



# Elan-tron<sup>®</sup>

Epoxy resins  
for electrotechnical applications



# Elan-tron®

## Environmental, Climatic and Fire resistance characteristics of Cast Resin Transformers.

The regulation identifies the classes with an alpha-numeric code. In detail the Environmental as E 0, E 1, E 2, E 3; the Climatic as C 1 or C 2, and the Fire Resistance with F 0 or F 1, where this is sometime comparable with alternative testing carried-out by UL laboratories.

Our Customers, with **Elan-tron®** resins, have passed the homologation E 3, C 2, F 1 which means: E 3 - a transformer, placed into a climatic chamber with control of humidity and temperature to guarantee a condensation, is tested with several electric modes: no flash over shall occur and no tracking shall be observed by visual inspection; C 2 - operating temperature, transport and storage down to -25°C; F 1 - the transformer, subjected to fire risk, in the burning test has self-extinguishing capability within a stated time.

A Cast Resin Transformer must be identified with all of the three classes.



Properties	Standards	Definitions
Viscosity	ISO 3219	The viscosity of a fluid is a measure of its resistance to flow under a shear stress.
Gelation time		The period of time for a thermosetting system to pass from a liquid to a non-flowing gel.
Glass transition	ASTM D 3418	Approximate midpoint of the temperature range over which a material undergoes a phase change from a hard, glass-like state to a rubbery state or vice versa.
Thermal class	IEC 60085	Designation of an Electrical Insulating Material (EIM) or Electrical Insulation System (EIS) equal to the numerical value of the maximum operative temperature in degree Celsius for which the EIM/EIS is appropriate.
Dielectric constant	ASTM D 150	The real part of the relative complex permittivity. It is also the ratio of the equivalent parallel capacitance, $C_p$ , of a given configuration of electrodes with a material as a dielectric to the capacitance, $C_v$ , of the same configuration of electrodes with vacuum (or air for most practical purposes) as the dielectric.
Loss tangent	ASTM D 150	The ratio of the loss index ( $k''$ ) to the relative permittivity ( $k'$ ) which is equal to the tangent of its loss angle ( $\delta$ ) or the cotangent of its phase angle ( $\phi$ ).
Volume resistivity	ASTM D 257	The volume resistance multiplied by that ratio of specimen volume dimensions (cross-sectional area of the specimen between the electrodes divided by the distance between electrodes) which transforms the measured resistance to that resistance obtained if the electrodes had formed the opposite sides of a unit cube.
Dielectric strength	ASTM D 149	The voltage gradient at which dielectric failure of the insulating material occurs under specific conditions of test.
Flexural strength	DIN 53452	The maximum stress at the outer fibers at the moment of break.
Strain at break %	DIN 53452	The strain at the outer fibers at the moment of break, expressed in %.
Flexural elastic modulus	DIN 53457	The ratio, within the elastic limit, of stress to corresponding strain expressed in megapascals (MPa).
Tensile strength	DIN 53455	The maximum load in meganewtons divided by the minimum cross-sectional area of the specimen in square metres.
Elongation at break %	DIN 53455	The ratio, multiplied by 100, between the extension of the specimen at the moment of break and the original gauge length.
Fire protection class	IEC 60076-11 UL 94	F0= low fire risk level, particular flammability precautions not required; F1= medium/high fire risk: the flammability level must be reduced, fire must be extinguished within a specific time interval; C2= transformer suitable to work, transportable and storable at ambient temperature down to -25 °C; E3= high condensation, intense pollution or both the conditions mixed together; UL 94 HB= horizontal burning flammability test.





## Epoxy resins for electrotechnical applications

ELANTAS Europa offers a complete range of products that can be used in electrical engineering for the production of medium voltage indoor and outdoor components, with the possibility to produce self-extinguishing castings where a high fire protection (F1) is required, as in the case of installations in closed spaces. The developed systems are suitable for power and measurement transformers, insulators, bushings, plugs, etc. by means of the production techniques normally used such as: vacuum casting, manual casting, and injection and gelation under pressure (APG).

## Unfilled systems

They are characterized by high electrical and mechanical properties, controlled viscosity and reactivity to allow the dispersion of high amount of fillers, maintaining high processability. Pigments are available on request.

The most representative physico-chemical characteristics of the main products are reported in tables 1,2. More information is available on the technical data sheet of the specific system. At ELANTAS Europa "Tailor Made" materials are also available, developed to meet specific application needs.

Properties at 25 °C	EC 011 WH 011	EC 013 WH 013	EC 015 HT WH 035 HT	EC 021 WH 021 WH 021.1* WH 025*	EC 58 WH 058 W 45	EC 58 WH 850 W 45	EC 200 WH 020 W 45 <sup>§</sup>	EC 248 WH 058 W 45	EC 248 WH 850 W 45	ECM 320 W45 Y 90 <sup>§</sup>	EC 442 WH 142 W 45	EC 448 WH 058 W 45
<b>Viscosity: Resin (mPas) Hardener (mPas)</b>	1.300-1.700 380-500	1.100-1.400 350-450	10.000-14.000 500-700	1.000-1.500 310-380	4.800-5.700 100-400	4.800-5.700 30-100	2.500-3.700 350-650	3.000-5.000 100-400	3.000-5.000 30-100	350-450 ---	700-1.200 70-90	2.300-3.000 100-400
<b>Mixing ratio (% by weight)</b>	100:110	100:80	100:90	100:100	100:105:0,9	100:85:0,9	100:82:1	100:100:0,9	100:80:0,9	100:0,5:5 <sup>§</sup>	100:90:0,7	100:95:0,9
<b>Initial mixture viscosity (mPas)</b>	750-900	900-1.100	3.500-5.000	700-1.000	350-500	500-700	1.200-1.600	400-600	400-600	300-500 300-500 <sup>§</sup>	200-300	500-700
<b>Suggested filler amount (% wt.)</b>	315	250-350	285	340 - 390	340-370	345	305	340-370	335	180-200	370	330-380
<b>Gelation time (minutes)</b>	65-74 (110 °C)	45-55 (100 °C)	50-62 (100 °C)	50-60 (110 °C) 38-48*(110 °C)	50-60 (90 °C)	40-55 (90 °C)	33-42 (90 °C)	50-60 (90 °C)	40-52 (90 °C)	22-27 (100 °C) 19-23 <sup>§</sup> (100 °C)	30-40 (100 °C)	50-60 (90 °C)
<b>Glass transition (°C)</b>	65-70	36-38	110-120	56-62	105-110	129-135	94-100	90-95	120-125	140-150 125-130 <sup>§</sup>	115-120	75-80
<b>Thermal class</b>	155 °C	130 °C	200 °C	155 °C	180 °C	180 °C	RTI 200 °C **	180 °C	180 °C	180 °C	155 °C	155 °C
<b>Dielectric constant</b>	3,1-3,3	3,4-3,6	2,9-3,2	3,2-3,6	2,9-3,2	2,9-3,2	3,0-3,3	2,9-3,2	2,8-3,1	2,8-3,1 2,8-3,1 <sup>§</sup>	3,0-3,2	3,0-3,3
<b>Loss tangent x 10<sup>-3</sup></b>	3-5	12-15	2-3	4-6	3-5	3-4	3-4	4-5	3-4	5-6 5-6 <sup>§</sup>	5-7	4-5
<b>Volume resistivity (ohm-cm)</b>	1-3 x 10 <sup>16</sup>	1-4 x 10 <sup>15</sup>	>1 x 10 <sup>17</sup>	1-3 x 10 <sup>16</sup>	2-4 x 10 <sup>16</sup>	>1 x 10 <sup>17</sup>	2-4 x 10 <sup>16</sup>	>1 x 10 <sup>17</sup>	6-8 x 10 <sup>16</sup>	3-5 x 10 <sup>16</sup> 2-3 x 10 <sup>16</sup> <sup>§</sup>	>1 x 10 <sup>17</sup>	4-5 x 10 <sup>16</sup>
<b>Dielectric strength (kV/mm)</b>	17-19	18-21	23-26	21-23	22-24	22-24	25-28	20-23	28-32	23-26 23-25 <sup>§</sup>	20-22	19-21
<b>Flexural strength (MN/m<sup>2</sup>)</b>	100-110	35-40	120-140	85-95	125-140	115 - 125	120-135	115-130	130-140	105-120 110-130 <sup>§</sup>	130-140	105-115
<b>Strain at break (%)</b>	12,0-13,0	>20	6,0-9,0	>15	5,5-7,0	4-5	8,0-10,5	5,5-7,5	5,0-8,5	3,5-5,0 4,5-6,5 <sup>§</sup>	5,0-7,0	8,0-11,0
<b>Flexural elastic modulus (MN/m<sup>2</sup>)</b>	2.500-2.700	1.300-1.400	3.000-3.300	2.350-2.600	3.000-3.200	3.000-3.300	3.200-3.600	2.700-3.300	2.700-3.300	2.800-3.200 2.600-3.200 <sup>§</sup>	3.000-3.300	2.700-3.000
<b>Tensile strength (MN/m<sup>2</sup>)</b>	65-70	24-28	70-80	53-58	65-75	65-75	70-80	60-70	70-80	65-75 60-75 <sup>§</sup>	50-60	65-70
<b>Elongation at break (%)</b>	6,0-7,0	70-80	4,0-6,0	8,0-10,0	5,5-7,0	4-6	3,5-5,5	3,5-5,5	5,5-8,5	4,0-6,0 4,5-6,5 <sup>§</sup>	3,0-4,0	5,0-6,0
<b>Applications</b>	Indoor transformers.	Indoor transformers, neon transformers.	Indoor transformers, switch-disconnectors, bushing plugs, motors.	Indoor transformers.	Indoor transformers, bushing plugs, motors.	Indoor transformers, switch-disconnectors, bushing plugs, motors.	Indoor HV/MV insulators, switch-disconnectors, bushing plugs, motors.	Indoor transformers, switch-disconnectors, bushing plugs, motors.	Indoor transformers, switch-disconnectors, bushing plugs, motors.	Indoor HV/MV insulators, switch-disconnectors, bushing plugs, motors.	Outdoor Transformers, switch-disconnectors, bushing plugs, motors.	Indoor transformers, switch-disconnectors, bushing plugs, motors.

\*WH 021.1 = same as WH 021 but more filler amount allowed;

\*\*WH 025 = accelerated version of WH 021;

§ Y90 = reactive plasticizer.





## Prefilled systems

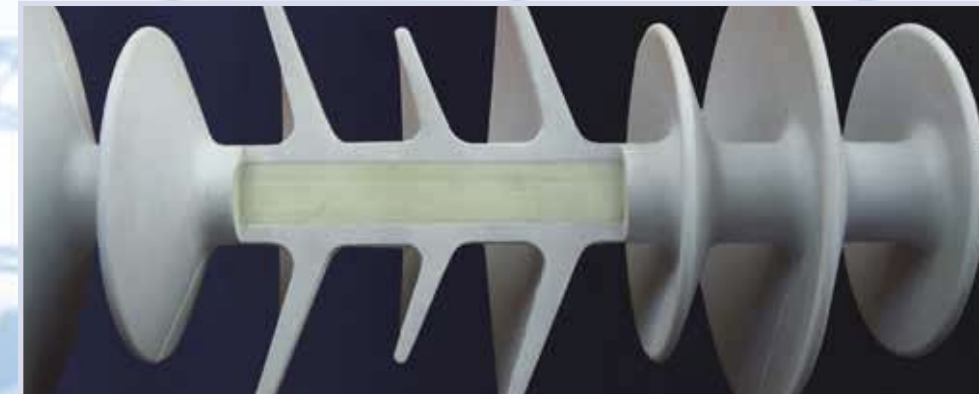
Besides the same good electrical and mechanical properties of the unfilled ones, they assure high steady quality on finished materials due to accurate controls carried out in the selection and pretreatment of mineral fillers and on dispersion steps. They allow an easy use with meaningful saving on pretreatment times and high workability due to the optimization of the system rheology.

Properties at 25 °C	MC 103 WH 113*	MC 111 WH 111	MC 115 HT WH 115 HT	MC 126.1 WH 126.1	MC 211 WH 211 WH 211 L*	MC 116 HT WH 116 HT	MC 226 WH 137	MC 448 WH 448
<b>Viscosity:</b> Resin (mPas) Hardener (mPas)	8.000-16.000 50-70	60.000-100.000 19.000-27.000	120.000-180.000 25.000-50.000	45.000-75.000 40.000-60.000	200.000-300.000 20.000-35.000	100.000-160.000 40.000-70.000	25.000-35.000	80.000 -160.000 50.000 - 80.000
<b>Mixing ratio</b> (% by weight)	100:77	100:100	100:100	100:100	100:100	70:100	100:100	100:100
<b>Initial mixture viscosity (mPas)</b>	600-900	30.000-40.000	100.000-130.000	40.000-55.000	40.000-55.000	30.000-50.000	12.000-20.000	50.000-70.000
<b>Gelation time (minutes)</b>	16-19 (100 °C)	75-87 (110 °C)	65-80 (100 °C)	45-55 (110 °C)	60-70 (100 °C) 100-120 (100 °C)*	25-40 (125 °C)	40-50 (100 °C)	50-70 (100 °C)
<b>Glass transition (°C)</b>	115-120	65-70	105-110	67-73	50-56	125-135	95-105	75-80
<b>Thermal class</b>	155 °C	155 °C	200 °C	155 °C	155 °C	180 °C	180 °C	155 °C
<b>Dielectric constant</b>	2,8-3,2	3,6-3,8	3,5-3,9	3,5-3,9	4,2-4,5	4,2-4,5	3,5-4,0	3,7-4,1
<b>Loss tangent x 10<sup>-3</sup></b>	4-5	9-11	6-7	15-20	10-12	15-20	15-25	30-40
<b>Volume resistivity (ohm-cm)</b>	1-4 X 10 <sup>16</sup>	4-6 x 10 <sup>15</sup>	6-9 x 10 <sup>15</sup>	3-5 x 10 <sup>15</sup>	1-3 x 10 <sup>15</sup>	2-4 10 <sup>15</sup>	2,5-4-5 x10 <sup>15</sup>	2-4 x 10 <sup>15</sup>
<b>Dielectric strength (kV/mm)</b>	20-23	20-22	18-21	25-28	18-21	21-23	21-23	20-22
<b>Flexural strength (MN/m<sup>2</sup>)</b>	60-80	110-120	110-120	125-135	65-75	95-115	120-140	115-130
<b>Strain at break (%)</b>	2,0-2,6	1,2-1,8	1,0-1,4	1,2-1,6	0,7-1,1	0,8-1,4	1,0-2,0	1,3-1,8
<b>Flexural elastic modulus (MN/m<sup>2</sup>)</b>	3.100-3.300	12.000-13.000	11.000-12.000	11.500-12.500	8.000-9.000	9.500-11.000	10.000-11.000	9.800-10.800
<b>Tensile strength (MN/m<sup>2</sup>)</b>	40-48	70-75	65-75	70-80	45-52	70-80	75-85	65 - 75
<b>Elongation at break (%)</b>	2,0-2,7	1,6-2,1	1,8-2,2	2,0-2,4	1,2-1,5	3-4	2,0-3,0	1,8-2,5
<b>Fire protection class</b>	F0	F0	F0 (UL 94 HB)	F0	F1 (C2, E3)	F0	F0	F0
<b>Applications</b>	Composites, pultruded bars for insulators.	Indoor transformers, switch-disconnectors, bushing plugs, motors.	Indoor transformers, switch-disconnectors, bushing plugs, motors.	Outdoor transformers, auxiliary transformers.	Indoor transformers, complies with C2-E3-F1 classes for fire resistance.	Medium voltage indoor transformers, switch-disconnectors, complex parts with metallic inserts, electrical motors, transformers.	Outdoor transformers, insulators, switch-disconnectors. Also for indoor applications.	Indoor transformers, switch-disconnectors, bushing plugs, motors.

\*WH 113 is unfilled; \*WH 211 L slower version.

### Release agents

Product	Base	Colour	Dry time	Surface
<b>Z 15 LC</b>	Wax release agent	milky	1 min	Opaque, not polishable
<b>Z 25 LE</b>	Spray wax release agent	colourless	3-4 min	Greasy, not polishable
<b>Z 61</b>	Liquid release agent	colourless	2-3 min	Polishable, slightly oily
<b>Z 63</b>	Liquid release agent	colourless	45-60 min at 25°C 2-3 min at 60°C	Bright
<b>Lubrolene E 6</b>	Spray silicon release agent	colourless	105-110 min	Glossy, slightly greasy



# Elan-tron®

## Epoxy resins for electrotechnical applications

ELANTAS Europe with production sites in Italy and Germany is part of the division ELANTAS Electrical Insulation of the ALTANA group. As a leading manufacturer of insulating and protective materials for the electrical and electronics industry our portfolio includes wire enamels, impregnating resins and varnishes, casting and potting resins, electronic coatings, adhesives and flexible electrical insulation materials. In addition, we supply materials for other application areas such as special coatings, printed electronic products as well as tooling and composite materials.

### ELANTAS Europe s.r.l.

Strada Antolini, 1  
Fraz. Lemignano  
43044 Collecchio (PR) - Italy

Tel +39 0521 304777  
Fax +39 0521 804410

[castingpotting.elantas.europe@altana.com](mailto:castingpotting.elantas.europe@altana.com)  
[www.elantas.com/europe](http://www.elantas.com/europe)

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IMEFY Group  
TRAFO ELETTRO  
L.C.T. Milano (Gruppo Bonomi)  
Laboratorio Electrotecnico S.C.C.L.  
UGUR TURKYURT A.S.

### ELANTAS Europe GmbH

Großmannstr. 105  
20539 Hamburg - Germany

Tel + 49 40 789460  
Fax + 49 40 78946276



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