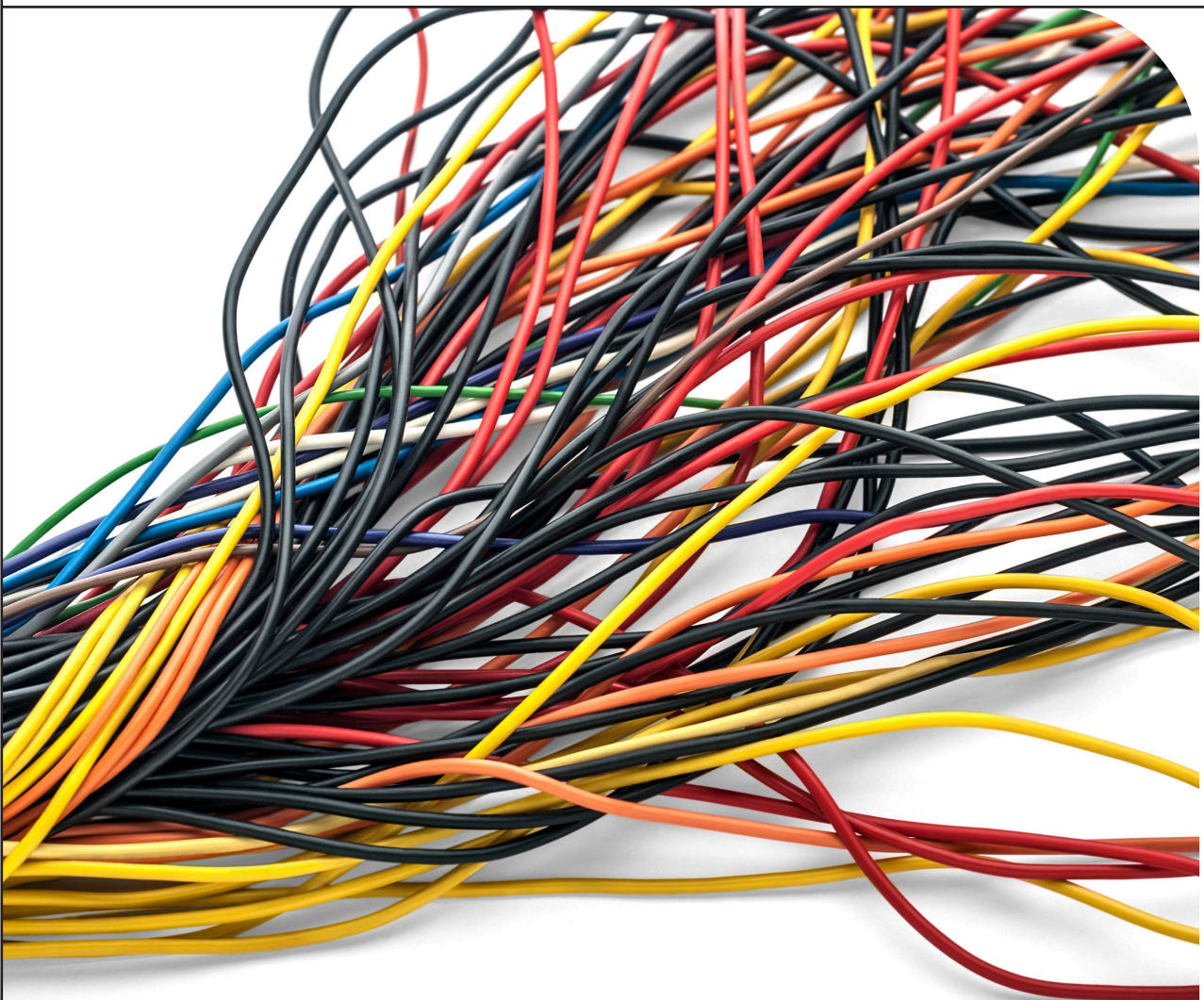


**ARKEMA**

**ORGALLOY®**

# High Performance Polyamide Alloys

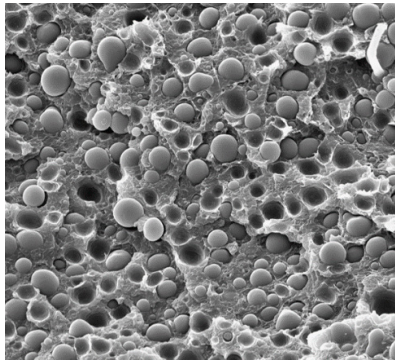


# INTRODUCTION

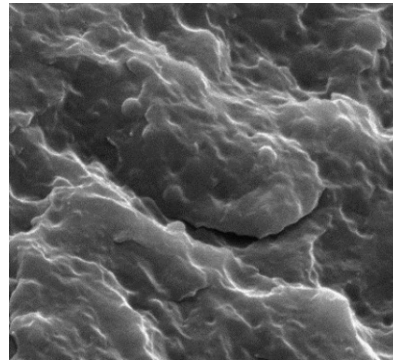
Orgalloy® polyamide alloys combine the important physical and chemical properties of short-chain polyamides with the economic and process advantages of polyolefins. They are designed to offer improved dimensional stability, lower density, and better mechanical properties than PA 6 and PA 66 resins.

- Dimensional stability
- Consistent mechanical properties
- Stable electrical properties
- Resistance to hydrolysis
- Easy processing
- High productivity rate

Orgalloy® resins are suitable for all the traditional application sectors of engineering polymers. These alloys are excellent solutions for cable jacketing and connectors, as well as automotive applications where chemical resistance and barrier properties are required. Orgalloy® polymers can be processed using conventional processing methods.



Immiscible blend of Polyamide and Polyolefin



Orgalloy® polyamide 6 or 6.6 based alloy with a dispersed polyolefin phase



# NOMENCLATURE GUIDE

FLEXIBLE  
GRADES

SEMI-FLEXIBLE  
GRADES

RIGID  
GRADES

Flexural  
Modulus

LT  
200 MPa

LE  
1000 MPa

RS  
7000 MPa

Example 1

LT 4060 ES Black

- Flexible material
- Flexibility level
- Blow-molding
- Black color

Example 2

LE 60 LM XV NAT

- Semi-flexible material
- PA 6 based material
- Low modulus
- Plasticized grade
- Natural color

Example 3

RS 66 30 Black

- Rigid material
- PA 66 based material
- 30% G.F reinforced
- Black color

	STANDARD	UNITS	LT 4060 ES BLACK T6L	LT 5050 T6L NAT	LE 60 LMXV NAT	LE 6000 NAT	LE 6000 ST NAT	LE 60 THM NAT	R 60 ES NAT
DENSITY	ISO 1183	g/cm3	1.04	1.04	1.04	1.04	1.04	1.05	1.03
MOISTURE ABSORPTION									
Water absorption at 23°C (equilibrium)	ISO 62	%	5.4	5.6	5.8	7	7	6.5	6.1
Humidity absorption at 23°C/50% RH (equilibrium)	ISO 62	%	1.8	2	2.1	2.5	2.5	2.4	2
MELT VOLUME FLOW RATE			235°C/5 kg	235°C/5 kg	235°C/ 2.16 kg	235°C/ 2.16 kg	235°C/ 2.16 kg	235°C/ 2.16 kg	235°C/ 2.16 kg
(after drying)	ISO 1133	cm³/10 min	1.4	1.8	3.5	2.5	2	3.8	2.5
MELTING POINT	ISO 11357-1/-3	°C	220	220	220	220	220	220	220
HDT / VICAT									
HDT 0.45 MPa	ISO 75-1/-2	°C	-	-	55	84	84	86	130
HDT 1.8 MPa	ISO 75-1/-2	°C	-	-	38	50	50	48	75
Vicat 10 N - A method	ISO 306	°C	194	204	200	209	209	208	204
Vicat 50 N - B method	ISO 306	°C	62	75	86	118	118	131	134
THERMAL EXPANSION (CLTE)									
(from 20°C to 60°C)									
Along flow direction	ISO 11359-1-2	1.E-06 / °K	200	170	200	216	216	-	93
Across flow direction	ISO 11359-1-2	1.E-06 / °K	300	180	-	170	170	-	130
FLEXURAL TEST (Dry / Cond*)									
Modulus	ISO 178	MPa	500 / 200	770 / 330	660 / 350	1300/800	1300/800	1700 / -	1960 / 1430
TENSILE TEST (Cond*)									
Young's Modulus	ISO 527-1/-2	MPa	230	470	650	1400	1400	1800	1880
Yield stress	ISO 527-1/-2	MPa	14	18	24	36	36	42	47
Strain at yield	ISO 527-1/-2	%	25	31	28	7	7	5	4.7
Strength at break	ISO 527-1/-2	MPa	31	34	45	33	33	44	31
Strain at break	ISO 527-1/-2	%	> 50	> 50	> 50	> 50	> 50	> 50	> 50
CHARPY IMPACT STRENGTH (Dry/Cond*)									
23°C / Notched	ISO 179/1eA	kJ/m2	79 / 78	76 / 82	82 / 89	29 / 35	29 / 35	23 / 26	8 / 10
23°C / Unnotched	ISO 179/1eU	kJ/m2	NB / NB	NB / NB	NB / NB	NB / NB	NB / NB	NB/NB	-
- 30°C / Notched	ISO 179/1eA	kJ/m2	-	28 / 30	12 / 12	11 / 11	11 / 11	12 / 12	-
- 30°C / Unnotched	ISO 179/1eU	kJ/m2	-	NB / NB	NB / NB	NB / NB	NB / NB	NB/NB	-
HARDNESS (Cond*)									
Shore D 15s	ISO 868		50	55	57	66	66	68	74
ELECTRICAL PROPERTIES									
Comparative Tracking Index	IEC60112	Volts	> 600	> 600	> 600	> 600	> 600	> 600	> 600
Surface resistivity	IEC 60093	Ohm	-	3.1 E15	-	-	-	-	4.8 E15
Volume resistivity	IEC 60093	Ohm.m	-	7.4 E11	-	-	-	-	1.6 E13
Dielectric strength (1 mm)	IEC 60243-1	kV/mm	-	36	-	-	-	-	38
"Dissipation factor - Tangent Delta 100 Hz"	IEC 60250	1E-4	-	1100	-	-	-	-	620
1 kHz	IEC 60250	1E-4	-	1100	-	-	-	-	650
1 MHz	IEC 60250	1E-4	-	500	-	-	-	-	250
FLAMMABILITY									
	IEC 60695-11-10	--	HB	HB	HB	HB / HB	HB / HB	-	HB

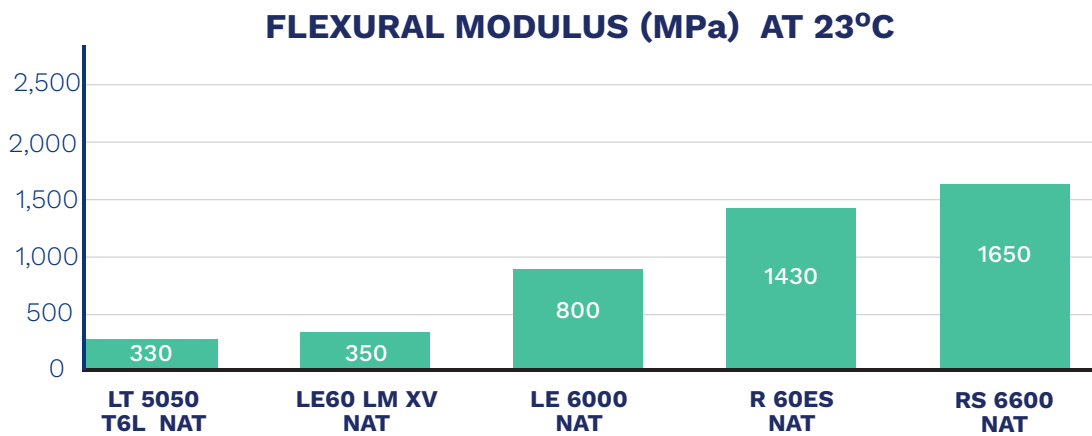
\*\* (D/C) : Dry / After conditioning at 23°C and 50 % relative humidity

RS 6000 NAT	RS 6010 NAT	RS 6030 NAT	RS 6630 BLACK
1.04	1.12	1.25	1.27
6.6	5.9	4.7	3.9
2.2	2	1.6	1.3
235°C/ 2.16 kg	235°C/ 2.16 kg	235°C/2.16 kg	275°C/2.16 kg
8	6	2.5	8.5
220	220	220	255
130	197	215	257
71	187	190	237
208	210	> 210	>250
150	167	185	204
93	-	19	18
130	-	126	110
2120 / 1650	3400 / 2900	7200/6240	7000/6600
2030	3650	8000	8300
47	70	-	-
6	3.4	-	-
40	68	126	125
21	4.1	3	3
7 / 8	9 / 9	15 / 16	10 / 11
61 / 67	40 / 44	59 / 60	58 / 58
5 / 5	6 / 6	10 / 11	9 / 9
59 / 59	44 / 45	57 / 58	50 / 50
73	74	78	79
> 600	> 600	> 600	> 600
4.8 E15	3.1 E15	1.3 E15	5.3 E15
1.6 E13	1.4 E13	1.3 E13	2.1 E13
38	36	34	34
620	630	640	290
650	650	660	310
250	240	230	160
HB / HB	HB	HB	HB



# TUBES / MANDRELS / PROFILES / CABLES

	LT 5050 T6L NAT	LE 60 LM XV NAT	LE 6000 NAT	LE 60 THM NAT	RS 6000 NAT
Tubes	●	●	●	●	
Mandrels	●				
Profiles			●	●	●
Cables			●	●	



## KEY PROPERTIES FOR...

### TUBES

- Low cost: performance ratio
- Easy processing

### MANDRELS

- Flexibility
- Durability
- Thermal resistance

### PROFILES

- Dimensional stability

### CABLES

- Dimensional stability
- Chemical and thermal resistance



# FILM AND PACKAGING

	LE 6000 NAT	LE 60 THM NAT	RS 6000 NAT	R 60 ES NAT
<b>Viscosity</b>	Medium	Medium	Low	High
<b>Blown film</b>	●	●		●
<b>Film</b>	●		●	
<b>Hollow vessels</b>	●	●		●
<b>Injection molding</b>	●	●	●	
<b>MVI 235°C /2.16 kg</b>	2.5	3.8	8	2.5

Properties of a 40 µm film	STANDARDS	UNITS	R 60 ES NAT	LE 6000 NAT	LE 60 THM NAT
<b>TENSILE STRENGTH m.d</b>					
Stress at yield	ISO 527-3	MPa	35	25	35
Elongation at yield		%	20	20	16
Stress at break		MPa	80	53	61
Elongation at break		%	530	410	610
<b>TENSILE STRENGTH t.d</b>					
Stress at yield	ISO 527-3	MPa	33	26	35
Elongation at yield		%	15	14	16
Stress at break		MPa	60	41	55
Elongation at break		%	530	490	510
<b>TEAR RESISTANCE</b>					
Melt direction	ISO 6383-2	N	40	25	45
Transverse direction		N	35	150	55
<b>DART TEST</b>					
	ISO 7765-1				
	Method A	g	> 360	> 360	> 360
	Method B	g	<< 321	313	<< 321

## FOOD CONTACT

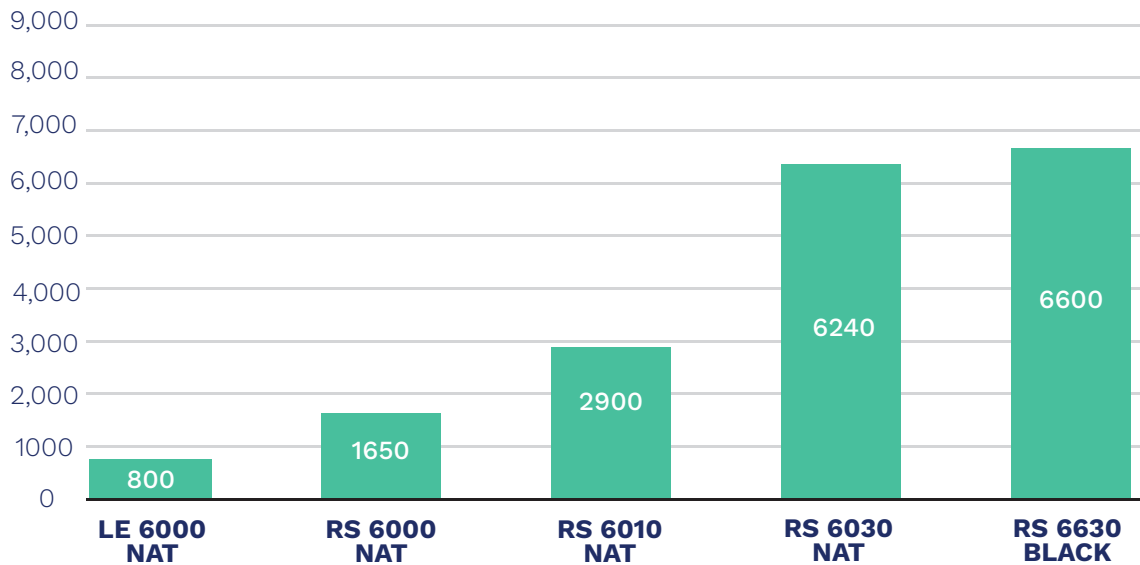
A number of specific Orgalloy® grades conform to the regulations concerning materials in contact with food.

For more information please contact Arkema.

# MOLDING OF ENGINEERING PARTS

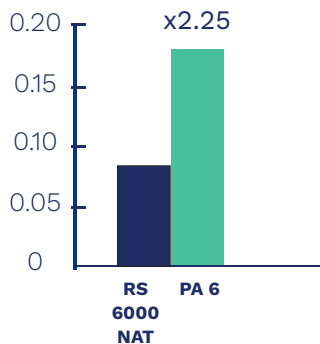
	LE 6000 NAT	RS 6000 NAT	RS 6010 NAT	RS 6030 NAT	RS 6630 BLACK
Glass Fiber (%)	0	0	10	30	30

## FLEXURAL MODULUS (MPa) AT 23°C



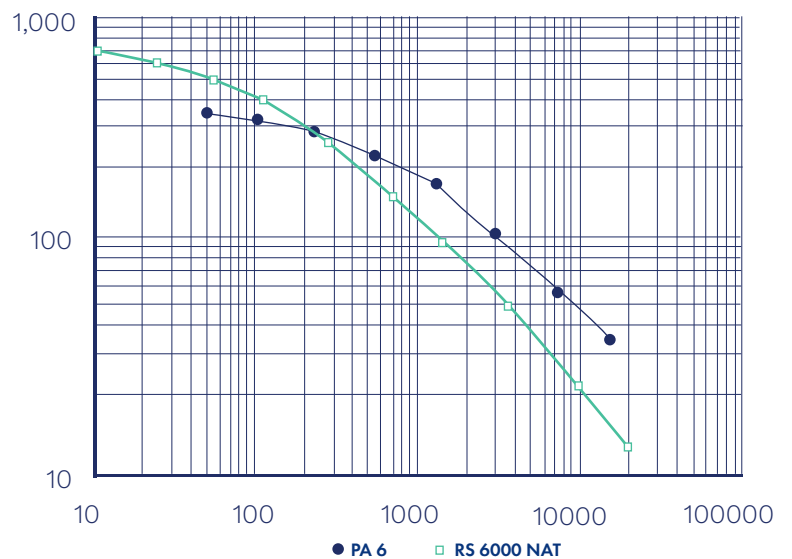
## BETTER DIMENSIONAL STABILITY THAN OTHER POLYAMIDES

DIMENSIONAL CHANGE (%) AFTER IMMERSION IN WATER AT 23°C (3 DAYS)



## RHEOLOGY (HIGH IN-MOLD FLOW)

RS 6000 NAT vs PA 6 at 260°C

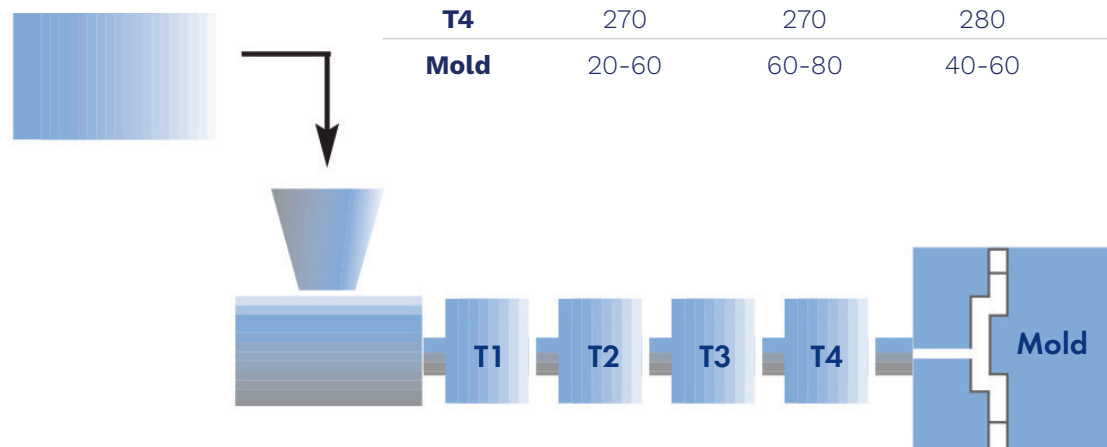




# PROCESSING

## Injection

Drying system  
(recommended)



T °C	RS 60XX, LE, & LT SERIES (PA 6 BASED)			RS 66XX SERIES (PA 66 BASED)
	RS 6000 NAT	RS 6010 NAT RS 6030 NAT	LE 6000 NAT	RS 6630 BLACK
<b>T1</b>	240	240	240	255
<b>T2</b>	250	250	260	260
<b>T3</b>	260	260	270	270
<b>T4</b>	270	270	280	280
<b>Mold</b>	20-60	60-80	40-60	60-80

## INJECTION SHRINKAGE AND POST-SHRINKAGE RATES OF MAIN ORGALLOY® GRADES

	BARREL Temp. (°C)	MOLD Temp. (°C)	SHRINKAGE (%) (24 Hrs after molding)		POST-SHRINKAGE* (%) (after 1 Hr 160 °C treatment)		TOTAL SHRINKAGE (%) (after heat treatment)	
			//	⊥	//	⊥	//	⊥
<b>RS 6000 NAT</b>	240/260	40	0.7	0.9	0.9	1.1	1.6	2.0
<b>PA 6</b>	240/260	40	0.45	0.5	0.75	1.0	1.2	1.5
<b>RS 6030 NAT</b>	250/265	60	0.2	0.5	0.1	0.6	0.3	1.4
<b>PA 6 + 30% G.F.</b>	260/280	65	0.25	0.9	0.05	0.4	0.3	1.3
<b>RS 6630 BLACK</b>	260/280	80	0.3	0.7	0.2	0.4	0.5	1.2
<b>PA 66 + 30%G.F.</b>	260/280	80	0.3	1.0	-	-	-	-
<b>LE 6000 NAT</b>	240/260	40	0.8	0.7	-	-	-	-

// : in the flow direction    \* Measured after complete cooling    ⊥ : across the flow direction    - Fan gate 0.9 mm  
- Plate 100 x 100 x 2 mm

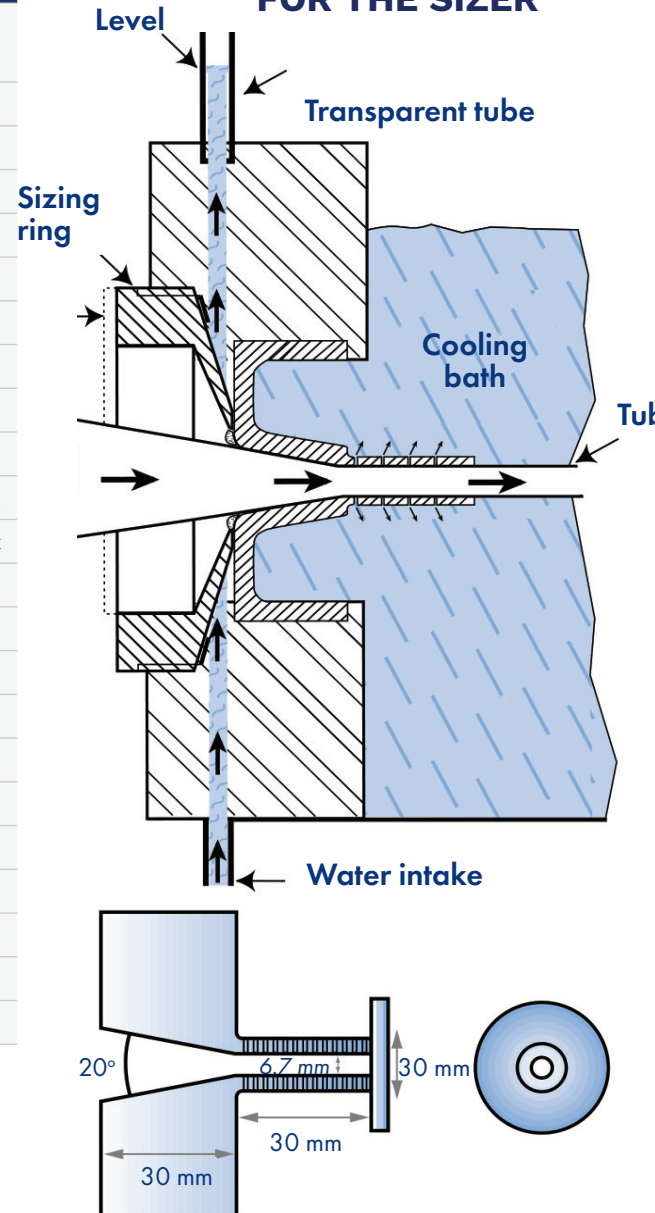
# PROCESSING

## Tube, mandrel, & cable extrusion

### EXTRUSION MACHINE

Standard Screw / 3 zones	TUBES	MANDRELS	CABLES
<b>ORGALLOY® GRADE</b>	LE 6000 NAT	LT 5050 T6L NAT	LE 6000 NAT
	LE 60 THM NAT		
	LE 60 LMXV NAT		
<b>Screw diameter (mm)</b>	45	60	
<b>Length (in diameters)</b>	26 D	30 D	
<b>TUBE</b>			
<b>OD (mm)</b>	8	12.5	
<b>Thickness (mm)</b>	1	-	
<b>TEMPERATURES (°C)</b>			
<b>Feeding</b>	210	250	210°C
<b>Compression</b>	225/240	240	225/240°C
<b>Metering</b>	250/260	230	250/260°C
<b>Head 1</b>	255	230	255°C
<b>Head 2</b>	250	220	250°C
<b>Die</b>	240	210	240°C
<b>TOOLING FEATURES</b>			
<b>Die</b>			
<b>Die x Pin (mm)</b>	18x14	17.7	
<b>Tooling Ratio</b>	4.57	-	
<b>Sizing Die</b>			
<b>Diameter (mm)</b>	8.7	14	
<b>Diam/tube's O.D. Ratio</b>	1.09	-	
<b>Entry Water Supply (l/h)</b>	32	-	
<b>Body</b>	SPECIFIC ORGALLOY® DESIGN		

### TUBING EXTRUSION WITH ORGALLOY® SKETCH FOR THE SIZER



## TUBES / MANDRELS / PROFILES / EXTRUSION RANGE

A comprehensive range for tube extrusion.

→ These products are particularly suitable for high speed extrusion. Arkema can recommend specific equipment for enhanced performance.

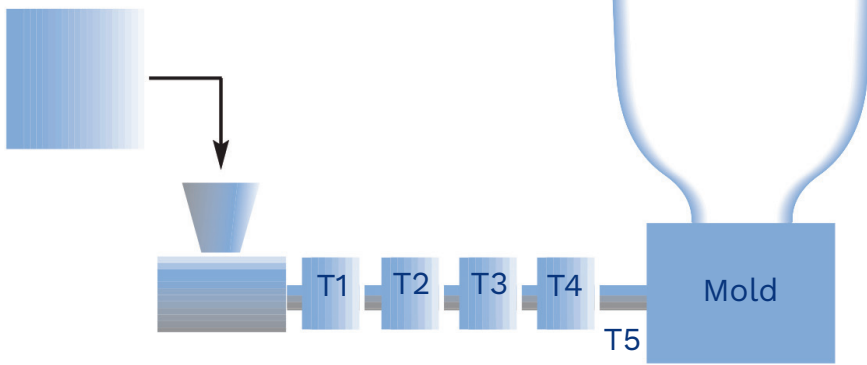
→ RS grades can also be extruded into profiles (RS 6010 NAT / RS 6030 NAT...).

# PROCESSING

## Film extrusion

### BLOWN FILM

Drying system (recommended)

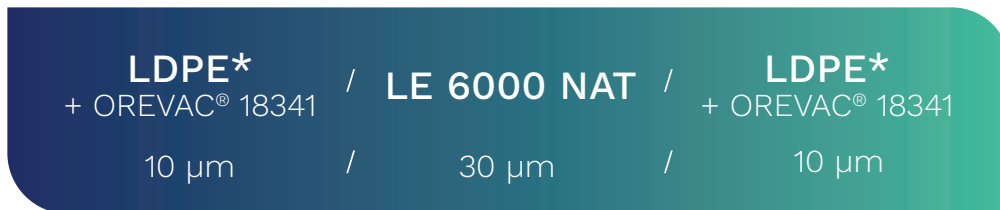


T °C	RS 60 ES NAT	LE 6000 NAT & LE 6000 ST NAT
T1	245	235
T2	250	235
T3	250	240
T4	250	250
T5	255	250
Die	270	255
Melt temperature	250	250
Blow-up ratio	20-60	60-80

### THREE-LAYER FILM

Orgalloy® Alloy and PE  
Extrusion conditions ( KIEFEL Line )

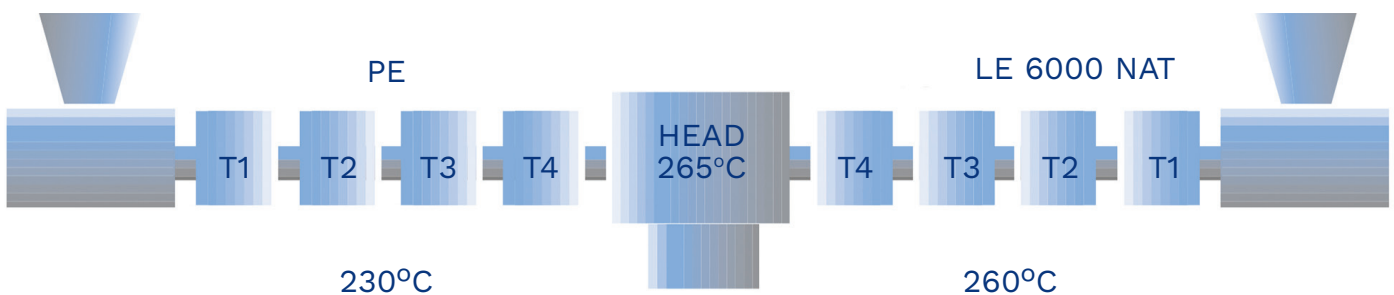
#### → FILM CONSTRUCTION



#### → EXTRUSION MACHINES

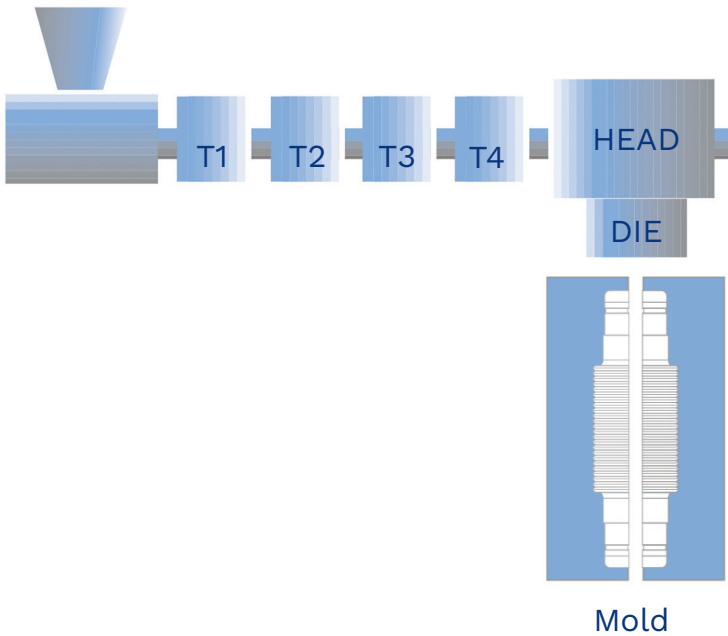
- ø 50 - L/D 29 for PE machines
- ø 60 - L/D 29 for ORGALLOY® machine
- die-gap: 1.2 mm
- blow-up ratio: 2.1

### TEMPERATURE PROFILE



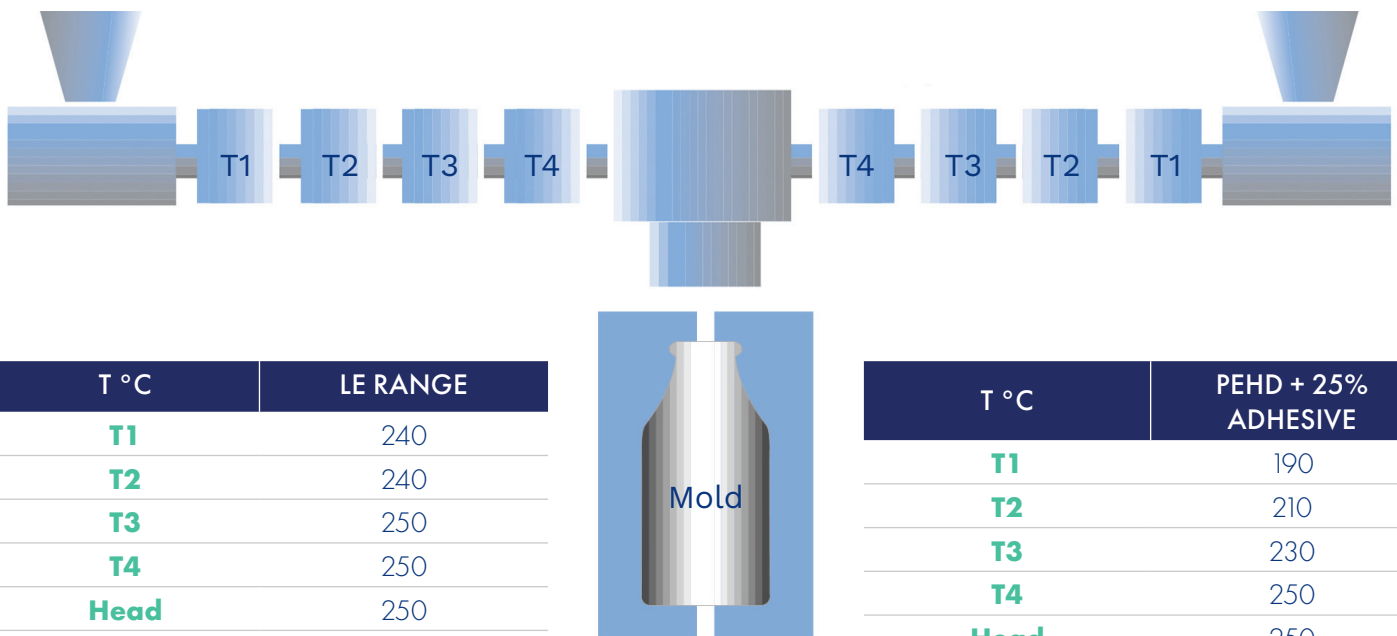
# PROCESSING

## Extrusion blow molding MONOLAYER STRUCTURE



T °C	LT 4060 ES BLACK T6L LE60 THM NAT
T1	230
T2	240
T3	250
T4	250
Head	250
Die	250
Mold	0 - 40
Melt temperature	250

## MULTILAYER STRUCTURE



T °C	LE RANGE
T1	240
T2	240
T3	250
T4	250
Head	250
Die	250
Mold	0 - 30
Melt temperature	250

T °C	PEHD + 25% ADHESIVE
T1	190
T2	210
T3	230
T4	250
Head	250
Die	250
Mold	0 - 20
Melt temperature	250
Mold	30

# APPLICATIONS

ENGINEERING  
COMPONENTS



Automotive

FILM AND  
PACKAGING



Packaging

HOLLOW  
VESSELS

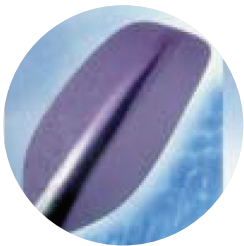


Hollow vessels

TUBES AND  
PROFILES



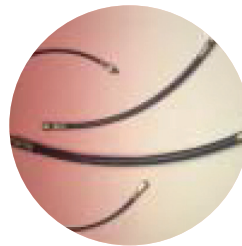
Tubes



Sport



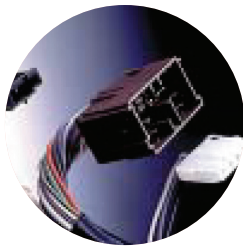
Technical film



Mandrels



Engine Air Intake



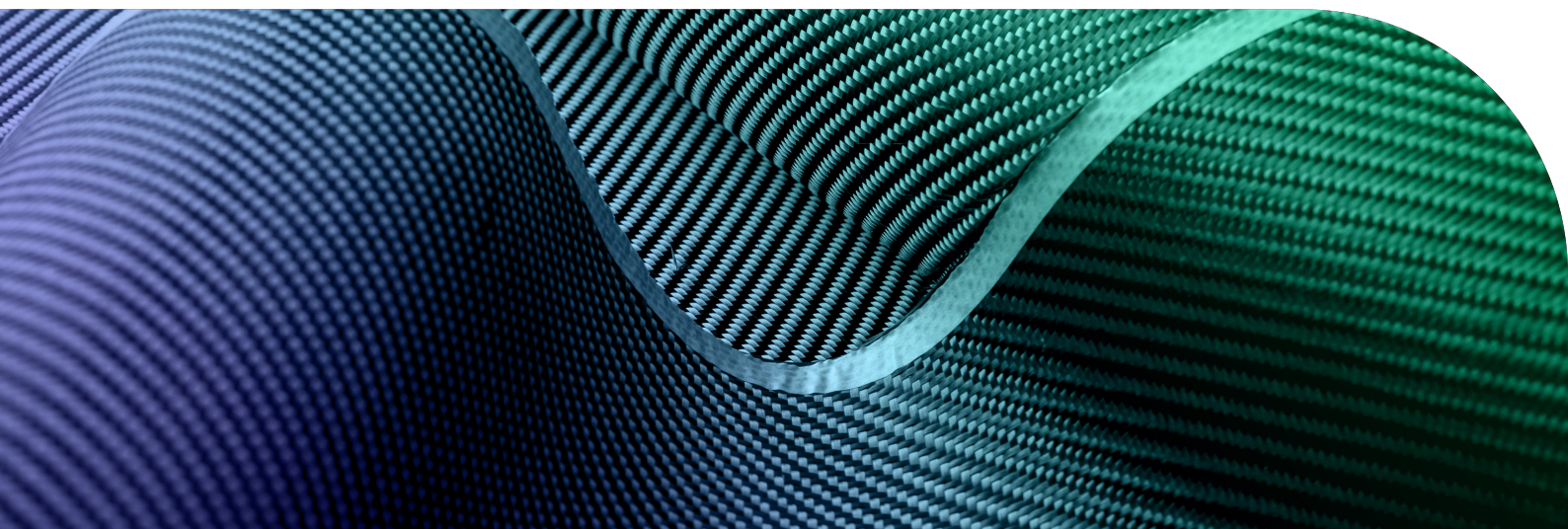
Connectors



Agriculture

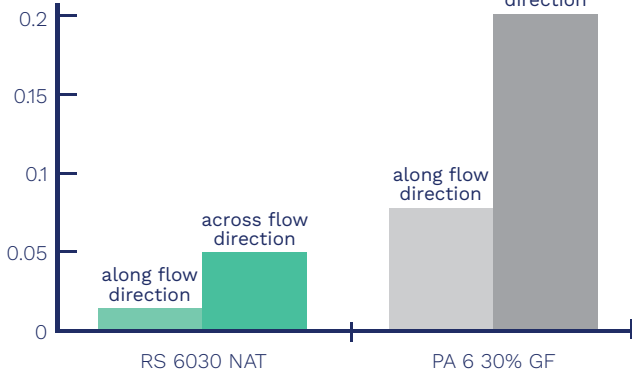


Cables

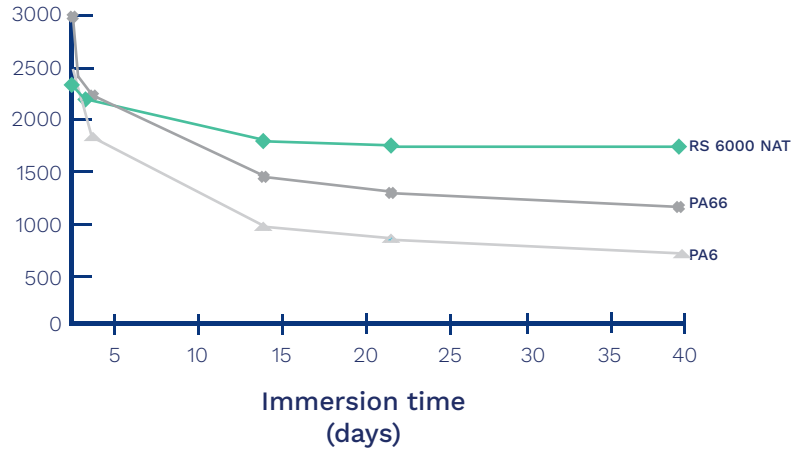


# KEY BENEFITS + DATA

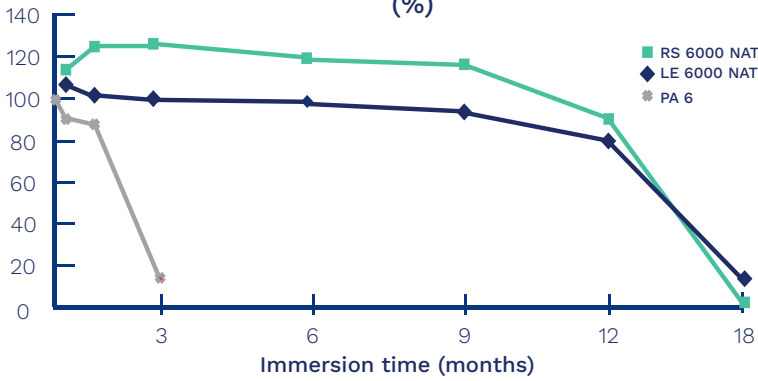
Dimensional variation – after 2months @ 23°C/50% RH (%)



Flexural modulus – immersion in water at 23°C (MPa)



Variation of elongation at break in H<sub>2</sub>SO<sub>4</sub> 3% - 23°C (%)



## OUTSTANDING CHEMICAL RESISTANCE

- ➔ No known solvents
- ➔ Resistance to hydrolysis
- ➔ Resistance to metallic salts



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