCIUM CHLORIDE, 25 PERCENT	2.40	2.00
CARBON DISULFIDE	0.37	0.29
CARBON TETRACHLORIDE	1.00	0.63
CHLOROBENZENE	0.80	0.77
CHLOROFORM	0.57	0.38
CHLOROPHENOL, META	11.00	8.70
CHLOROPHENOL, ORTHO	4.10	3.30
CHLOROSULFONIC ACID	2.90	
CHLOROTOLUENE, META	0.90	0.84
CHLOROTOLUENE, ORTHO	1.10	1.00
CHLOROTOLUENE, PARA	0.90	0.84
CREOSOTE	12.00	
CRESOL, META	22.00	21.00
CYCLOHEXANE	1.10	1.30
CYCLOHEXANOL	73.00	76.00
DIBROMOMETHANE	1.70	
DICHLOROETHANE	0.85	0.68
DICHLOROMETHANE	0.47	
DIETHYL KETONE	0.48	0.59
DIETHYL OXALATE	2.10	1.90
DIETHYLAMINE	0.35	.049
DIETHYLANILINE	2.20	2.40
DIETHYLCARBINOL	7.00	
DIETHYLENE GLYCOL	41.00	30.00
DIMETHYLANILENE	1.40	1.40
DIPHENYL	3.00	3.00
DIPROPYL ETHER	0.43	0.58
DIPROPYL OXALATE	2.90	2.80
DODECANE	1.30	1.70
ETHYL ACETATE	0.48	0.53
ETHYL ACRYLATE	0.60	0.67
ETHYL ALCOHOL, 100 PERCENT	1.20	1.50
ETHYL ALCOHOL, 40 PERCENT	3.00	5.80
ETHYL BENZENE	0.75	0.87
ETHYL BROMINE	0.40	0.28
ETHYL CHLORIDE	0.27	0.29
ETHYL ETHER	0.24	
ETHYL FORMATE	0.42	0.46
ETHYL IODIDE	0.60	0.31
ETHYL PROPIONATE	0.54	0.61
ETHYL PROPYLETHER	0.32	
ETHYL SULFIDE	0.46	
ETHYLBENZENE, BROMIDE	0.40	0.27
ETHYLENE BROMIDE	1.60	0.73
ETHYLENE CHLORIDE	0.84	
ETHYLENE GLYCOL	22.00	19.00
ETHYLFORMATE	0.40	0.43
ETHYLIDENE CHLORIDE	0.48	
EUGENOL	9.20	8.50
FLUOROBENZENE	0.60	
FORMAMIDE	3.50	3.10
FORMIC ACID	1.80	1.50
FREON-11	0.47	
FREON-113	0.72	
FREON-12	0.27	
FREON-21	0.37	
FREON-22	0.24	
FURFUROL	1.50	1.30
GLYCERIN	1490.00	1192.00
GLYCERIN TRINITRATE	36.00	
GLYCEROL, 50 PERCENT	6.30	5.60
HEPTANE	0.43	0.63
HEXANE	0.33	0.50

APPROXIMATE VISCOSITIES OF LIQUIDS AT 68°F/20°C

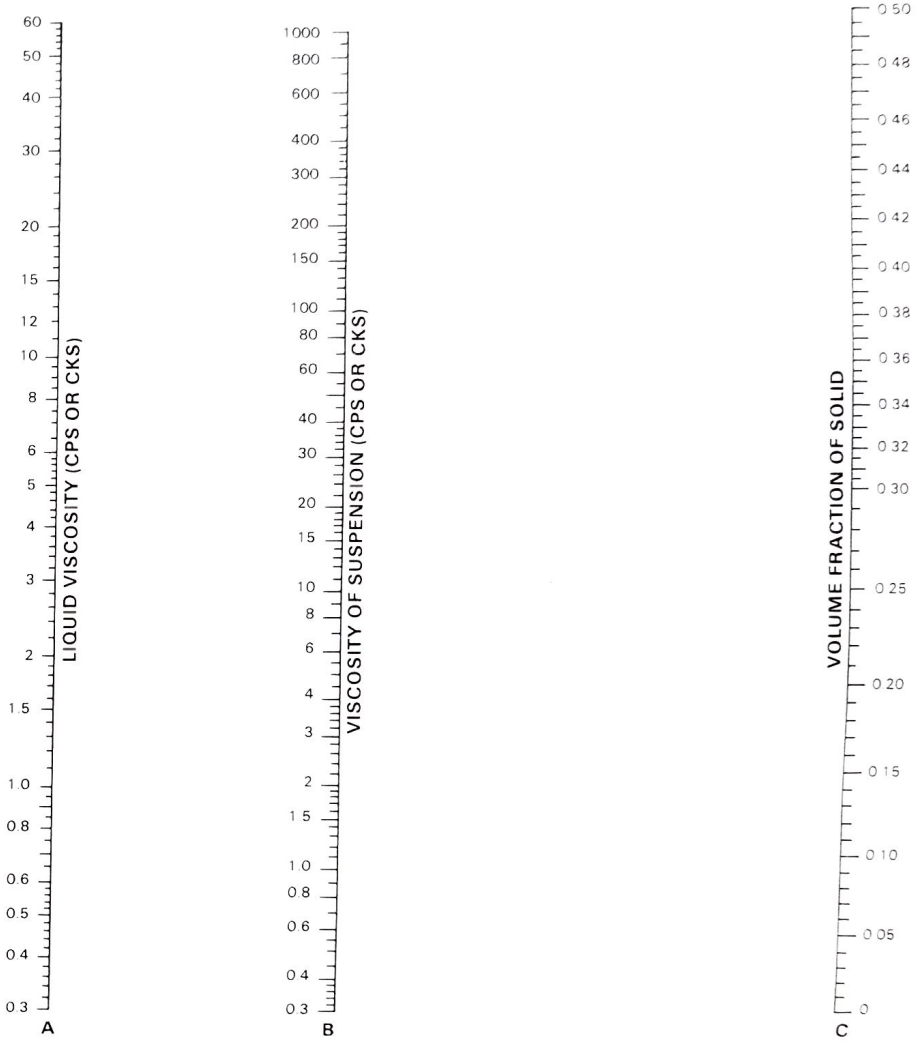
LIQUID	CENTIPOISE (CPS)	CENTISTOKES (CKS)
HYDRAZINE	0.97	
HYDROCHLORIC ACID, 31.5 PERCENT	2.00	1.20
IODOBENZENE	1.70	0.93
ISOAMYL ACETATE	0.87	
ISOAMYL AMINE	0.75	
ISOBUTYL ALCOHOL	4.20	5.20
ISOBUTYRIC ACID	1.30	1.40
ISOEUGENOL	28.00	
ISOHEPTANE	0.38	
ISOHEXANE	0.31	
ISOPENTANE	0.22	
ISOPROPYL ALCOHOL, 50 PERCENT	2.20	2.40
ISOPROPYL BROMIDE	0.48	
ISOPROPYL CHLORIDE	0.33	
ISOPROPYL IODIDE	0.76	
ISOQUINOLINE	4.00	
ISOSAFROL	4.00	
LINSEED OIL, RAW	44.00	
MERCURY	1.60	0.12
METHANOL, 100 PERCENT	0.60	0.76
METHANOL, 40 PERCENT	2.10	2.30
METHANOL, 90 PERCENT	0.78	0.95
METHYL ACETATE	0.42	0.45
METHYL ACRYLATE	0.50	
METHYL ANILINE	2.00	2.00
METHYL CHLORIDE	0.18	0.19
METHYL ETHYL KETONE	0.43	0.53
METHYL FORMATE	0.35	0.36
METHYL I-BUTYRATE	0.52	0.58
METHYL IODIDE	0.49	0.22
METHYL N-BUTYRATE	0.60	0.67
METHYL PROPIONATE	0.46	0.50
METHYL PROPYL KETONE	0.50	0.62
METHYL SULFIDE	0.30	
METHYLENE BROMIDE	1.00	0.40
METHYLENE CHLORIDE	0.42	0.31
MILK	1.00	0.97
NAPTHALENE	4.00	3.50
NITRIC ACID, 60 PERCENT	2.40	1.80
NITRIC ACID, 95 PERCENT	1.20	0.80
NITRO METHANE	0.70	
NITROBENZENE	2.10	1.70
NITROGEN DIOXIDE	0.41	
NITROTOLUENE	2.30	2.00
OCTANE	0.55	0.78
OCTYL ALCOHOL	10.60	13.00
OIL, CASTOR	986.00	1016.00
OIL, COTTONSEED	70.00	78.00
OIL, LINSEED	35.00	38.00
OIL, OLIVE	84.00	91.00
OIL, RAPE	163.00	
OIL, SOYA BEAN	69.00	
OLEIC ACID	28.00	33.00
PENTACHLOROETHANE	2.60	1.60
PENTADECANE	2.80	3.60
PENTANE	0.24	0.38
PHENOL	8.60	8.00
PHENYLCYANIDE	1.30	
PHOSPHORUS TRIBROMIDE	1.90	
PHOSPHORUS TRICHLORIDE	0.67	
PROPIONIC ACID	1.20	1.20
PROPYL ALDEHYDE	0.41	
PROPYL ACETATE	0.69	0.68
PROPYL ALCOHOL	2.40	3.00
PROPYL BROMIDE	0.52	0.38
PROPYL CHLORIDE	0.35	0.39
PROPYL FORMATE	0.52	0.58
PROPYL IODIDE	0.75	
PYRIDINE	0.97	0.99
SALICYLIC ACID	2.70	1.90
SODIUM CHLORIDE 25 PERCENT	2.20	1.80
SODIUM HYDROXIDE 20 PERCENT	6.40	4.20
SODIUM HYDROXIDE, 50 PERCENT	110.00	72.00
STANNIC CHLORIDE	0.95	0.43
SUCCINONITRILE	5.80	
SULFURIC ACID, 100 PERCENT	25.00	27.00
SULFURIC ACID, 60 PERCENT	6.60	4.40
SULFURYL CHLORIDE	0.86	
TETRACHLOROETHANE	1.70	1.10
TETRADECANE	2.20	2.90
THIOPHENE	0.67	0.69
TITANIUM TETRACHLORIDE	0.85	0.48
TOLUENE	0.60	0.69
TRIACETIN	28.00	
TRIBUTYRIN	12.00	
TRICHLORETHANE	1.20	
TRICHLOROETHYLENE	0.62	0.42
TRIDECANE	1.70	2.20
TRIETHYLCARBINOL	6.80	
TRIETHYLENE GLYCOL	47.00	42.00
TURPENTINE	1.50	1.70
VINYL ACETATE	0.45	0.48
VINYL TOLUENE	0.82	
WATER	1.00	1.00
XYLENE, META	0.62	0.72
XYLENE, ORTHO	0.83	0.94
XYLENE, PARA	0.67	0.78

APPROXIMATE AFFECT OF TEMPERATURE ON VISCOSITY OF LIQUIDS



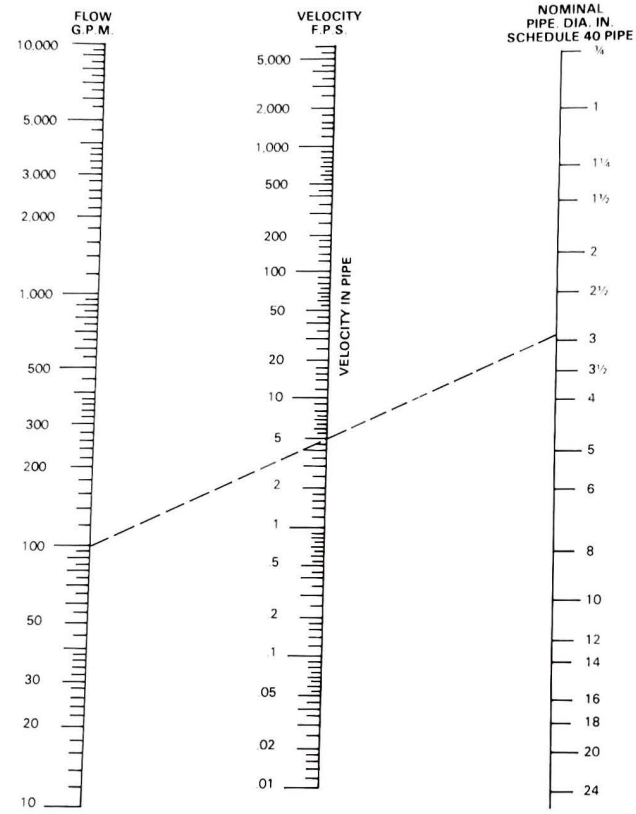
Use of curve:
1. Given viscosity in centipoise of a liquid at 68°F, from page 20 or 21, locate viscosity on curve opposite corresponding point on vertical scale (example: 105 CPS)
2. Establish point to right or left for higher or lower temperature differential (example: 150 - 68 = 82).
3. Draw vertical line to curve and read approximate viscosity from vertical scale (approximately 20 CPS)

VISCOSITY OF SUSPENSIONS NOMOGRAPH



A STRAIGHT LINE DRAWN THROUGH POINTS ON LINES A & C WILL DETERMINE APPROXIMATE VISCOSITY OF DISPERSION AT INTERSECTION OF LINE B

FLOW VELOCITY OF LIQUIDS THROUGH PIPES



Reasonable Velocities For the Flow of Water through Pipe

Service Condition	Reasonable Velocity
Boiler Feed	8 to 15 feet per second
Pump Suction and Drain Lines	4 to 7 feet per second
General Service	4 to 10 feet per second
City	to 7 feet per second

BY DRAWING A STRAIGHT LINE THROUGH TWO KNOWN VALUES ON THE ORDINATE SCALES THE APPROXIMATE VALUE ON THE THIRD ORDINATE SCALE CAN BE DETERMINED.

EXAMPLE: GIVEN A FLOW RATE OF 100 CFM AND LIMITING VELOCITY OF 5 FEET PER SECOND, CONSTRUCT A STRAIGHT LINE THROUGH THESE TWO POINTS AND EXTEND IT TO INTERSECT PIPE SIZE SCALE AT APPROXIMATELY 3 IN. DIAMETER.

APPROXIMATE VISCOSTIES OF GASES AT 20°C (68°F)

GAS OR VAPOR	VISCOSITY MICROPOISES	GAS OR VAPOR	VISCOSITY MICROPOISES
AIR	183	HYDROGEN PHOSPHIDE	114
AMMONIA	98	HYDROGEN SULFIDE	125
ARGON	222	ISOPENTANE (VAP)	68
BENZENE (VAP)	75	KRYPTON	251
BROMINE (VAP)	154	METHANE	109
BUTYLENE, BETA	75	METHYL CHLORIDE	106
CARBON DIOXIDE	148	NEON	311
CARBON DISULFIDE (VAP)	98	NITRIC OXIDE	188
CARBON MONOXIDE	174	NITROGEN	175
CHLORINE	133	NITROUS OXIDE	146
CHLOROFORM (VAP)	101	OXYGEN	202
ETHANE	91	PENTANE (VAP)	67
ETHER, DIETHYL (VAP)	73	PROPANE	80
ETHYLENE	101	SULFUR DIOXIDE	125
HELIUM	194	TRIMETHYLETHYLENE (VAP)	69
HYDROGEN	88	WATER (VAP) 100°C	125
HYDROGEN BROMIDE	183	WATER (VAP) 200°C	163
HYDROGEN CHLORIDE	144	WATER (VAP) 300°C	202
HYDROGEN IODIDE	165	XENON	226

EQUIPMENT AND MEDIA SELECTION QUESTIONNAIRE

FLUID

*INFLUENT _____

MOLECULAR WEIGHT (GAS) _____

CONCENTRATION (%) _____

DIRT LOADING (%, PPM) _____

*INITIAL PRESSURE DROP (PSI, IN. WATER) _____

*PARTICLE RETENTION (MICRONS) _____

*FLOW RATE (GPM, SCFM, OTHER) _____

*VISCOSITY @ INLET TEMPERATURE _____

*SPECIFIC GRAVITY @ INLET TEMPERATURE _____

*SYSTEM PRESSURE _____

*SYSTEM TEMPERATURE _____

PIPING

SIZE _____ MATERIAL _____

FILTER MEDIA

MATERIAL _____

CARTRIDGE:

SIZE _____ CORE MATERIAL _____

CORE COVER _____ OUTER COVER _____

END TREATMENT _____

HOUSING

MATERIAL _____ SIZE _____

GASKETS _____ LINING _____

*ASME CODE: YES ☐ NO ☐

*LETHAL SERVICE: YES ☐ NO ☐

CONNECTIONS (SIZE & TYPE)

INLET _____ VENT _____

OUTLET _____ DRAIN _____

GAUGE _____ OTHER _____

OTHER

_____

_____

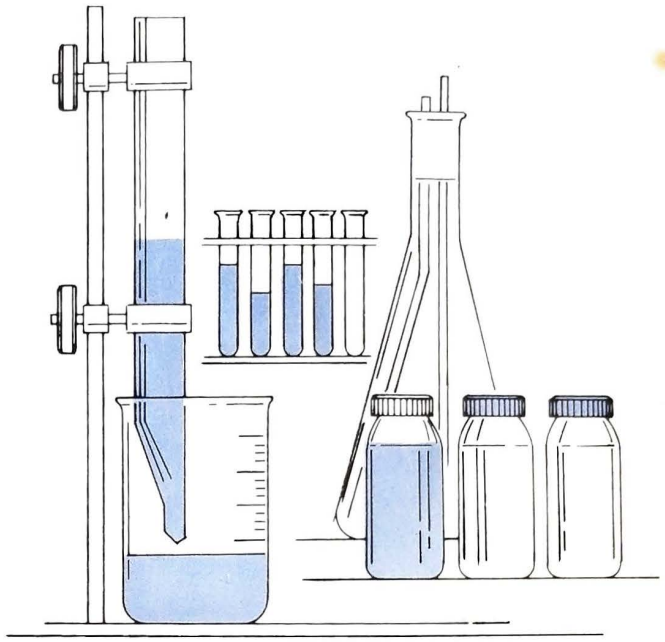
_____

_____

* MANDATORY INFORMATION

GREAT LAKES FILTER provides the best selection of filters available:

AIR MAZE—Filters, air/oil separators and breathers
FILTERITE—Vessels and tubes
BRUNSWICK Membrane Products
DYNALOY Metallic elements
ION EXCHANGE PRODUCTS
Cyclonic Separators
Filter Presses—Cloth, paper and pads
Dust Collector Bags
Liquid Pressure Vessels and Bags
Oil/Water Coalescer Separators
Oil Reclamation Systems
Custom Bags
Air Filters
Replacement Elements
Coolant Media
Sand Filters
Screens and Strainers
Flex-Sock® Connectors for Screeners



Laboratory and technical assistance readily available . . .

Our engineers make house calls.

FILTRATION APPLICATIONS FOR INDUSTRY

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A MEMBER OF THE ACME GROUP

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Detroit, Michigan 48208
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Toll Free (800) 521-8565, U.S.