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APPENDIX

APPENDIX A

SPECIFICATION OF THE UNSATURATED POLYESTER RESIN,
"ALPOLIT VUP 9026"

Characteristics

Alpolit VUP 9026 is a medium viscous, light stabilized unsaturated polyester resin of medium reactivity, containing methyl methacrylate. It can be cured at ambient or at elevated temperature according to the usual method.

Application

Alpolit VUP 9026 is specially formulated for the production of highly translucent laminates and the continuous manufacture of plane and corrugated sheets. It has an excellent optical clarity and the superior weather resistance.

Remarks

Alpolit VUP 9026 can be thinned with styrene in any ratio. Additions of more than 5% are not recommended since the mechanical properties will be influenced adversely.

<u>Property</u>		<u>Unit</u>	<u>Test method</u>
Appearance	clear liquid		
Colour	max. 100	Hazen	-
Viscosity at 20 ^o c	220-240	sec.	. DIN 53211
Content of styrene	27±1	% B.W.	-
Gel time at 25 ^o c (0.6% CO.1,1% MEKP)	13-18	min	-
Styrene compatibility	∞	-	-
Storage stability at 25 ^o c in darkness	at least 6	month	-

APPENDIX B

PATTERN OF CONSUMPTION OF AN UNSATURATED POLYESTER AND REINFORCED
 UNSATURATED POLYESTER IN JAPAN FROM 1985 TO 1992

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1984	1985
FRP uses	144	149
Non FRP uses	50	59
Total	194	208

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1984	1985
Construction	25	26
Building materials	93	95
Marine and ships	32	30
Automotive and vehicles	7	10
Tanks and containers	34	36
Industrial materials	31	32
Miscellaneous uses	18	19
Other	14	15
Total	254	263

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1985	1986
FRP uses	149	145
Non FRP uses	50	45
Total	199	190

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1985	1986
Construction	25	25
Building materials	96	98
Marine and ships	33	33
Automotive and vehicles	9	14
Tanks and containers	35	37
Industrial materials	35	36
Miscellaneous uses	16	19
Other	15	15
Total	266	277

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1986	1987
FRP uses	150	147
Non FRP uses	50	48
Total	200	195

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1986	1987
Construction	27	28
Building materials	100	101
Marine and ships	33	34
Automotive and vehicles	11	14
Tanks and containers	32	34
Industrial materials	38	37
Miscellaneous uses	18	18
Other	13	12
Total	272	278

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1987	1988
FRP uses	166	180
Non FRP uses	41	45
Total	207	225

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1987	1988
Construction	30	32
Building materials	129	148
Marine and ships	34	35
Automotive and vehicles	12	13
Tanks and containers	38	42
Industrial materials	48	55
Miscellaneous uses	21	23
Other	10	9
Total	322	357

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1988	1989
FRP uses	181	199
Non FRP uses	57	65
Total	238	264

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1988	1989
Construction	31	37
Building materials	154	180
Marine and ships	37	39
Automotive and vehicles	17	20
Tanks and containers	46	49
Industrial materials	56	53
Miscellaneous uses	26	32
Other	12	11
Total	379	421

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1989	1990
FRP uses	195	201
Non FRP uses	63	65
Total	258	266

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1989	1990
Construction	35	29
Building materials	182	190
Marine and ships	38	40
Automotive and vehicles	21	23
Tanks and containers	49	49
Industrial materials	52	53
Miscellaneous uses	33	38
Other	12	13
Total	422	444

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1990	1991
FRP uses	210	202
Non FRP uses	48	45
Total	258	247

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1990	1991
Construction	38	36
Building materials	194	191
Marine and ships	40	35
Automotive and vehicles	25	26
Tanks and containers	49	51
Industrial materials	54	56
Miscellaneous uses	41	44
Other	13	6
Total	454	445

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1991	1992
FRP uses	206	197
Non FRP uses	47	64
Total	253	261

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1991	1992
Construction	37	38
Building materials	188	180
Marine and ships	34	31
Automotive and vehicles	27	25
Tanks and containers	52	51
Industrial materials	58	58
Miscellaneous uses	48	37
Other	13	12
Total	457	432

Source : Modern Plastic International, vol. 16 - 23 , NO. 1.

APPENDIX C

PATTERN OF CONSUMPTION OF AN UNSATURATED POLYESTER AND REINFORCED
UNSATURATED POLYESTER IN USA FROM 1983 TO 1992

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1982	1983
Reinforced polyester ^a		
Molded, filament-wound, pultruded, etc.	237	283
Sheet, flat and corrugated	50	60
Surface coatings	5	6
Export	4	6
Other ^b	90	95
Total	386	450

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1982	1983
Aircraft/aerospace	9	10
Appliances/business equipment	32	34
Construction	120	150
Consumer ^c	45	55
Corrosion-resistant products	110	130
Electrical	53	60
Marine	112	135
Transportation	64	80
Other	30	25
Total	575	689

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1983	1984
Reinforced polyester ^a		
Molded, filament-wound, pultruded, etc.	300	350
Sheet, flat and corrugated	74	80
Surface coatings	6	7
Other ^b	111	127
Total	386	450

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1983	1984
Aircraft/aerospace	10	12
Appliances/business equipment	34	39
Construction	180	190
Consumer ^c	52	59
Corrosion-resistant products	130	145
Electrical	23	28
Marine	125	140
Transportation	80	92
Other	33	36
Total	667	741

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1984	1985
Reinforced polyester ^a		
Molded, filament-wound, pultruded, etc.	350	347
Sheet, flat and corrugated	77	75
Surface coatings	7	7
Other ^b	125	125
Total	386	450

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1984	1985
Aircraft/aerospace	12	13
Appliances/business equipment	39	39
Construction	191	182
Consumer ^c	59	60
Corrosion-resistant products	141	145
Electrical	28	22
Marine	140	145
Transportation	91	100
Other	23	24
Total	724	730

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1985	1986
Reinforced polyester ^a		
Molded, filament-wound, pultruded, etc.	350	349
Sheet, flat and corrugated	80	81
Surface coatings	7	7
Export	4	5
Other ^b	117	120
Total	558	592

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1985	1986
Aircraft/aerospace	13	15
Appliances/business equipment	39	40
Construction	182	183
Consumer ^c	60	59
Corrosion-resistant products	145	146
Electrical	22	24
Marine	145	147
Transportation	100	91
Other	24	23
Total	730	728

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1986	1987
Reinforced polyester ^a		
Molded, filament-wound, pultruded, etc.	349	357
Sheet, flat and corrugated	81	86
Surface coatings	7	8
Export	4	5
Other ^b	120	142
Total	561	598

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1986	1987
Aircraft/aerospace	14	15
Appliances/business equipment	40	41
Construction	183	179
Consumer ^c	55	59
Corrosion-resistant products	117	148
Electrical	24	25
Marine	147	159
Transportation	91	89
Other	23	23
Total	728	738

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1987	1988
Reinforced polyester ^a		
Molded, filament-wound, pultruded, etc.	357	379
Sheet, flat and corrugated	86	82
Surface coatings	8	9
Export	4	7
Other ^b	142	147
Total	597	624

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1987	1988
Aircraft/aerospace	15	15
Appliances/business equipment	41	42
Construction	179	188
Consumer ^c	59	61
Corrosion-resistant products	148	154
Electrical	25	24
Marine	159	171
Transportation	89	92
Other	23	23
Total	738	770

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1988	1989
Reinforced polyester ^a		
Molded, filament-wound, pultruded, etc.	379	356
Sheet, flat and corrugated	82	75
Surface coatings	9	9
Export	7	14
Other ^b	147	149
Total	624	603

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1988	1989
Aircraft/aerospace	15	16
Appliances/business equipment	42	42
Construction	188	194
Consumer ^c	61	63
Corrosion-resistant products	154	159
Electrical	24	24
Marine	171	161
Transportation	94	101
Other	23	24
Total	772	784

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1989	1990
Reinforced polyester ^a		
Molded, filament-wound, pultruded, etc.	350	328
Sheet, flat and corrugated	75	76
Surface coatings	9	9
Export	11	9
Other ^b	149	37
Total	600	529

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1989	1990
Aircraft/aerospace	16	15
Appliances/business equipment	42	42
Construction	194	175
Consumer ^c	63	58
Corrosion-resistant products	159	153
Electrical	24	24
Marine	161	137
Transportation	100	98
Other	24	22
Total	783	724

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1990	1991
Reinforced polyester ^a		
Molded, filament-wound, pultruded, etc.	328	282
Sheet, flat and corrugated	76	76
Surface coatings	9	8
Export	9	9
Other ^b	137	117
Total	559	492

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1990	1991
Aircraft/aerospace	15	16
Appliances/business equipment	42	38
Construction	175	153
Consumer ^c	58	55
Corrosion-resistant products	153	150
Electrical	24	23
Marine	137	100
Transportation	98	84
Other	22	20
Total	724	639

UNSATURATED POLYESTER		
Market	1000 metric tons	
	1991	1992
Reinforced polyester ^a		
Molded, filament-wound, pultruded, etc.	282	330
Sheet, flat and corrugated	76	82
Surface coatings	8	7
Export	9	15
Other ^b	117	108
Total	492	542

REINFORCED UNSATURATED POLYESTER		
Market	1000 metric tons	
	1991	1992
Aircraft/aerospace	16	14
Appliances/business equipment	38	40
Construction	153	176
Consumer ^c	55	56
Corrosion-resistant products	150	136
Electrical	23	24
Marine	100	111
Transportation	84	87
Other	20	24
Total	639	668

^a : Resin only.

^b : Autobody putty, furniture, cultured marble, etc.

^c : Includes motor homes and recreation vehicles.

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