

# Aliphatic Polyketone

## Physical Property Data

### 1. Mechanical Properties

25°C

Tensile Properties (ASTM D638)	PK	PA11 BESNO P40TL	PVDF Kynar 710	PVDF Solef 1010	HDPE PE3408
Modulus, Kpsi	223	35.8	322	333	158
Yield Stress, psi	8740	-	8000	7970	3900
Yield strain, %	24.5	-	7.92	8.42	12.4
Break Stress, psi	11900	5920	6180	5750	3350

-30°C

Tensile Properties (ASTM D638)	PK	PA11 BESNO P40TL	PVDF Kynar 710	PVDF Solef 1010	HDPE PE3408
Modulus, Kpsi	484.6	170.7	368.4	402.4	303.6
Yield Stress, psi	12380	6815	11320	11210	5889
Yield strain, %	13.3	34.8	6.98	7.27	10.1

120°C

Tensile Properties (ASTM D638)	PK	PA11 BESNO P40TL	PVDF Kynar 710	PVDF Solef 1010	HDPE PE3408
Modulus, Kpsi	86.0	19.13	76.16	76.20	15.99
Yield Stress, psi	5600	-	2934	3064	-
Yield strain, %	22.97	-	12.3	12.8	-

25°C

Flexural Properties (ASTM D638)	PK	PA11 BESNO P40TL	PVDF Kynar 710	PVDF Solef 1010	HDPE PE3408
Modulus, Kpsi	210	37.6	276	278	113
Yield Stress, psi	7710	1680	1030	1020	3310

Laboratory test data; Actual field performance may vary

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## 2. Gas Permeability<sup>(1)</sup>

### CH<sub>4</sub>

Temperature (°C)	Relative Humidity %	Permeability, 10 <sup>9</sup> * cm <sup>3</sup> / cm <sup>2</sup> * s * bar		
		PK	PA11 (Rilsan BESNO P40TL)	HDPE
20	0		0.60	
40	0		2.00	
60	0		5.50	
80	0	4.70	15.0	
100	0	11.1	35.0	
120	0	27.6		

PK data measured at IFP; PA data cited from Rilsan BESNO P40TL data sheet.

### CO<sub>2</sub>

Temperature (°C)	Relative Humidity %	Permeability, 10 <sup>9</sup> * cm <sup>3</sup> / cm <sup>2</sup> * s * bar		
		PK	PA11 (Rilsan BESNO P40TL)	HDPE
20	0	2.4	7.1 (6.0)*	27.4
50	0		(21)	
60	0	5.4	52.4	104
	50	6.9	58.9	106
75	0		(54)	
100	0		(110)	

<sup>(1)</sup> Data measured on commercial sheet (0.5mm thick) at Mocon

\*( ): PA data cited from Rilsan BESNO P40TL data sheet

Laboratory test data; Actual field performance may vary

### 3. Multicomponent Liquid Exposure – BTX, Cycloaliphatic and Aliphatic Hydrocarbons\*

PK tensile bar samples exposed at various temperatures for 4 months to hydrocarbon liquid.

Tensile bars taken from extruded pipeliner.

Exposure Temp °C	Young's Modulus, MPa (kpsi)		Yield Stress, MPa (psi)		Elongation at Yield, %	
	Control	Exposed	Control	Exposed	Control	Exposed
-20	3237 (466)		96.3 (13,856)		20.1	
0	2322 (334)		77.8 (1119)		24.9	
20	1274 (183)	1173 (169)	61.6 (8863)	57.6 (8288)	33.8	34.4
40	1042 (150)	989 (142)	56.0 (8057)	54.4 (7827)	35.7	32.2
60	693 (100)	978 (141)	50.4 (7252)	54.8 (7885)	36.8	29.6
80	593 (85)	837 (120)	45.8 (6590)	50.7 (7295)	37.4	30.2
100	505 (72.7)	664 (95)	41.0 (5899)	40.2 (5784)	38.3	20.3
120	413 (59)	525 (75)	36.4 (5237)	30.3 (4360)	34.9	15.2

\* Multicomponent Liquid: Benzene 1%; Toluene 7%; Xylene 11%; Cyclopentenes 6%; Cyclohexanes 6%; C4-C5 17%; C6-C10 42%; C11 10%

Laboratory test data; Actual field performance may vary

## 4. Oilfield Chemical Exposure – PK vs PA11

### PK exposed for 3 months at 23C and 80C

#### Exposure at 23°C for 3 months

	PERCENT RETENTION			
	Drilling Mud	1% EC110A*	1% Corexit*	1.5% HF and 7.5% HCL
<b>Modulus</b>	104%	80%	82%	
<b>Yield Stress</b>	100%	95%	96%	
<b>Yield Strain</b>	98%	104%	101%	
<b>Break Stress</b>	99%	98%	97%	
<b>Break Elongation</b>	70%	72%	58%	

#### Exposure at 80°C for 3 months

	PERCENT RETENTION			
	Drilling Mud	1% EC110A*	1% Corexit*	1.5% HF and 7.5% HCL
<b>Modulus</b>	103%	59%	60%	66%
<b>Yield Stress</b>	115%	101%	100%	109%
<b>Yield Strain</b>	68%	103%	102%	91%
<b>Break Stress</b>	118%	101%	99%	120%
<b>Break Elongation</b>	48%	51%	88%	36%

\* Corrosion inhibitors: 1% EC110A in 3% NaCl  
1% Corexit 6315 in 3% NaCl

### PA11 exposed for 3 months at 80°C

	PERCENT RETENTION			
	Drilling Mud	1% EC110A*	1% Corexit*	1.5% HF and 7.5% HCL
<b>Modulus</b>		70%	70%	
<b>Yield Stress</b>		101%	98%	
<b>Yield Strain</b>		88%	87%	
<b>Break Stress</b>		97%	94%	
<b>Break Elongation</b>		48%	48%	

\* Corrosion inhibitors: 1% EC110A in 3% NaCl  
1% Corexit 6315 in 3% NaCl

Laboratory test data; Actual field performance may vary

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## 4. Oilfield Chemical Exposure (continued)

### Weight Changes for PK and PA11 Exposures

	WEIGHT CHANGES, %			
	Drilling Mud	1% EC110A*	1% Corexit*	HF and HCL
<b>PK at 23°C</b>	0	0.7	1.8	1.8
<b>PK at 80°C</b>	0.4	4.8	4.9	5.6
<b>PA11 at 80°C</b>		-4.7	-3.8	

Laboratory test data; Actual field performance may vary

## 5. Strain Relaxation of PK Pipe

### Axial Strain Recovery of PK Pipe from 8% Initial Elongation\*

Temperature °C	Time Held	% Strain after 0.5 hr relaxation	% Strain after 1.0 hr relaxation	% Strain at elapsed time
-20	30 sec; 2 hours	0.47; 3.76	2.43; 3.64	2.25 at 5 hrs 3.05 at 12 hrs
23	30 sec; 1 hour; 2 hours	1.52; 1.59; 1.73	0.96; 1.45; 1.46	0.93 at 5 hrs 1.36 at 9 hrs 1.36 at 19 hrs
50	30 sec; 1 hour	1.58 2.00	1.10 1.95	1.07 at 4 hrs 1.60 at 14 hrs
80	30 sec; 2 hours	1.49 2.64	1.45 2.50	1.37 at 5 hrs 2.03 at 16 hrs

\* Tensile bars cut from pipe were held at 8% elongation at given temperature & time.

Laboratory test data; Actual performance in the field may vary

## 6. Chemical Exposure Data for PK 630A

Chemical	Conc.	Temp. (°C)	Days Exposed	Appearance	Change from Original, %				Yield Strain %	Change %	Yield Stress psi	Chg %	Break Strain %	Chg %	Break Stress psi	Chg %
					Length	Thickness	Weight	Tensile Mod								
Acetic acid (aq)	5%	23	100	No Change		0	2.7	-29	31	22	7587	-9	244	-19	15268	1
Acetic acid (aq)	5%	23	100	No Change		0	2.4	-31	29	16	7933	-2	255	-15	14867	-2
Acetic acid (aq)	5%	23	365	No Change		1	2.8	-34	30	17	7571	-8	240	-20	13187	-13
Acetic acid (aq)	5%	23	730	Slight Yellow		1	2.7	-47	27	8	7342	-11	246	-18	13303	-12
Acetic acid (aq)	5%	23	1095	Slight Yellow		0	3.0	-16	23	-11	7715	-7	231	-23	12815	-16
Acetic acid (aq)	5%	83	25	Very Slightly Yellow	1	0	3.3	-26	25	0	9398	1	271	-10	15329	1
Acetic acid (aq)	5%	50	100	Yellow/Brown	2	2	3.9	-40	31	22	9539	7	234	-22	13782	-9
Acetone	100%	23	100	No Change	2	7	4.8	-51	35	39	9969	-18	294	-2	15034	-1
Acetone	100%	23	365	Slight Yellow	3	2	5.0	-40	34	33	7455	-10	281	-6	15188	0
Acetone	100%	23	365	No Change	2	1	4.7	-29	25	0	6974	-16	242	-19	12628	-17
Acetone	100%	23	730	Very Slight Yellow	3	1	5.2	-44	28	11	7187	-13	279	-7	14752	-3
Ammonium Hydroxide	10%	23	100	Orange brown	-1	1	-0.6	48	23	-11	8294	0	54	-82	9800	-35
Ammonium hydroxide	10%	23	365	Orange brown	0	0	-2.6	56	20	-20	9387	13	36	-88	8998	-41
Ammonium Hydroxide	10%	23	365	Dark Red Brown	0	0		102	7	-71	9315	12	16	-95	8120	-47
Ammonium Hydroxide	10%	23	730	Dark Brown with Black Edges	-1	0	-4.0	87	10	-61	10195	23	16	-95	8517	-44
Ammonium Hydroxide	10%	23	1095	Black	-1	-1	-3.9	196	8	-70	7225	-13	3	-99	9569	-37
Ammonium Hydroxide	10%	50	25	Dark Carmel; Tacky	-1			62	11	-72	7952	-8	47	-84	10043	-34
Ammonium Sulfate	50%	23	100	Very Light Yellow	1	0	1.4	-9	25	0	7931	-4	298	-1	18396	21
Ammonium Sulfate	20%	53	365	Yellow with tan edges		1	1.2	-27	25	0	7933	-4	281	-6	13337	-12
Ammonium Sulfate	20%	23	730	Golden Brown	0	0	1.6	-17	20	-20	8162	-2	270	-10	14900	-2
Aniline	99%	23	100	Swollen/Tacky/Orange Brown		8	25.9	-90	63	150	2256	-73	42	-86	2256	-85
Aniline <sup>1</sup>	99%	23	365	Dk brn; warped and slimy	15	4	15.2	-94	41	64	1353	-84	29	-90	1230	-92
Aniline <sup>1</sup>	99%	23	730	Brown/Rubbery	18	-8	7.5	-91	35	39	1145	-98	3"	-90	1374	-91
Anisole	99%	23	100	No Change	1	1	2.7	-29	29	16	7410	-11	303	1	16525	9
Anisole	99%	23	365	Slight warp	3	2	5.9	-40	34	33	7233	-13	274	-9	14530	-4
Anisole	99%	23	730	Very Lt Yellow	3	1	6.6	-47	25	0	7221	-13	269	-10	14631	-4
Antifreeze	100%	23	100	No Change	1	3	-0.1	-1	25	0	8664	4	242	-19	14862	-2
Antifreeze	100%	23	365	Very slightly green	0	0	-0.2	-9	27	8	9699	17	259	-14	15124	0
Antifreeze	100%	23	730	Slight Yellow	0	0	0.6	-26	23	-8	8350	1	246	-18	13861	-9
Antifreeze	100%	23	1095	Slight Yellow	0	0	0.3	-48	21	-17	8439	2	260	-13	14752	-3
Antifreeze	100%	50	25	Light Gold	1		2.6	-14	29	16	9264	12	177	-41	14663	-3
Barium Hydroxide	10%	23	100	No Change	1	1	1.6	-34	25	0	7737	-7	260	-13	15212	0
Barium Hydroxide	10%	23	365	Slight Med. Yellow	1	1	1.6	-19	25	0	8331	-2	255	-15	14194	-7
Barium Hydroxide	10%	23	730	Yellow	1	1	2.1	-24	24	-4	7735	-7	269	-10	14265	-6
Beer, Schlitz	100%	23	100	No Change	1	0	1.9	-14	76	11	7962	-5	293	-2	16127	6
Beer, Schlitz	100%	23	365	Very Slight Yellow	1		2.0	-22	25	0	7771	-6	265	-12	14433	-5

NY = No Yield; SS = Stainless Steel

<sup>1</sup> Appears to be reactive dissolution <sup>2</sup> CCl4 reaction with stainless steel is apparent <sup>3</sup> Carried out with large volume of reagent – reactive dissolution observed

## 6. Chemical Exposure Data for PK M630A

Chemical	Conc.	Temp. (°C)	Days Exposed	Appearance	Change from Original, %				Yield Strain %	Change %	Yield Stress psi	Chg %	Break Strain %	Chg %	Break Stress psi	Chg %
					Length	Thickness	Weight	Tensile Mod								
Benzaldehyde	99%	23	100	No Change	1	1	2.0	-28	30	20	7605	-8	271	-10	15144	0
Benzaldehyde	99%	23	366	Slight warped	3	3	7.0	-50	35	40	6965	-16	292	-3	14796	-3
Benzaldehyde	99%	73	730	No Change	1	2	9.4	-54	30	20	6920	-17	291	-3	15067	-1
n-Butanol	100%	23	100	No Change	0	0	-0.5	11	23	-8	9004	9	260	-13	15182	0
n-Butanol	100%	23	365	No Change	0	1	-0.3	21	23	-8	6161	-26	255	-15	15069	-1
n-Butanol	100%	23	730	Very Light Yellow	0	0	0.2	4	20	-20	9499	15	261	-13	14825	-2
Calcium Chloride	5%	23	100	No Change	1	0	1.6	-23	30	20	7731	-7	248	-17	13996	-8
Calcium Chloride	5%	23	365	Light Cream	1	0	1.7	-27	28	12	9131	10	301	0	16195	7
Calcium Chloride	5%	23	730	Yellow	1	0	1.1	-41	24	-4	7594	-8	251	-16	13430	-12
Calcium Chloride	5%	23	1095	Yellow	1	0	1.6	-11	21	-16	7995	-4	277	-8	15031	-1
Calcium Chloride	5%	80	25	No Change	1	0	2.2	-29	21	-16	8938	8	191	-36	14113	-7
Calcium Chloride	5%	90	25	Very Light Off-White	1	1	2.2	-41	29	16	8690	5	271	-10	15205	0
Calcium Chloride	5%	80	100	Cream Tan	1	0	1.1	-19	28	12	9268	12	229	-24	13951	-8
Calcium Hydroxide	2%	23	100	No Change	1	0	2.0	-29	27	8	7829	-6	302	1	16326	7
Calcium Hydroxide	2%	23	365	Slight Yellow	1	2	1.7	-23	27	8	7968	-4	299	0	15906	5
Calcium Hydroxide	2%	23	730	Yellow	1	-1	2.1	-22	23	-8	8904	7	293	-2	16630	9
Carbon Tetrachloride	100%	23	100	No Change	1	1	1.0	4	25	0	8199	-1	244	-19	13999	-8
Carbon Tetrachloride	100%	23	395	No Change	0	1	0.6	11	23	-8	8528	3	275	-8	15734	4
Carbon Tetrachloride	100%	23	730	Very Light Yellow	0	0	1.9	-6	23	-8	8181	-1	273	-9	15294	1
Carbon Tetrachloride2	99%	80	25	Dark Brown	-1	0	-0.2	64	21	-16	16929	104	21	-93	15930	5
Carbon Tetrachloride2	99%	90	100	Dark Brown	-1	0	-1.3	129	NY		No Yield		12	-96	16219	7
Champion RN-Z47	2000 ppm	ao	25	Beige-tan/yellow	1	1	2.2	-30	27	8	8727	5	242	-19	14017	-8
Champion RN-247	2000 ppm	80	100	Tan	2	1	2.2	-49	NY		No Yield		202	-33	12767	-16
Chloroform	100%	23	100	Swollen	7	6	25.9	-69	51	104	5694	-31	285	-5	12312	-19
Chloroform	100%	23	365	Warped	7	6	26.6	-72	44	76	5391	-35	243	-19	11577	-24
Chloroform	100%	23	730	Very Slight Yellow/Curved	7	3	25.4	-71	37	48	6253	-25	293	-2	14266	-6
Chloroform	99%	ao	23	Golden Yellow	6	6	32.0	-50	70	180	5770	-30	263	-12	11721	-23
Chloroform	99%	ao	no	Dark Brown	6	4	25.9	-25	NY		No Yield		12	-96	7813	-49
Cupric Chloride	20%	23	mo	Light Yellow	1	0	1.4	-5	25	0	7899	-5	283	-6	15797	4
Cupric Chloride	20%	23	395	Yellow with Tan Edges	1	1	1.3	-22	25	0	8238	-1	302	1	15969	5
Cupric Chloride	20%	23	730	Golden Brown	0	0	1.4	-15	23	-8	8310	0	284	-5	15139	0
Detergent-Tide	5%	23	100	No Change	1	1	1.9	-23	27	8	7733	-7	229	-24	13077	-14
Detergent-Tide	5%	23	365	No Change	1	1	1.6	-22	25	0	7803	-6	290	-3	15607	3
Detergent-Tide	100%	23	730	Slight Yellow	1	0	2.4	-22	24	-4	8103	-2	273	-9	14867	-2
1,2-Dichlorobenzene	100%	23	100	No Change	0	1	1.1	-27	24	-4	7999	-4	285	-5	15735	4
1,2-Dichlorobenzene	100%	23	365	No Change	1	1	1.3	-17	27	8	8262	0	295	-2	16000	5
1,2-Dichlorobenzene	100%	23	730	Very Slight Yellow	1	1	2.9	-30	25	0	7858	-5	282	-6	14664	-3

NY = No Yield; SS = Stainless Steel

<sup>1</sup>Appears to be reactive dissolution    <sup>2</sup>CCl4 reaction with stainless steel is apparent    <sup>3</sup>Carried out with large volume of reagent – reactive dissolution observed



## 6. Chemical Exposure Data for PK M630A

Chemical	Conc.	Temp. (°C)	Days Exposed	Appearance	Change from Original, %				Yield Strain %	Change %	Yield Stress psi	Chg %	Break Strain %	Chg %	Break Stress psi	Chg %
					Length	Thickness	Weight	Tensile Mod								
Dimethyl Formamide	100%	23	100	No Change	3	2	7.2	-99	37	48	8752	6	293	-2	15041	-1
Dimethyl Formamide	100%	23	365	Warp	3	3	9.0	-49	35	40	7052	-15	245	-18	13093	-14
Dimethyl Formamide	100%	23	730	Gold	4	2		-54	32	28	6664	-20	276	-8	14154	-7
Dimethyl Sulfoxide	100%	23	100	No Change		2	3.9	-31	35	40	7197	-13	259	-14	15102	-1
Dimethyl Sulfoxide	100%	23	365	No Change	4	2	9.9	-54	39	56	6821	-18	253	-16	13196	-13
Dimethyl Sulfoxide	100%	23	730	Slight Yellow	4	2	9.8	-65	37	48	6593	-21	263	-12	12392	-18
Dimethyl Sulfoxide	100%	23	1035	Slight Warp	4	2	9.3	-51	34	36	6690	-19	231	-23	12304	-19
Dimethyl Sulfoxide	100%	80	25	No Change. Blooming		4	16.0	-73	49	96	6574	-21	211	-30	14574	-4
Detergent, Cascade	5%	23	100	Yellow		0	1.7	-20	26	4	7632	-8	296	-1	18262	20
Detergent, Cascade	5%	23	365	Orange, Light Brown edges		1	1.7	-13	25	0	7669	-8	292	-3	15803	4
Detergent, Cascade	100%	23	730	Golden Brown		0	1.8	-21	24	-4	6052	-27	276	-8	15018	-1
Ethanol	100%	23	100	No Change		1	0.4	3	25	0	5113	-38	279	-7	16225	7
Ethanol	100%	23	365	No Change		1	1.3	-16	26	4	7935	-4	277	-8	45350	199
Ethanol	100%	23	730	Very Slight Yellow		0	2.2	-31	24	-4	7749	-7	246	-18	14077	-7
Ethanol	100%	80	25	No Change		0	4.2	-54	34	36	6199	-25	220	-27	15455	2
Ethanol	100%	80	100	Cream		t	3.2	-43	35	40	8424	2	255	-15	14432	-5
Ethyl Acetate	100%	23	100	No Change		0	0.6	-8	30	20	8184	-1	186	-38	11748	-23
Ethyl Acetate	100%	23	365	No Change		1	2.2	-35	31	24	7704	-7	286	-5	16132	6
Ethyl Acetate	100%	23	730	Slight Yellow		2	3.4	-41	30	20	7253	-13	225	-25	12526	-18
Ethyl Acetate	100%	23	1095	No Change		1	3.4	-28	25	0	7308	-12	229	-24	12788	-16
Ethyl Acetate	100%	80	35	No Change		0	3.7	-45	32	28	8801	6	183	-39	11087	-27
Ethyl Acetate	100%	80	100	Off-White		1	4.0	-35	35	40	8568	3	222	-26	13192	-13
Ethylene Glycol	100%	80	25	Light Yellow		0		-47	30	20	9801	18	172	-43	11825	-22
Ethylene Glycol	100%	80	100	Gold Yellow		1	3.2	-6	30	20	9744	17	39	-87	7966	-48
Ferrous Sulfate	20%	23	100	Yellow		0	1.7	-22	27	8	7800	-6	302	1	16195	7
Ferrous Sulfate	20%	23	365	No Change		1	1.0	-17	27	8	9099	10	295	-2	15934	5
Ferrous Sulfate	20%	23	730	Spots/Edges		-1	2.0	-15	24	-4	8782	6	272	-9	15988	5
Formic Acid	10%	23	100	No Change	2	2	4.3	-49	28	12	7061	-15	259	-14	13734	-10
Formic Acid	10%	23	365	Very slight warp	2	2	4.4	-35	30	20	7675	-7	124	-59	8651	-43
Formic Acid	10%	23	730	Yellow	1	1	4.7	-35	24	-4	7163	-14	20	-93	5832	-62
Gasoline, unleaded	100%	73	100	Slightly Yellow	2	1	0.4	-8	25	0	7999	-4	275	-8	15964	5
Gasoline, unleaded	100%	23	365	Slightly Yellow	1	1	0.4	-4	25	0	8165	-2	271	-10	15268	1
Gasoline, unleaded	100%	23	730	Slightly Yellow	0	2	0.9	-1	21	-16	8185	-1	282	-6	16240	7
Gasoline, unleaded	100%	80	25	No Change	1	0	1.2	-31	28	11	9004	9	262	-12	15657	3
Gasoline, unleaded	100%	80	100	No Change	3	2	1.3	-4	28	11	9131	10	248	-17	14996	-1

NY = No Yield; SS = Stainless Steel <sup>1</sup> Appears to be reactive dissolution <sup>2</sup> CCl4 reaction with stainless steel is apparent <sup>3</sup> Carried out with large volume of reagent – reactive dissolution observed



## 6. Chemical Exposure Data for PK M630A

Chemical	Conc.	Temp. (°C)	Days Exposed	Appearance	Change from Original, %				Yield Strain %	Change %	Yield Stress psi	Chg %	Break Strain %	Chg %	Break Stress psi	Chg %
					Length	Thickness	Weight	Tensile Mod								
Hexane	100%	23	100	No Change	0	0	0	-18	24	-6	8198	-1	267	-11	15196	0
Hexane	100%	23	365	No Change	0	0	-0.2	7	24	-6	8731	5	291	-3	16452	8
Hexane	100%	23	730	Slight Yellow	0	0	0.2	1	21	-17	8486	2	284	-5	15871	5
Hydrochloric Acid	1%	23	100	No Change	1	1	2.0	-26	28	11	7800	-6	271	-9	15268	1
Hydrochloric Acid	1%	23	365	No Change	1	1	1.9	-26	27	6	7835	-5	284	-5	15208	0
Hydrochloric Acid	1%	23	730	Very Light Beige	1	0	2.2	-31	23	-11	8033	-3	240	-20	13475	-11
Hydrochloric Acid	10%	23	100	Yellow	1	1	1.4	-23	25	0	8000	-3	292	-2	15689	3
Hydrochloric Acid	10%	23	730	Red Brown	0	-1	1.7	7	NY		NY		3	-99	4049	-73
Hydrochloric Acid	1%	80	25	Light Yellow	1	1	2.0	-37	28	11	8630	4	224	-25	12878	-15
Hydrochloric Acid	1%	80	100	Carmel	1	1	2.0	-24	31	22	9020	9	232	-22	12904	-15
Hydrochloric Acid	10%	80	25	Brown	0	0	1.0	-17	27	7	9370	13	177	-41	11177	-26
Hydrochloric Acid	10%	80	100	Dark Brown	0	0	0.2	5	28	11	10561	29	41	-88	8772	-42
Methanol	100%	23	100	No Change	2	0	2.9	-43	34	36	7176	-13	258	-14	15472	2
Methanol	100%	23	365	No Change	2	0	2.9	-35	32	28	8555	3	277	-8	14624	-4
Methanol	100%	23	730	Slight Yellow	2	0	2.9	-54	27	8	7014	-15	270	-10	13967	-8
Methanol	100%	23	1095	Very Slight Yellow	1	1	2.9	-54	23	-8	7388	-11	256	-15	13576	-11
Methanol	100%	ao	25	No Change	2	1	4.5	-50	35	40	7672	-7	256	-15	15410	1
Methylene Chloride	100%	23	100	No Change	7	5	23.4	-73	49	96	5271	-36	304	1	14402	-5
Methylene Chloride	100%	23	365	Warped	8	5	24.4	-76	59	136	5128	-38	267	-11	11985	-21
Methylene Chloride	100%	23	730	Slight Yellow	7	5		-76	45	80	5621	-32	283	-6	12485	-18
Methylene Chloride	100%	23	1095	Very Slight Warping	1	2	16.1	-60	35	40	6511	-21	283	-6	13759	-9
Methylene Chloride	99%	80	25	No Change	9	7	35.0	-85	70	180	5807	-30	230	-23	10618	-30
Methylene Chloride	100%	80	25	No Change	7	4	30.9	-62	54	116	12295	48	269	-10	15049	-1
Methylene Chloride	99%	80	ICC	Slightly Yellow	10	6	34.3	-63	77	208	5726	-31	239	-20	10974	-28
Methyl Ethyl Ketone	100%	23	too	No Change	2	1	1.4	-34	31	24	7606	-8	296	-1	18392	21
Methyl Ethyl Ketone	103%	23	355	No Change	2	2	4.1	-42	34	36	7420	-11	263	-12	14194	-7
Methyl Ethyl Ketone	100%	23	730	Slight Yellow	3	1	4.0	-52	31	24	7346	-11	293	-2	15066	-1
Methyl Ethyl ketone	100%	23	1095	Very Slight Warping	2	1	4.2	-31	25	0	7222	-13	246	-18	13313	-12
Methyl Ethyl Ketone	100%	60	25	No Change	2	2	5.1	-51	34	36	8199	-1	167	-44	16399	8
MTBE	100%	23	100	No Change	0	0	-0.2	13	23	-8	8367	1	263	-12	19331	27
MTBE	100%	23	365	No Change	1	1	0.0	16	23	-8	8594	4	272	-9	15403	1
MTBE	100%	23	730	Slightly Yellow	0	0	0.0	19	11	-56	8422	2	275	-8	15742	4
Mustard	100%	23	100	Bright Yellow	1	1	2.6	7	26	4	7567	-9	269	-10	12261	-19
Mustard	100%	23	385	Very Bright Yellow	1	2	2.9	-27	27	8	7839	-5	306	2	16519	9
Nalco 94VJ002	2000 ppm	80	25	Lt. Yellow/Tan	2	2	2.6	-32	27	8	8609	4	240	-20	13824	-9
Nalco 94VJ002	2000 ppm	80	100	Lt. Yellow/Tan	2	2	2.6	-55	30	20	8937	8	227	-24	13520	-11
N-Methyl Pyrrolidone	100%	23	100	No Change	1	2	2.3	-24	28	12	7972	-4	261	-13	15615	3
N-Methyl Pyrrolidone	100%	23	365	Very Slight Warp, Tan Edges	3	3	6.0		37	48	7245	-13	287	-4	15590	3
N-Methyl Pyrrolidone	100%	23	730	Light Tan	4	2	9.3	56	34	36	6783	-18	274	-9	14122	-7

## 6. Chemical Exposure Data for PK M630A

Chemical	Conc.	Temp. (°C)	Days Exposed	Appearance	Change from Original, %				Yield Strain %	Change %	Yield Stress psi	Chg %	Break Strain %	Chg %	Break Stress psi	Chg %
					Length	Thickness	Weight	Tensile Mod								
Potassium Hydroxide	45%	23	100	Very Light Tan	0	0	-0.2	20	23	-8	6931	-16	278	-7	16196	7
Potassium Hydroxide	45%	23	365	Grey w/Black Edges	0	-1	-0.6	29	18	-28	9519	15	231	-23	13252	-13
Potassium Hydroxide	45%	23	730	Light Brown	0	-1	-1.0	22	18	-28	9027	9	293	-2	15328	1
Propylene Carbonate	100%	23	730	Very Slight Yellow	2	2	6.4	42	31	24	6944	-16	264	-12	14137	-7
Propylene Carbonate	100%	23	100	No Change	1	1	1.3	24	27	8	8331	0	224	-25	13355	-12
Propylene Glycol	100%	80	25	Light Yellow	1	0	4.3	43	31	24	9407	13	173	-42	11694	-23
Propylene Glycol	100%	80	100	Orange Yellow	2	1	3.6	20	34	36	9691	17	82	-73	9996	-34
Sodium Bisulfite	20%	23	100	No Change	1	1	3.8	-28	27	6	7803	-6	258	-14	14097	-7
Sodium Bisulfite	20%	23	365	Dissolved Edges. Warped	3	2	-6.6	-67	42	87	4656	-44	79	-74	4787	-68
Sodium Hydroxide	10%	23	100	Amber brown	0	0	1.0	-17	27	6	7963	-4	152	-46	10172	-33
Sodium Hydroxide	10%	23	365	Brown w/Dk Brn Surface Residue	1	0	0.9	-14	30	17	7998	-3	158	-47	9717	-36
Sodium Hydroxide	10%	23	730	Brown	1	0	0.6	-33	24	-6	7874	-5	55	-81	7049	-54
Sodium Hydroxide	10%	23	1095	Brown with White Surface Residue	0	0	-0.2	-5	21	-17	8091	-2	97	-68	7705	-49
Sodium Hypochlorite <sup>3</sup>	5%	23	100	Brown Edges, Yellow Surface	0	-6	-10.9	-29	27	12	7880	-3	39	-85	6583	-54
Sodium Hypochlorite <sup>3</sup>	5%	23	365	Medium Brown, Dull Surface	0	-7	-10.3	-16	20	-19	7782	-4	23	-91	4959	-65
Sodium Hypochlorite	5%	23	100	Gold/Pitted Surface	1	0	0.9	-29	25	0	7728	-7	92	-69	7258	-52
Sodium Hypochlorite	5%	23	365	Light brown, Pitted Surface	1	0	0.6	-18	27	6	7731	-7	25	-92	5485	-64
Sodium Hypochlorite	12%	23	100	Brown/Yellow	1	-1	-2.4	-30	30	17	9338	13	31	-90	6224	-59
Sodium Hypochlorite	12%	23	365	Brown/Yellow	1	1	-2.4	-23	27	6	7733	-7	229	-23	13077	-14
Sodium Hypochlorite	12%	23	730	Medium Brown	0	-6	-10.3	-12	20	-22	7952	-4	25	-92	8175	-48
Sodium Hypochlorite	5%	80	25	Light Brown	1	0	1.7	-34	27	6	8995	9	35	-88	7398	-51
Sodium Hypochlorite	5%	80	100	Brown	1	0	1.1	-12	27	6	9436	14	41	-86	7763	-49
Sulfuric Acid	5%	23	365	No Change	1	0	1.9	-19	20	-19	7769	-5	214	-15	11966	-17
Sulfuric Acid	30%	23	100	Light Yellow	0	0	0.6	0	24	-6	8065	-3	84	-72	7798	-49
Sulfuric Acid	30%	23	365	Med Brown w/Dark Brown Edges	0	1	0.6	-11	25	0	7440	-10	25	-94	6452	-58
Sulfuric Add	30%	23	365	Brown	1	0	0.9	6	14	-42	7370	-10	14	-95	7058	-51
Sulfuric Add	30%	23	730	Light Red Brown	0	-1	0.9	7	15	-39	7365	-11	15	-96	7529	-50
Sulfuric Add	30%	80	25	Light Yellow/Brown	1	1	2.0	-39	28	11	8625	4	228	-24	12772	-16
Sulfuric Acid	30%	80	100	Golden Brown	0	0	1.4	-16	31	22	9259	12	99	-57	8495	-44
Trichloroethylene	99%	23	730	Slight Yeflow	2	0	7.2	-26	25	0	8148	-2	290	-3	16041	6
Toluene	100%	23	730	Very Slight Yellow	1	1	2.8	-29	25	0	7658	-9	267	-11	14794	-3
Water (Seawater)	100%	23	730	Very Slight Yellow	0	0	1.7	-31	24	-6	8226	-1	279	-7	15230	0
Water (Seawater)	100%	80	100	Light Brown/Tan	1	0	1.7	-19	28	11	9264	12	187	-38	11597	-24
Zinc Chloride	50%	23	730	Black	3	1	13.9	-46	14	-44	3750	-55	26	-91	6875	-55
Zinc Chloride	50%	80	100	Dark Brown	5	3	18.1	-64	49	94	7210	-13	135	-55	9803	-35

NY = No Yield; SS = Stainless Steel

<sup>1</sup> Appears to be reactive dissolution

<sup>2</sup> CCl4 reaction with stainless steel is apparent

<sup>3</sup> Carried out with large volume of reagent – reactive dissolution observed

## 7. Chemical Exposure Data for PA66 (Zytel 101)

Chemical	Conc.	Temp. (°C)	Days Exposed	Appearance	Change from Original, %				Yield Strain %	Change %	Yield Stress psi	Chg %	Break Strain %	Chg %	Break Stress psi	Chg %
					Length	Thickness	Weight	Tensile Mod								
Acetic acid	5%	23	730	Yellow, Brown Spots	2	3	9.25	-75	0	-100	0	-100	7	-97	3445	-50
Acetic acid	5%	23	1095	Tan with Brown Streaks	2	2	9.06	-57	0	-100	0	-100	3	-99	2356	-66
Acetic acid	5%	80	25	No Change	2	3	9.22	-58	26	4	4697	-43	30	-87	8322	20
Acetone	100%	23	100	No Change	2	1	0.51	39	11	-56	10509	27	190	-15	12316	77
Acetone	100%	23	365	No Change	2	1	0.51	39	11	-56	10509	27	190	-15	12316	77
Acetone	100%	23	730	Light Yellow	0	0	1.50	51	8	-68	8390	1	213	-4	12748	83
Ammonium Hydroxide	10%	23	100	No Change		2	7.40	44	37	48	4703	-43	322	44	13064	88
Ammonium Hydroxide	10%	23	365	No Change	2	3	7.65	-67	38	52	4635	-44	260	17	10794	55
Ammonium Hydroxide	10%	23	730	No Change	2	3	7.85	-77	34	36	4588	-45	299	34	11842	70
Ammonium Hydroxide	10%	23	1095	No Change	2	2	7.19	-64	28	12	4676	-44	293	31	12220	76
Ammonium Hydroxide	10%	50	25	Slightly Yellow		3	6.69	-56	30	20	5057	-39	261	17	12803	84
Ammonium Sulfate	20%	23	100	No Change	2	3	10.40	-64	28	12	4937	-40	30	-87	4195	-40
Ammonium Sulfate	30%	23	365	No Change	2	2	6.19	-61	31	24	4944	-40	252	13	10799	55
Ammonium Sulfate	20%	23	730	No Change	2	0	8.36	-26	24	-4	4943	-40	167	-25	14113	103
Aniline	99%	23	100	No Change	2	3	10.40	-64	28	12	4937	-40	30	-87	4195	-40
Aniline	99%	23	365	NA												
Anisole	99%	23	100	No Change	2	3	10.40	-64		-100	4937	-40	35	-84	4195	-40
Anisole	99%	23	365	NA												
Beer. Schlitz	100%	23	100	Very Light Brown	3	3	9.17	-63	38	52	4307	-48	278	25	10927	57
Beer. Schlitz	100%	23	365	Yellow, Brown Edges	2	4	9.08	-66	35	40	4191	-49	253	13	10034	44
Benzaldehyde	99%	23	100	No Change	2	3	10.40	-64	28	12	4937	-40	30	-87	4195	-40
Benzaldehyde	99%	23	365	NA												
Calcium Chloride	6%	23	100	No Change	2	2	7.72	-67	37	48	4639	-44	322	44	13391	93
Calcium Chloride	5%	23	365	No Change	3	3	7.93	-62	37	48	4711	-43	291	30	11809	70
Calcium Chloride	5%	23	730	No Change	2	3	7.65	-73	32	28	4439	-46	288	29	11431	64
Calcium Chloride	5%	23	1095	No Change	2	2	7.63	-81	30	20	4631	-44	249	12	10478	51
Calcium Chloride	5%	80	25	No Change	2	2	6.69	-56	30	20	4944	-40	298	34	13338	92
Calcium Hydroxide	2%	23	100	No Change	2	3	10.40	-64	29	16	4937	-40	30	-87	4195	-40
Calcium Hydroxide	2%	23	365	Yellow	2	3	6.10	-63	34	36	4601	-45	241	8	9987	44
Calcium Hydroxide	2%	23	730	No Change	3	0	7.85	-55	25	0	5488	-34	278	25	11937	72
Chloroform	100%	23	100	No Change	1	1	5.53	-32	32	28	5120	-38	217	-3	11714	68
Chloroform	100%	23	365	No Change	2	4	7.68	-39	35	40	6161	-26	236	6	11560	66
Chloroform	100%	23	730	No Change	2	4	11.81	-57	31	24	5188	-37	222	0	10254	47
Cupric Chloride	20%	23	100	No Change	2	3	7.63	-64	29	16	4937	-40	30	-87	4195	-40
Cupric Chloride	20%	23	365	Fluorescent green	2	2	7.37	-64	31	24	4969	-40	267	20	11163	61
Cupric Chloride	20%	23	730	Green	2	1	7.59	-61	24	0	4762	-42	37	-83	4953	-29

# 7. Chemical Exposure Data for PA66 (Zytel 101)

Chemical	Conc.	Temp. (°C)	Days Exposed	Appearance	Change from Original, %				Yield Strain %	Change %	Yield Stress psi	Chg %	Break Strain %	Chg %	Break Stress psi	Chg %
					Length	Thickness	Weight	Tensile Mod								
Detergent, Tide	5%	23	100	No Change	2	3	9.15	-63	39	56	4287	-48	264	18	10563	52
Detergent, Tide	5%	23	365	No Change, white	2	4	9.10	-66	34	36	4175	-50	259	16	10121	46
Detergent, Tide	5%	23	730	Mo Change	3	.	9.32	-69	23	-8	4943	-40	247	11	10153	46
Dishwasher Soap, Cascade	5%	23	100	No Change	2	3	8.38	-63	38	52	4259	-49	274	23	11035	59
Dishwasher Soap, Cascade	5%	23	365	No Change, white	2	a	8.08	-67	35	40	4353	-48	232	4	9474	36
Dishwasher Soap, Cascade	100%	23	730	Very Sit Yellow	2	2	9.30	-66	27	8	4790	-42	284	27	11131	60
Ethanol	100%	23	100	Sit. Swollen	1	4	4.79	-35	37	48	5635	-32	208	-7	10906	57
Ethanol	100%	23	365	Slight Yellow	3	4	8.82	-91	46	84	5438	-34	245	10	10976	58
Ethanol	100%	23	730	Very Slight Yellow	3	2	9.00	-67	34	36	4993	-40	231	4	13124	89
Ethyl Acetate	100%	23	100	No Change	2	1	0.89	60	10	-60	10708	29	196	-12	12361	78
Effiyt Acetate	100%	23	365	No Change	2	1	0.69	60	10	-60	10708	29	188	-16	12361	78
Ethyl Acetate	100%	23	730	Slightly Whiter	1	D	1.79	50	8	-68	9376	13	182	-18	11988	72
Ethylene Glycol	100%	80	25	No Change	2	a	13.38	-73	42	68	5163	-38	223	0	10131	46
Ethylene Glycol	100%	80	100	Slight Yellow	4	5	13.51	-68	42	68	5065	-39	164	-26	7412	7
Ferrous Sulfate	20%	23	100		2	3	10.40	-64	20	-20	4937	-40	30	-87	4195	-40
Ferrous Sulfate	20%	23	365	No Change	2	3	7.34	-62	35	40	4905	-41	279	25	11553	66
Ferrous Sulfate	20%	23	730	Yellow Spots/Edges	2	4	7.68	-91	25	0	5206	-37	210	-6	9524	37
Formic Acid	10%	23	100	No Change	3	4	10.91	-72	35	40	4221	-49			7623	10
Formic Acid	10%	23	365	No Change	3	4	10.81	-95	31	24	4763	-43	49	-78	4316	-38
Formic Acid	10%	23	730	Light Brown	3	2	10.85	-58	13	-48	2309	-72	23	-90	4368	-37
Hydrochloric Acid	10%	22	100	Shattered		2	14.29									
Hydrochloric Add	10%	23	365	NA												
Hydrochloric Acid	1%	80	25	Cracked, Brittle	2	3	9.09									
Hydrochloric Acid	1%	80	100	Shattered												
Hydrochloric Acid	10%	80	25	Dissolved												
Hydrochloric Acid	10%	80	100	Dissolved												
Hydrogen Peroxide	3%	29	100	Very white	2	3	8.77	-76	36	44	6582	-21	107	-52	5550	-20
Hydrogen Peroxide	3%	23	365	No Change, white	2	3	8.70	-64	31	24	4545	-45	55	-75	4395	-37
Hydrogen Peroxide	3%	23	730	White	2	1	8.10	-93	26	4	5482	-34	26	-88	5591	-20
Hydrogen Peroxide	35%	23	100	Crumbs	2	3									10563	52
Hydrogen Peroxide	35%	23	365		2	3	9.15	-63	30	20	4257	-49	254	14	10563	52
Hydrogen Peroxide	35%	23	730	White/Very Rough	2	0	2.39	-7	NY		NY		3	-99	2877	-59
Ketchup	100%	23	100	Slight amber/clear edges	2	2	6.06	-67	38	52	4424	-47	30	-87	4228	-39
Ketchup	100%	23	365	Yellow with Brown edges	3	3	6.06	-67	35	40	4756	-43	283	27	11626	67
Lactic Acid	20%	23	100		2	3	10.40	-64	28	12	4937	-40	30	-87	4195	-40

# 7. Chemical Exposure Data for PA66 (Zytel 101)

Chemical	Conc.	Temp. (°C)	Days Exposed	Appearance	Change from Original, %				Yield Strain %	Change %	Yield Stress psi	Chg %	Break Strain %	Chg %	Break Stress psi	Chg %
					Length	Thickness	Weight	Tensile Mod								
Liquor, Tequila	100%	23	100	Very Light Brown	4	1	13.27	-70	45	80	3845	-54	250	12	9116	31
Liquor, Tequila	100%	23	365	Yellow w/dark tan edges	4		13.25	-73	39	56	4090	-51	261	17	9585	38
Methanol	100%	23	100	Slightly Swollen	6	7	12.80	-71	49	96	3999	-52	269	21	9815	41
Methanol	100%	23	365	Slightly Swollen	6	7	12.60	-73	49	96	3899	-53	269	21	9815	41
Methanol	100%	23	730	No Change	4	5	12.18	-66	30	20	4722	-43	251	13	10101	45
Methyl ethyl ketone	100%	23	100	No Change	2	1	0.24	56	11	-56	11022	33	187	-16	11962	72
Methyl ethyl ketone	100%	23	365	No Change	2	1	0.24	55	11	-56	11022	33	187	-16	11962	72
Methyl ethyl ketone	100%	23	730	No Change	1	0	1.47	52	11	-56	3393	-59	165	-26	10105	45
Methyl ethyl ketone	100%	80	25	No Change	2	3	1.20	9	25	0	6389	-23	223	0	12584	81
Methyl ethyl ketone	100%	80	100	Light Yellow	2	2	3.26	-21	38	52	7410	-11	218	-2	12131	74
MTBE	100%	23	100	No Change	0	1	1.21	-3	27	8	7527	-9	253	13	13844	99
MTBE	100%	23	385	No Change	1	1	1.53	-11	27	8	7834	-6	223	0	11617	67
MTBE	100%	23	730	No Change	1	0	1.60	16	20	-20	6163	-26	222	0	11956	72
Mustard	100%	23	100	Golden Yellow	3	4	9.89	-64	38	52	4126	-50	246	10	9944	43
Mustard	100%	23	365	Orange w/Brown edges	2	4	9.64	-69	35	40	4509	-46	283	27	11241	62
Potassium Hydroxide	45%	23	100		2	3	10.40	-64	28	12	4937	-40	30	-87	4195	-40
Potassium Hydroxide	45%	23	365	NA												
Propylene Carbonate	100%	23	100	No Change	0	0	0.11	55	1	-96	9692	17	155	-30	10637	53
Propylene Carbonate	100%	23	365	No Change	1	0	-0.10	70	10	-60	11222	35	195	-13	13506	94
Sodium Bisulfite	20%	23	100		2	3	10.40	-64	23	-8	4937	-40	30	-87	4196	-40
Sodium Bisulfite	20%	23	365	No Change	2	2	7.91	-60	32	28	5074	-39	251	13	10604	53
Sodium Bisulfite	20%	23	730	White	3	1	7.85	-59	23	-8	5632	-32	170	-24	8085	16
Sodium Hydroxide	50%	23	100	Clear Edges	0	0	0.16	-44	IB				216	-3	13115	89
Sodium Hydroxide	50%	23	365	Light Yellow	0	0	-0.15	59	11	-56	11491	39	190	-15	12566	81
Sodium Hydroxide	50%	23	730	Light Tan w Brown Edges	0	-1	0.19	22	17	-32	10731	29	164	-26	11182	61
Sodium Hydroxide	10%	80	25	Soft Molten	2	2	6.12	-71	28	12	4226	-49	28	-87	4194	-40
Sodium Hydroxide	1%	80	25	No Change	2	4	8.14	-71	30	20	4758	-43	258	16	10268	48
Sodium Hydroxide	1%	80	100	Clear Edges	3	3	9.20	.65	34	36	4635	-44	129	-42	6011	-14
Sodium Hydroxide	10%	80	300	Soft Molten	2	3	6.25	-80	0	-100	0	-100	7	-97	1226	-82
Sodium Hypochlorite	5%	23	100	Pitted Surface	1	2	8.07	-64	34	36	4715	-43	82	-63	4715	-32
Sodium Hypochlorite	5%	23	365	White w/ Waxy surface	2	-2	4.68	-62	NY		NY		10	-96	3836	-45
Sodium Hypochlorite	5%	23	730	Light Tan	2	-8	0.96	-56	NY		NY		5	-98	3469	-50
Sodium Hypochlorite	12%	23	100	Gummy	2	1	3.27	-82	32	28	5016	-40	114	-49	5829	-16
Sodium Hypochlorite	12%	23	365		2	3	3.27	-53	39	56	4257	-49	254	14	10563	52
Sodium Hypochlorite	12%	23	730	Whiter/Slightly Tacky	1	-10	-9.51	-54	NY		NY		13	-94	5362	-23

## 7. Chemical Exposure Data for PA66 (Zytel 101)

Chemical	Conc.	Temp. (°C)	Days Exposed	Appearance	Change from Original, %				Yield Strain %	Change %	Yield Stress psi	Chg %	Break Strain %	Chg %	Break Stress psi	Chg %	
					Length	Thickness	Weight	Tensile Mod									
Sulfuric Acid	30%	23	100	Dissolved	10	3	10.40										
Sulfuric Acid	30%	23	365	NA													
Water (DI)	100%	21	100	No Change		3	5.36	-76	37	48	6757	-19	262	17	10624	53	
Water (DI)	100%	23	355	No Change		3	7.69	-76	32	28	4563	-45	241	8	6363	-8	
Water (DI)	100%	23	730	No Change		1	7.34	-60	26	4	5688	-31	120	-46	6327	-9	
Water (DI)	100%	80	25	Off-White		3	7.70	-71	32	28	4820	-42	157	-30	6941	0	
Water (DI)	100%	80	100	Slight Yellow		3	7.96	-66	34	36	4929	-41	243	9	9409	35	
Water (Seawater)	100%	23	100	No Change		0	8.26	-70	36	44	4329	-48	269	21	11105	60	
Water (Seawater)	100%	23	365	No Change			4	6.40	-65	34	36	4316	-48	272	22	10669	53
Water (Seawater)	100%	23	730	No Change		2	2	8.68	-63	27	8	5166	-38	249	12	10941	57
Water (Seawater)	100%	80	25	No Change		2	3	6.76	-56	31	24	4640	-44	249	12	10261	48
Water (Seawater)	100%	80	100	Light Yellow		2	-1	7.64	-62	34	36	5246	-37	231	4	9747	40
Wine, Red	100%	23	100	Stained Darker Red		2	3	10.86	-65	39	56	4130	-50	271	22	10583	52
Wine, Red	100%	23	355	Orange-Yellow w/ Red Sediment		3	4	11.04	-71	37	48	4436	-47	267	20	10314	48
Zinc Chloride	50%	23	100	Slightly Rough		1	2	4.91	-47	31	24	6008	-28	80	-64	5975	-14
Zinc Chloride	50%	23	365	No Change		1	2	6.68	-52	32	28	5672	-32	200	-10	9265	33
Zinc Chloride	50%	23	730	No Change		1	1	6.04	-43	25	0	5724	-31	124	-44	7123	2
Zinc Chloride	50%	80	25	Molten. Sticky, Cracked													
Zinc Chloride	50%	80	100	Shattered													

NY = No Yield

## 7. Chemical Exposure Data for PVDF (Kynar 710)

Chemical	Conc.	Temp. (°C)	Days Exposed	Appearance	Change from Original, %				Yield Strain %	Change %	Yield Stress psi	Chg %	Break Strain %	Chg %	Break Stress psi	Chg %
					Length	Thickness	Weight	Tensile Mod								
Acetone	100%	23	100	Swollen	12	7	15.9	-89	62	439	4202	-44	137	-53	5445	-14
Acetone	100%	23	365	No Change	13	6	16.1	-90	65	465	4488	-40	142	-52	5770	-9
Acetone	100%	23	730	White	8	4	12.7	-80	32	178	4777	-37	91	-69	5140	-19
Ethyl Acetate	100%	23	100	No change	13	4	10.1	-77	37	222	5440	-28	136	-54	6326	0
Ethyl Acetate	100%	23	365	No change	7	4	10.4	-74	35	204	5270	-30	179	-39	7068	12
Ethyl Acetate	100%	23	730	White	1	4	104	-84	37	222	5168	-31	155	-47	7031	11
Ethyl Acetate	100%	23	1095	No Change	6	2	8.8	-76	25	117	5739	-24	133	-55	6490	3
Ethyl Acetate	100%	80	25	Swollen	13	10	20.2	-94	76	561	4674	-38	134	-54	5700	-10
Methyl Ethyl ketone	100%	23	100	No change	13	5	11.8	-63	41	257	4942	-34	90	-69	5066	-20
Methyl Ethyl Ketone	100%	23	365	No change	10	5	12.9	-82	42	265	4903	-35	149	-49	6068	-4
Methyl Ethyl Ketone	100%	23	730	Snow White	9	4	11.6	-86	41	257	4971	-34	175	-40	6667	5
Methyl Ethyl Ketone	100%	23	1095	No Change	8	4	11.4	-79	31	170	5096	-32	125	-57	5896	-7
Methyl Ethyl Ketone	100%	80	25	Dissolve / gel												
MTBE	100%	23	100	No Change	0	1	1.1	-13	13	13	7467	-1	100	-66	6467	2
MTBE	100%	23	366	No Change	1	2	0.9	-19	15	30	7411	-2	116	-60	6886	9
MTBE	100%	23	730	White	0	0	0.7	-16	15	30	7069	-6	67	-77	5398	-15
Propylene Carbonate	100%	23	100	No Change	2	4	5.9	-54	23	100	6436	-15	15	-95	6468	2
Propylene Carbonate	100%	23	365	Slight Yellow	7	4	14.0	-75	35	204	5643	-25	169	-42	7184	14
Propylene Carbonate	100%	23	730	Light Gold	7	4	14.7	-77	32	178	5520	-27	134	-54	6180	-2



## 8. Chemical Exposure Data for PK vs. POM (Delrin II 500, Celcon M-90)

Chemical	Conc.	Temp. (°C)	Days Exposed	Appearance	Change from Original, %			Yield Strain %	Change %	Yield Stress psi	Chg %	Break Strain %	Chg %	Break Stress psi	Chg %
					Thickness	Weight	Tensile Mod								
<b><u>POLYKETONE M630A</u></b>															
Gasoline (Unleaded)	100%	80	30	Slight Yellow	1	1.7	-10	20	12	8612	7	273	-9	14025	-3
Methanol	100%	80	30	Very Slight Yellow	1	42	-40	37	49	7806	-6	288	-11	12887	-11
Methanol/Unlead Gas	15%/85%	80	30	Very Slight Yellow	1	4.8	-52	36	45	7658	-7	282	-6	13385	-7
MTBE/Unlead Gas	15%/85%	80	30	Very Slight Yellow	1	1.2	-19	29	16	8833	8	269	-10	13894	-4
<b><u>POM-H (Delrin II 500)</u></b>															
Gasoline (Unleaded)	100%	80	30	Barely Yellow	1	2.3	-40	16	79	9779	-2	38	-6	9834	4
Methanol	100%	80	30	No Change	2	3.2	-60	19	88	9674	-3	35	-13	9372	4
Methanol/Unlead Gas	15%/85%	80	30	No Change	2	4.1	-60	19	91	9614	-4	39	-2	9205	3
MTBE/Unlead Gas	15%/85%	80	30	Barely Yellow	1	2.3	-46	19	91	9796	-2	40	-1	9137	4
<b><u>POM-CO (Celcon M-90)</u></b>															
Gasoline (Unleaded)	100%	80	30	Barely Yellow	1	1.9	-32	21	39	8186	-9	59	-2	7308	-3
Methanol	100%	80	30	No Change	2	2.5	-38	22	47	8076	-11	66	10	7380	-2
Methanol/Unlead Gas	15%/85%	80	30	No Change	2	3.5	-48	24	59	7817	-14	70	17	7157	-5
MTBE/Unlead Gas	15%/85%	80	30	Very Slight Yellow	1	2.1	-28	21	39	8219	-9	56	-6	7418	-2



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