The Retention Index System in Gas Chromatography: McReynolds Constants

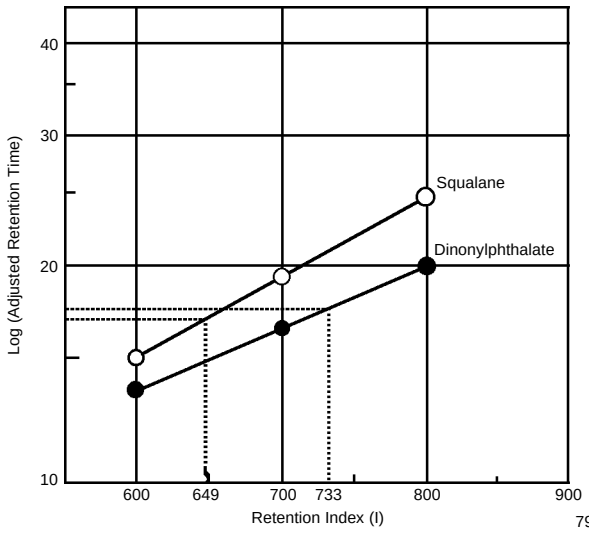
McReynolds values provide a systematic approach to ranking GC stationary phases by polarity and simplify the task of cross-comparing phases to determine whether they are equivalent. They also are useful for predicting elution orders among related analytes and resolution of analytes from differing chemical families. Values are obtained by measuring the degree to which a phase retains several probe compounds, relative to their retention by a nonpolar phase (squalane). An extensive table of McReynolds values in this bulletin enables you to use the McReynolds system without expending the time to derive the values.

Key Words:
McReynolds constants • Rohrschneider constants
retention index

The selectivity of a stationary phase can be accurately estimated by determining the degree to which polar compounds are retained by the phase, relative to their retention by a nonpolar phase (squalane). The *retention index system* used for many years by gas chromatographers is a systematic method for expressing and comparing such data. In this system, the *retention index* for any normal paraffin is defined as 100 times the number of carbon atoms in the molecule, regardless of the stationary phase, column dimensions, or analytical conditions used. For example, the retention indices for n-hexane, n-heptane, and n-octane are 600, 700, and 800, respectively. For all compounds except the n-paraffins, the column dimensions and operating conditions must be specified. Retention indices for compounds other than n-paraffins are determined as follows, using benzene as an example.

1. Inject a sample containing benzene, n-hexane, n-heptane, and n-octane onto the column and determine the retention times.
2. Correct for dead volume by subtracting the retention time for an unretained compound from each time measured in step 1.
3. For each of the three n-paraffins, plot the logarithm of the adjusted retention time (t'_R) against the retention index. For example, on 20% squalane at 120°C, n-hexane has a t'_R of 15 minutes, n-heptane has a t'_R of 19 minutes, and n-octane has a t'_R of 25 minutes (Figure A). The intersection of $\log_{15\ min}$ on the t'_R axis and 600 on the retention index axis gives the point for hexane; $\log_{19\ min}$ and 700 and $\log_{25\ min}$ and 800 give the other two points.
4. Connect the three points. The plot thus obtained is the basis for determining the retention index for benzene on this phase and under these conditions. The retention index for benzene is read at the point on the plot at $\log_{17\ min}$ (t'_R for benzene). The retention index, 649, indicates that on 20% squalane at 120°C benzene elutes approximately midway between n-hexane (600) and n-heptane (700) on a logarithmic time scale.

Figure A. Graph for Determining Retention Indices



Retention indices can be estimated by extrapolation, but greatest accuracy is obtained by bracketing the analyte in question with n-paraffins, as shown in the example. Retention indices also can be calculated by using the following equation:

$$I = 100Z + \frac{100[\log t'_R(i) - \log t'_R(z)]}{\log t'_R(z+1) - \log t'_R(z)}$$

where

$t'_R(i)$ is the corrected retention time required to elute the compound of interest from the column

$t'_R(z)$ is the corrected retention time for the n-alkane eluted prior to the compound of interest

$t'_R(z + 1)$ is the corrected retention time for the n-alkane eluted after the compound of interest

Z is the carbon number of the n-alkane of retention $t'_R(z)$

Note that in the early work carrier gas volumes, rather than retention times, were used. The selectivity of a stationary phase for a particular compound can be expressed as the degree to which the retention index is greater than that for a nonpolar phase. If the retention index for benzene is determined in exactly the same manner with dinonylphthalate as the stationary phase, the retention index is 733 (Figure A). The difference ($\Delta I_{benzene}$), 84

units, indicates that dinonylphthalate holds benzene slightly longer than does squalane, hence it is slightly more polar. Under identical conditions the retention index for SP-2340, a highly polar phase, is 1169 ($\square I_{benzene}$ = 520).

The apparent polarities of dinonylphthalate and SP-2340, relative to squalane ($\square I_{benzene}$ values of 84 and 520, respectively), measure retention of aromatic and olefinic (alkene) substances (benzene and n-paraffins were the analytes). Because it is important to classify each phase by its ability to retard a variety of classes of compounds, retention indices are calculated for other analytes. Phase selection then can be simplified by comparing the retention indices for the classes of compounds to be analyzed. This classification was done by Rohrschneider and was further developed by McReynolds, using selected compounds as "probes" with which to characterize a phase.

McReynolds analyzed 68 compounds on 25 columns and selected the 10 probes that best characterized the columns (Table 1). The most informative of these, benzene, n-butanol, 2-pentanone, nitropropane, and pyridine, are either the same compounds Rohrschneider used or homologs of Rohrschneider's probes. These now widely used probes have been assigned the index codes x', y', z', u', and s'. The Rohrschneider/McReynolds (R/M) system has been discussed in detail, with many examples, by many reviewers (see References).

Table 1. Probe Compounds

Code	Compound	Characteristic Group
x'	benzene	aromatics, olefins
y'	butanol	alcohols, nitriles, carboxylic acids, diols
z'	2-pentanone	ketones, ethers, aldehydes, esters, epoxides, dimethylamino derivatives
u'	nitropropane	nitro and nitrile derivatives
s'	pyridine	aromatic bases
H	2-methyl-2-pentanol	
J	1-iodobutane	
K	2-octyne	
L	1,4-dioxane	
M	cis-hydrindane	

Practical Applications for McReynolds Values

Comparison of Phases for Similarity

With the current literature base for gas chromatography, a computer search for some applications will produce volumes of recommendations. McReynolds values simplify the task of cross-comparing the phases referred to in such searches. For example, several trade names define generally similar methyl silicone phases (Table 2), but the similarities are not obvious unless you know how the phases compare chromatographically. Phases that provide the same McReynolds values, within ±4 units, can be freely substituted for each other. Phases that differ by within ±10 units generally give the same separation.*

Ranking Phases by Degree of Polarity

McReynolds values can be used to rank phases by degree of polarity. Phases that provide $\square I$ values between 0 and 100 typically are considered nonpolar. Phases providing values from 100+ to 400 are of intermediate polarity. Values over 400 indicate a highly polar phase. Table 3 lists examples of widely used phases that fit these categories. Remember that these definitions are intended to be generalizations, not accurate definitions of polarity.

Table 2. Comparable Dimethyl Silicone Phases

Phase	Min./Max. Temp (°C)	McReynolds Values x'	y'	z'	u'	s'
OV-101[a]	0/350	17	57	45	67	43
OV-1[a]	100/350	16	55	44	65	42
SP-2100[b]	0/350	17	57	45	67	43
SE-30[c]	50/300	15	53	44	64	41
SF-96[c]	0/250	12	53	42	61	37
UC W982[d]	0/300	16	55	45	66	42

[a]Ohio Valley Specialty Chemical Co.
[b]Supelco, Inc.
[c]General Electric Co.
[d]Union Carbide Corp.

Table 3. McReynolds Values Increase with Increasing Phase Polarity

Polarity	Phase	McReynolds Values x'	y'	z'	u'	s'
Nonpolar	SP-2100	17	57	45	67	43
Intermediate Polarity	SP-2250	119	158	162	243	202
	Carbowax® 20M	322	536	368	572	510
Highly Polar	SP-2340	520	757	659	942	800
	OV-275	629	872	763	1106	849

Squalane = zero polarity.

Table 4. Alcohol vs Aromatic Shift for Two Stationary Phases

Phase	x' (benzene)	y' (butanol)
PDEAS	386	555
LAC-2R-446	387	616

Prediction of Analyte Elution Order

Because the probe analytes used in the McReynolds system were chosen to represent whole chemical families, knowledge of where the probe compound elutes will enable you to predict where other analytes in the family will elute in boiling point order. The value for the probe compound indicates the degree of shift from a boiling point order. In other words, for SP-2340 phase, an x' $\square I$ value of 520 means that benzene will elute after C11, a 5 carbon shift and 20% of the way between C11 and C12. Hence, toluene would elute one carbon number later – a shift of 620.

Alternatively, you can compare the shift for an aromatic versus an alcohol. For example, look at two different phases with close x' (benzene) values and compare the y' (butanol) values (Table 4). The shift of 61, or about 61% of a carbon number, might well cause you to switch from a PDEAS column to a LAC-2R-446 column if you have an aromatic/alcohol coelution. Note that with higher polarity columns benzene does not elute significantly later, but normal hydrocarbons elute much faster. Hydrocarbons are poorly soluble in polar phases and thus elute very quickly.

The lists of values in this bulletin will enable you to use the McReynolds system to your advantage, without expending the time to obtain them by experiment. With practice, we think you will find McReynolds values a useful aid for methods development.

*NOTE: Of the phases listed in Table 2, only the Supelco and Ohio Valley phases are made and evaluated specifically for use as chromatographic stationary phases. Whenever possible, use materials made and tested specifically for chromatographic use. Also notice that there is a large discrepancy in minimum and maximum operating temperatures for the phases in Table 2. When all other factors (e.g., McReynolds values) are equal, the phase with the widest temperature range will provide you the greatest freedom in establishing conditions for your analysis.

Stationary Phases and McReynolds Values

Phase [USP Code]	Solvent	Temp (°C) Min./Max	McReynolds' Constants x'	y'	z'	u'	s'
Acetyltributyl citrate	A	/180	135	268	202	314	233
Amine 220	W	0/180	117	380	181	293	133
Apiezon® H	T	50/275	59	86	81	151	129
Apiezon J	T	50/300	38	36	27	49	57
Apiezon L	C,T	50/300	32	22	15	32	42
Apiezon M	T	45/275	31	22	15	30	40
Apiezon N	T	45/325	38	40	28	52	58
Apiezon T	T	45/275	41		30	55	82
Atpet 200			108	282	186	235	289
BCEF			690	991	853	1110	1000
Beeswax	C	0/200	43	110	61	88	122
n,n-Bis (2-cyanoethyl) formamide	C	0/125	690	991	583	1110	1000
Bis(ethoxyethoxyethyl)phthalate			233	408	317	470	389
Bis (2-ethylhexyl) phthalate [G22]	M	/150	92	186	150	236	167
Butyloctylphthalate			97	194	157	246	174
Butanediol succinate, purified	C	50/225	370	571	448	657	611
Butoyxethyl stearate			56	135	83	136	97
Butyl stearate			41	109	65	112	71
Carbowax® 20M [G16]	C	60/225	322	536	368	572	510
Carbowax 20M-terephthalic acid [G25]	C	60/225	321	537	367	573	520
Carbowax 400 [G20]	C	10/100	333	653	405	—	—
Carbowax 600	C	30/125	323	583	382	—	—
Carbowax 1000 [G14]	A	40/125	347	607	418	626	589
Carbowax 1540	A	50/175	371	639	453	666	641
Carbowax 4000 [G15]	C	60/120	371	545	378	578	521
Carbowax 4000 monostearate	C	0/200	282	496	331	517	467
Carbowax 6000	C	70/200	322	540	369	577	512
Castorwax	C	0/200	108	265	175	229	246
Convoil 20	C	/200	14	14	8	17	21
Cresyldiphenylphosphate			199	351	285	413	336
Cyanoethyl sucrose	A	0/100	647	919	797	1043	976
Cyclohexanedimethanol succinate (CHDMS)*	C	100/250	269	446	328	493	481
DC-11	C	0/300	17	86	48	69	56
DC-200 (500 cstks)	A	0/200	16	57	45	66	43
DC 330	A	0/275	13	51	42	61	36
DC 410	A	0/300	18	57	47	68	44
DC 510			25	65	60	89	57
DC-550 [G28]	A	20/250	74	116	117	178	135
DC 556			37	77	80	118	79
DC 560	A	0/300	32	72	70	100	68
DC 702	A	20/250	77	124	126	189	142
DC 703	C	20/250	76	123	126	189	140
DC-710	A	–5/250	107	149	153	228	190
DC QF-1 (FS 1265)	A	0/250	144	233	355	463	305
DEGA - see Diethylene glycol adipate							
DEGS - see Diethylene glycol succinate							
DEGS-PS	A	20/200	496	746	590	837	835
DEG stearate	A	/175	64	193	106	143	191
Dexsil® 300 carborane/methylsilicone	T	50/540	47	80	103	148	96
Dexsil 400 carborane/methylphenyl silicone	T	50/400	72	108	118	166	123
Dexsil 410 carborane/methylcyanoethyl silicone	T	50/400	72	286	174	249	171
Dibutoxyethyl adipate	C	/150	137	278	198	300	235
Dibutoxyethyl phthalate	C	0/125	151	282	227	338	267
Dicyclohexyl phthalate			146	257	206	316	245
Di-n-decyl phthalate	A	10/175	136	255	213	320	235
Diethylene glycol adipate (DEGA)	A	0/200	378	603	460	665	658
Diethylene glycol succinate (DEGS) [G4]	A	20/200	496	746	590	837	835
Diethylhexyl phthalate	A	0/125	135	254	213	320	235
Di (2-ethylhexyl) sebacate [G11]	A	0/125	72	168	108	180	125
Diethoxyethyl phthalate			214	375	305	446	364
Diethoxyethyl sebacate			151	306	211	320	274
Diethylhexyl tetrachlorophthalate	C	0/150	109	132	113	171	168
Diglycerol	M	20/100	371	826	560	676	854
Diisodecyl adipate	A	0/175	71	171	113	185	128
Diisodecyl phthalate [G24]	A	0/175	84	173	137	218	155
Diisooctyl adipate	A	0/175	76	181	121	197	134
Diisooctyl phthalate	A	0/175	94	193	154	243	174
Dilauryl phthalate	A	0/150	79	158	120	192	158
Dina enjay			73	174	116	189	129

Stationary Phases and McReynolds Values (contd.)

Phase [USP Code]	Solvent	Temp (°C) Min./Max	McReynolds' Constants x'	y'	z'	u'	s'
Dinonyl phthalate	A	20/150	83	183	147	231	159
Dinonyl sebacate	A	0/150	66	166	107	178	118
Dioctyl phthalate	A	0/125	92	186	150	236	167
Dioctyl sebacate	A	0/125	72	168	108	180	123
Ditridecyl phthalate			75	156	122	195	140
E-301	C	50/300	15	56	44	66	40
ECNSS-M	C	30/200	421	690	581	803	732
EGA	A	100/225	372	576	453	655	617
EGS	C	100/200	537	787	643	903	889
EGSP-Z	C	/210	308	474	399	548	549
EGSS-X	C	90/200	484	710	585	831	778
EGSS-Y	C	/205	391	597	493	693	661
Elastex 50-B			140	255	209	318	239
Emulphor® ON-870	C	0/200	202	395	251	395	344
EPON 1001	C	50/225	284	489	406	539	601
Estynox	C	0/175	136	257	182	285	227
Ethofat 60/25	C	50/125	191	382	244	380	333
Ethomeen S/25	C	0/125	186	395	242	370	339
Ethomeen 18/25	C	/75	176	382	230	353	323
Ethylene glycol adipate	A	100/225	372	576	453	655	617
Ethylene glycol isophthalate	C	100/225	326	508	425	607	561
Ethylene glycol phthalate	C	100/200	453	697	602	816	872
Ethylene glycol succinate	C	100/200	537	787	643	903	889
Ethylene glycol tetrachlophthalate	C	120/200	307	345	318	428	466
FFAP - see Free Fatty Acid Phase							
Flexol B-400			121	284	169	259	217
Flexol GPE			93	210	140	224	162
Flexol 8N8	A	0/175	96	254	164	260	179
Fluorad® FC-431 (50% in solv. E)	E	40/200	281	423	297	509	360
Fluorolube HG 1200	A	/200	51	68	114	144	118
Free Fatty Acid Phase (FFAP) [G25]	C	50/250	340	580	397	602	627
GE Phases - see SE, SF, SR, XE							
Hallcomid® M-18	C	40/150	79	268	130	222	146
Hallcomid M-18-OL	C	–8/150	89	280	143	239	165
Halocarbon 10-25	C	20/100	47	70	108	133	111
Halocarbon K-352	F	0/250	47	70	73	238	146
Halocarbon wax	A	50/150	55	71	116	143	123
Hercoflex 600	C	0/150	112	234	168	261	194
Hexakis(2 cyanoethoxycyclohexane) (1,2,3,4,5,6)	C,T	125/150	567	825	713	978	901
Hexatriacontane	C	125/150	12	2	-3	1	11
Hyprose SP-80	C	0/175	336	742	492	639	727
Igepal CO-630	M	/200	192	381	253	382	344
Igepal CO-710			205	397	266	401	361
Igepal CO-730			224	418	279	428	379
Igepal CO-880 (Nonoxynol) [G31]	M	100/200	259	461	311	482	426
Igepal CO-990	M	100/200	298	508	345	540	475
KEL-F® wax	A	50/150	55	67	114	143	116
LAC IR-296	C	0/200	377	601	458	663	655
LAC-2-R-446	C	50/200	387	616	471	679	667
LAC-3-R-728	C	0/200	502	755	597	849	852
LSX-3-0295	A	0/250	152	241	366	479	319
M & B silicone oil	T	/300	14	57	46	67	43
Mer 2	C	30/250	381	539	456	646	615
Mer-21	C	70/200	322	541	370	575	512
Montan wax	C	/175	19	58	14	21	47
Neopentyl glycol adipate	C	50/225	234	425	312	402	438
Neopentyl glycol sebacate	C	50/225	172	327	225	344	326
Neopentyl glycol succinate [G21]	C	50/225	272	469	366	539	474
Nonoxynol (Igepal CO-880) [G31]	A	100/200	259	461	311	482	426
NPGA - see Neopentyl glycol adipate							
NPG sebacate - see Neopentyl glycol sebacate							
NPGS - see Neopentyl glycol succinate							
Nujol	T	0/200	9	5	2	6	11

Stationary Phases and McReynolds Values (contd.)

Phase [USP Code]	Solvent	Temp (°C) Min./Max	McReynolds' Constants x'	y'	z'	u'	s'
Octoil S			72	167	107	179	123
Octyldecyl adipate	A	/125	79	179	119	193	134
Oronite® NIW	A		185	370	242	370	327
OS 124	T	0/200	176	227	224	306	283
OS 138	T	0/225	182	233	228	313	293
OV®-1 (gum) [G2]	T	100/350	16	55	44	65	42
OV-3	C	0/350	44	86	81	124	88
OV-7 [G32]	C	0/350	69	113	111	171	128
OV-11	C	0/350	102	142	145	219	178
OV-17 [G3]	C	0/375	119	158	162	243	202
OV-22	C	0/350	160	188	191	283	253
OV-25 [G17]	C	0/350	178	204	208	305	280
OV-73 [G27]	T	0/325	40	86	76	114	85
OV-101 (fluid) [G1]	C	0/350	17	57	45	67	43
OV-105	A	0/275	36	108	93	139	86
OV-202 (fluid)	C	0/275	146	238	358	468	310
OV-210 (fluid) [G6]	A	0/275	146	238	358	468	310
OV-215 (gum)	E	0/275	149	240	363	478	315
OV-225 [G19]	A	0/275	228	369	338	492	386
OV-275	A	25/250	629	872	763	1106	849
OV-330 silicone - Carbowax	A,T	0/250	222	391	273	417	368
OV-351	C	50/270	335	552	382	583	540
OV-1701 (vinyl)		0/250	67	170	153	228	171
Paraplex G-25			189	328	239	368	312
Paraplex G-40			282	459	355	528	457
PDEAS - see Phenyldiethanolamine succinate							
PEG 600	M	30/125	350	631	428	632	605
PEG 4000	C		325	551	375	582	520
Phenyldiethanolamine succinate [G12]	C	0/230	386	555	472	674	654
Pluracol P-2010			129	295	174	266	227
Pluronics® F68			264	465	309	488	423
Pluronics F88			262	461	306	483	419
Pluronics L35			206	406	257	398	349
Pluronics L81			144	314	187	289	249
Pluronics P65			203	394	251	393	340
Pluronics P85			201	390	247	388	335
Polybutene 32	T	0/200	21	29	24	42	40
Polybutene 128	T	0/200	25	26	25	41	42
Polyethyleneimine	A	0/175	322	800		573	524
Polyethylene glycol adipate (PEGA) [G23]			371	579	454	355	633
Polyglycol 15-200			207	410	262	401	354
Polyphenyl ether (5 rings) OS-124	A	0/200	176	227	224	306	283
Polyphenyl ether (6 rings) OS-138	A	0/225	182	233	228	313	293
Polypropylene glycol	M	0/150	128	294	173	264	226
Polypropylene glycol sebacate	C	0/200	196	345	251	381	328
Polypropyleneimine	C	0/200	122	425	168	263	224
Polytergent B-350			202	392	260	395	353
Polytergent G-300			203	398	267	401	360
Polytergent J-300			168	366	227	350	308
Polytergent J-400			180	375	234	366	317
PPE-20 (poly-M-phenoxylene)	C	125/375	257	355	348	433	—
PPE-21	C	125/375	232	350	398	413	—
PPG 2000	M	/150	128	294	173	264	226
PPG sebacate - see Polypropylene glycol sebacate							
QF-1	A	0/250	144	233	355	463	305
Quadrol®	C	0/150	214	571	357	472	489
Renex 678	M	0/150	223	417	278	427	381
Reoplex 400	A	0/200	364	619	449	647	671
Resoflex R 296			380	609	463	668	667
SAIB - see Sucrose acetate isobutyrate							
SE-30 GC grade [G2]	C	50/300	15	53	44	64	41
SE-31	T	/350	16	54	45	65	43
SE-33	T	/300	17	54	45	67	42
SE-52 [G27]	C	50/300	32	72	65	98	67
SE-54 [G36]	T	50/300	33	72	66	99	67
SF-96	T	0/250	12	53	42	61	37
Silar 5 CP	C,A	0/250	319	495	446	637	531
Silar 10 CP [G5]	C,A	0/250	520	757	660	942	800
Siponate DS-10	M	0/200	99	569	320	344	388

Stationary Phases and McReynolds Values (contd.)

Phase [USP Code]	Solvent	Temp (°C) Min./Max	McReynolds' Constants x'	y'	z'	u'	s'
Sorbitol [G13]	M	/150	232	582	313	—	—
Sorbitol hexaacetate			335	553	449	652	543
SP™-216	A	25/200	632	875	733	1000	680
SP-392	C	0/200	133	169	176	258	219
SP-400	A	0/350	32	72	70	100	68
SP-400, chlorophenyl		0/350	32	72	70	100	68
SP-1000 [G25]	C	50/250	332	555	393	583	546
SP-1200	C	25/200	67	170	103	203	166
SP-1220	C	50/200	207	297	153	283	328
SP-2100, methyl [G1]	C	0/350	17	57	45	67	43
SP-2250, 50% phenyl [G3]	C,T	0/375	119	158	162	243	202
SP-2300, 50% cyanopropyl [G7]	C,A	20/275	316	495	446	637	530
SP-2310, 55% cyanopropyl	A	25/275	440	637	605	840	670
SP-2330, 90% cyanopropyl [G8]	A	25/275	490	725	630	913	778
SP-2340, 100% cyanopropyl [G5]	A	25/275	520	757	659	942	800
SP-2401, trifluoropropyl [G6]	A	0/275	146	238	358	468	310
SP-2510	C	50/250	182	622	371	343	316
Span 60	T	/150	88	263	158	200	258
Span 80	T	15/150	97	266	170	216	268
Squalane	T	20/100	0	0	0	0	0
Squalene	T	0/100	152	341	238	329	344
SR 119			166	238	221	314	299
STAP	C	100/225	345	586	400	610	627
Stepan DS 60			97	550	303	338	402
Sucrose acetate isobutyrate (SAIB)	C	0/200	172	330	251	378	295
Sucrose octaacetate	T	/200	344	570	461	671	569
Surfonic N 300	M	0/150	261	462	313	484	427
TCEP - see 1,2,3-Tris (2-cyanoethoxy)propane)							
Tergitol NPX	C	10/175	197	386	258	389	351
Tetracyanoethoxy pentaerythritol	T	30/175	526	782	677	920	837
Tetrahydroxyethylenediamine (THEED)	C	0/125	463	942	626	801	893
Tetrakis(2-cyanoethoxy)butane (1,2,3,4)	C	110/200	617	860	773	1048	941
Thanol PPG 1000	C	/150	131	314	185	277	243
THEED - see Tetrahydroxyethylenediamine							
TMP tripelargonate	A	0/200	84	182	122	197	143
Tri(butoxyethyl)phosphate	M		141	373	209	341	274
Tributyl citrate	M	/150	135	286	213	324	262
Tricresyl phosphate	M	20/125	176	321	250	374	299
Tri(ethylhexyl)phosphate	M		71	288	—	215	132
Trimer acid	C	0/150	94	271	163	182	378
1,2,3-Tris(2-cyanoethoxy)propane (TCEP)	M,C	0/175	594	857	759	1031	917
Tris (2-cyanoethyl)nitromethane (TCENM)	C	201/140	635	—	—	—	—
Triton® X-100	M	0/200	203	399	268	402	362
Triton X-200	M		117	289	172	266	237
Triton X-305	M	0/200	262	467	314	488	430
Triton X-400	M		68	334	97	176	131
UC L 46	M	/300	16	56	44	65	41
UC W982 [G9]	T	0/300	16	55	45	66	42
UCON® 50-HB-280-X	M	0/200	177	362	227	351	302
UCON 50-HB-660	M	/250	193	380	241	376	321
UCON 50-HB-2000	M	0/200	202	394	253	392	341
UCON 50-HB-3520	M		198	381	241	379	323
UCON 50-HB-5100	M	0/200	214	418	278	421	375
UCON LB-550-X	M	0/200	118	271	158	243	206
UCON LB 1715	M	0/200	132	297	180	275	235
UCON 50-LB-1800-X	M	0/	123	275	161	249	212
UCON 75-H-90000	M	/200	255	452	299	470	406
Versamid® 930		115/150	109	313	144	211	209
Versamid 940		/275	109	314	145	212	209
Versilube F-50	C	/300	19	57	48	69	47
W 982 - see UC W982							
XE-60, cyanoethyl [G26]	A	/250	204	381	340	493	367
XF-1150	M	/200	308	520	470	669	528
Zinc stearate	M	0/150	61	231	59	98	544
Zonyl E-7	C	0/200	223	359	468	549	465
Zonyl E-91	C	0/200	130	250	320	377	293

Solvents

A – acetone	C – chloroform	E – ethyl acetate
F – Freon	M – methanol	P – pyridine
T – toluene	( ) – hot solvent	

McReynolds Values for Stationary Phases in Supelco General Purpose Capillary Columns

Phase	Operating Temp (°C)	McReynolds' Constants x'	y'	z'	u'	s'
SPB-Octyl	–60 to 280	3	14	11	12	11
SPB-1	–60 to 320	4	58	43	56	38
SPB-5	–60 to 320	19	74	64	93	62
SPB-20	–25 to 300	67	116	117	174	131
SPB-35	0 to 300	101	146	151	219	202
SPB-1701	subambient to 280	67	170	153	228	171
SPB-50	30 to 310	125	175	183	268	220
SP-2250	ambient to 320	119	158	162	243	202
PAG	30 to 220	252	499	310	489	416
Nukol	60 to 200	311	572	374	572	520
SUPELCOWAX 10	35 to 280	305	551	360	562	484
TCEP	subambient to 145	594	857	759	1031	917
SP-2330	subambient to 250	382	610	506	710	591
SP-2380	subambient to 275	402	629	520	744	623
SP-2340	25 to 250	419	654	541	758	637

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*Cyclohexanedimethanol succinate (CHDMS) is a patented material (US Patent No. 3,239,997).

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Equivalent Capillary GC Phases

General-Purpose Phases (in order of increasing polarity)

Supelco	Alltech	Chrompack	Hewlett-Packard	J&W	Quadrex	Restek	SGE	Nonbonded/Packed Column Phases
SPB-Octyl	—	—	—	—	—	—	—	Squalane
SPB-1	AT-1	CP-Sil 5CB	HP-1, Ultra-1	DB-1, DB-1ht	007-1	RT_x-1	BP-1	SE-30, SP-2100, OV-1, OV-101
SPB-5	AT-5	CP-Sil 8CB	HP-5, Ultra-2	DB-5	007-2	RT_x-5	BP-5	SE-54, SE-52, OV-73
SPB-20	—	—	—	—	007-7	RT_x-20	—	OV-7
SPB-35	AT-35	—	—	DB-35	007-11	RT_x-35	—	OV-11
SPB-1701	AT-1701	CP-Sil 19CB	HP-1701	DB-1701	007-1701	RT_x-1701	BP-10	OV-1701
SPB-50	AT-50	—	HP-50, HP-17	DB-17	007-17	RT_x-50	—	OV-17, SP-2250
PAG	—	—	—	—	—	—	—	Pluronics F68
Nukol	AT-1000	CP-Wax 58CB	HP-FFAP	DB-FFAP	007-FFAP	Stabilwax-DA	BP-21	SP-1000, OV-351
SUPELCOWAX 10	AT-Wax	CP-Wax 52CB	HP-INNO Wax HP-Wax	DB-WAX	007-CW	Stabilwax	BP-20	Carbowax 20M
SP-2330	AT-Silar	CP-Sil 84	—	DB-23	007-23	RT_x-2330	BPX-70	SP-2330
SP-2380	—	—	—	—	—	RT_x-2330	—	
SP-2340	—	CP-Sil 88	—	—	—	RT_x-2330	—	SP-2340, OV-275

Special-Purpose Phases

Supelco	Alltech	Chrompack	Hewlett-Packard	J&W	Quadrex	Restek	SGE
Petrocol 50.2	—	Squalane	PONA	—	007-1-50-0.5F	—	PONA
Petrocol DH	AT-100	CP-Sil PONA CB	—	DB-Petro100	007-1-100-0.5F	—	—
Petrocol DH 150	—	—	—	—	—	—	—
Petrocol 2887	AT-2887	SimDist-CB	—	DB-2887	007-1-10V-1.0F	RT_x-2887	—
Petrocol EX2887	—	—	—	—	—	—	HT-5
Petrocol 3710	—	—	—	—	007-1-10V-5.0F	—	—
SPB-1 Thin Film	—	—	—	—	—	—	—
SPB-1 Sulfur	AT-Sulfur	—	—	—	—	—	—
PTE-5	—	—	HP-5 MS	DB-5.625 DB-5 MS	—	XTI-5	BPX625
SAC-5	—	—	—	—	—	—	—
VOCOL	AT-624	CP-Sil 13CB	HP-624 HP-VOC	DB-624 DB-VRX	007-624 007-502	RT_x-624 RT_x-502.2 RT_x-Volatiles	BPX624
SPB-608	AT-Pesticide	CP-Sil 8CB for pesticides	HP-608	DB-608	007-608	—	BP608
Sup-Herb	—	—	—	—	—	—	—
□-DEX	Chiraldex-A	—	—	—	—	—	—
□-DEX	Chiraldex-B	—	—	Cyclodex-B	—	—	Cydex-B
□-DEX	—	—	—	—	—	—	—
OVI-G43	AT-624	—	HP-624	DB-624	007-624	RT_x-624	BPX 624
CLOT	GLOT	—	—	—	—	—	—
Carbowax Amine	—	CP-Wax 51	—	CAM	—	Stabilwax DB	—
Omegawax	—	—	—	—	—	—	—
SP-2331	—	CP-Sil 88	—	DB-Dioxin	007-Dioxin	—	—
SP-2560	—	—	—	—	—	—	—
TCEP	—	TCEP	—	—	—	RT-TCEP	—

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