

Araldite® Giessharze / Isolatoren

Epoxidharz Giessharz gefüllt Härtend: erhöhte Temperatur

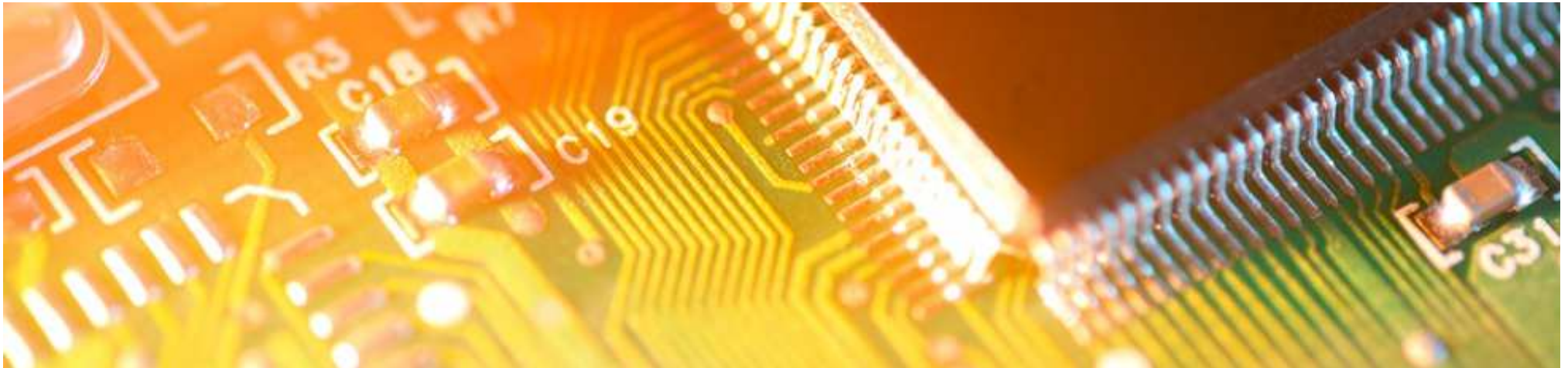
Zwei-Komponenten Epoxidharz härtend bei erhöhter Temperatur

Die Epoxidharze zur Isolatorenherstellung sind mineralisch sehr hoch gefüllt woraus eine hohe Viskosität (zähes Fließverhalten) resultiert. Bedingt durch diese Vorgabe werden die Giessharze vorzugsweise im Vakuum oder im Druckgeliervorgang verarbeitet. Als wesentlicher Vorteil gleicht das Druckgeliervorgang den chemischen Volumenschwund welcher bei der Härtung entsteht aus.

Einsatz-Kernbereich sind schwierige elektronische Anwendungen:

- Generatoren und Motoren
- Hochspannungs-Messwandler
- Isolatoren und Buchsen
- Trockene Verteilungstransformatoren
- Schaltanlagen

Die Verarbeitung erfolgt bei erhöhten Temperaturen um die entsprechenden Flieseigenschaften zu erzielen. Der hohe Füllstoffgehalt wird benötigt damit der Formstoff möglichst nahe an den Wärmeausdehnungskoeffizienten vom Metall herankommt.



Quelle: Technical data sheets of Huntsman Advanced Materials
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System	resin hardener flex accelerator filler	Araldite F HY 905 DY 040 DY 061 Silicia flour	CY 5980 HY 5980 DY 040 DY 061 Silicia flour	CY 5936 HY 5945 Silicia flour	CY 5948 HY 5945 Silicia flour	CW 229-3 HW 229-1 Silicia flour	CY 5995 HY 5996 Silicia flour	CY 5995 HY 925 Silicia flour	CY 5995 HY 227 Silicia flour	CY 228-1 HY 918 DY 062 Silicia flour	CY 228-1 HY 918 DY 045 DY 062 Silicia flour	CY 225 HY 925 Silicia flour	CY 225 HY 225 Silicia flour	CY 225 HY 227 Silicia flour
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Type of System		Bis-A EP/flex; tds dif. filler load	Bis-A EP/flex; class H	Bis-A/F EP flex low viscous	Bis-A/F EP flex low viscous	Bis-A EP/ prefilled	Bis-A EP/ toughened	Bis-A EP/ toughened	Bis-A EP/ toughened	Bis-A EP	Bis-A EP flex	Bis-A EP low viscous/flex long-term data tds	Bis-A EP low viscous/flex long-term data tds	Bis-A EP low viscous/flex
Color														
Density of casting	g/cm3			1.8-1.9	1.8-1.9	1.85	1.76	1.7-1.8	1.7-1.8	1.75-1.85	1.75-1.85	1.75-1.85	1.75-1.80	1.77-1.81
Filler content	resin %	66	66	66	66	resin 55-58 hardener 62-65	60	60	60	65	65	60	60	60
Mixing ratio	resin/hardener/accelerator/filler parts by weight	100/100/10/1/410	100/95/15/1/410	100/80/350	100/83/355	100/100	100/87/280	100/80/270	100/100/300	100/85/345/0.8	100/85/20/385/0.8	100/80/270	100/80/270	100/100/300
Viscosity	resin mPas/°C	9000-12000/25	600-7000/25	1500-2500/25	2000-3000/25	120000/25	45000-70000/25	45000-70000/25	45000-70000/25	5200-6200/25	5200-6200/25	8.5-15Pas/25	8.5-15Pas/25	8.5-15Pas/25
	hardener mPas/°C	150-250/25	150-250/25	250-600/25	250-600/25	12000/25	100-250/25	250-450/25	1500-4000/25	50-80/25	50-80/25	250-450 mPa*s	1500-2500/25	1500-4000/25
	mixture mPas/25°C	15000/60	15000/60	1000/60	1000/60	2000/60	3000/60	9000/60	9000/60	8000/60	8000/60	6000/60	10000/60	10000/60
	mPas/°C	1000/80	10000/80	700/80	800/80	1000/90	1000/90	3000/80	3000/80	2500/80	2500/80	2000/80	2000/80	2500/80
Pot life	min / °C / mPas					480/60/15000	420/60/15000	14h/60/15000	7h/60/15000	150/60/15000	150/60/15000	300/60/15000	180/60/15000	120/60/15000
Gel time	min/°C	100/80	100/80	800/80	800/80	300/80	110/80	16h/80	300/80	110/80	150/80	300/80	280/80	130/80
		15/120	12/120	100/120	100/120	18/120	18/120	40/120	35/120	12/120	18/120	12/120	15/120	18/120
			3/140	40/140	35/140	6/140	3/140	13/140	15/140	4/140	4/140	3/140	5/140	4/140

Minimum curing time	h/°C	6/80+10/130	4/80+6/140	10/140	10/140	0/80+10/140	5/80 + 10/140	12/130 + 8/140	12/130 + 8/140	4/80 + 8/140	4/80 + 8/140	12/130 or 8/140	6/80 + 10/130	6/80 + 10/130
Mould temperatur/demolding times	APG process °C/min Vacuum casting °C/h	80-100/6-12	60-100/4-8	130-140/10-30 80-100/4-8	130-140/10-30 80-100/4-8	130-160/10-40 70-100/4-8	130-150/12-40 70-100/4-8	130-160/12-40 70-100/4-8	130-160/12-40 70-100/4-8	120-160/10-45 80-100/1-6	120-160/10-45 80-100/1-6	130-160/10-40 70-100/5-8	130-160/10-40 70-100/5-8	130-160/10-40 70-100/5-8
Glass transition temperature (DSC)	°C	90-100	60-80	65-75	75-85	115	130-150	115-125	55-65	110-120	65-75	105-115	90-105	60-70
Martens deflection temperature	°C	80-90				100-110					70-75	110-115	90-100	
Thermal conductivity	25°C W/mK	0.8-0.9				0.7	0.75-0.8	0.75-0.8	0.75-0.8	0.95-1.05	0.95-1.05	0.8-0.9	0.8-0.9	0.8-0.9
Coefficient of linear thermal expansion	ppm/K	31-36@20-60°C	34-40@25-55°C	40-45	35-40	27-30@20-80°C 100@90-170°C	35-39@20-105°C	35-39@20-80°C	41-45@20-40°C	36-39@20-110°C	40@20-80°C	35-37@20-60°C	36-40@20-60°C	41-46@20-50°C
Thermal class		F (155°C)	H (180°C)	F (155°C)	F (155°C)	H (180°C)	F (155°C)			H (180°C)		H (180°C)		F (155°C)
Flammability	UL 94 grade	HB 4mm/V1 12mm				V-1 (12mm)	HB (4mm)	HB (4mm)	HB (4mm)	V1 (12mm)		V1 (12mm)	HB 4mm/V1 12mm	HB 4mm/V1 12mm
Flexural strenght	max bending stress 25°C MPa	25-135	130-140	130-140	140-150	120-130	115-125	125-135	130-140	125-135	130-140	110-125	120-130	135-145
	surface strain failure 25°C %	1.1-1.5	1.3-1.5	1.2-1.4	1.4-1.6	1.4-1.6	1.6-1.7	1.8-2	1.2-2.4	1.2-2.4	1.3-1.5	1.2-1.7	1.8-2.2	1.8-2.2
	Modulus of elasticity 25°C MPa	11600-12000	11500-12500	11500-12500	13000-14000	9600-10000	8400-8600	9100-9500	9400-9700	11000-12000	11500-12500	9700-10200	9700-10200	9700-10200
Tensile strenght	max bending stress 25°C MPa	75-85	75-85	75-85	80-85	80-90	70-80	65-75	80-90	80-90	80-85	70-80	75-85	70-80
	surface strain failure 25°C %	0.9-1.1	1.0-1.2	1.2-1.4	1.0-1.2	1.3-1.5	1.3-1.4	1.7-2.1	0.90-1.10	0.80-1.00	1.0-1.3	1.2-1.7	2.0-2.5	2.0-2.5
	Modulus of elasticity 25°C MPa	12000-13000	11500-12500	11500-12500	12000-13000	8500-9500	8600-9600	8500-9500	11000-12000	12000-13000	10000-11000	9600-10600	9400-10400	9400-10400
Compressive strenght max.	25°C MPa	140-150	170-190	160-170	170-180	170-190				160-180	145-165	140-150	120-130	
Double torsion test	Critical stress intensity factor (K _{1c}) Mpa*m ^{1/2} Specific energy at break (G _{1c}) J/m ²	2.7-2.9 570-620	2.9-3.1 700-800	3.1-3.3 820-870	3.0-3.2 650-700	2.8-3 670-750	2.0-2.1 420-500	2.4-2.6 575-625	3.4-3.6 1100-1200	2.3-2.5 620-670	2.65-2.85 300-350	1.8-2.0 300-350	2.3-2.7 550-650	2.8-3.2 850-950
Impact strength	kJ/m ²	10-12	8-12	10-13	11-13	9-11	11-13	14-16	8-12	10-15	7-10	11-13	11-13	
Water absorption	23°C days / % 100°C min / %	10 / 0.10-0.20 60 / 0.10-0.20	10 / 0.06-0.08 60 / 0.10-0.15	10 / 0.09-0.13 60 / 0.15-0.24	10 / 0.09-0.13 60 / 0.12-0.18	10 / 0.1-0.2 60 / 0.4	10 / 0.15-0.2 60 / 0.1-0.15	10 / 0.15 100 / 0.65-0.7	10 / 0.25 100 / 1.10-1.25	10 / 0.10-0.15 60 / 0.05-0.10	10 / 0.10-0.20 60 / 0.20-0.25	10 / 0.10-0.15 60 / 0.10-0.15	10 / 0.10-0.20 60 / 0.10-0.20	10 / 0.10-0.15 60 / 0.30-0.35
Chrackresistance shock test	°C/%	-10/75				-80/100	-10/25	-20/90	-80/90	-10/10	-40/93	-10/28	-10/73	-60/85

Dielectric strenght	IEC 60243-1 Rogowski electrodes IEC 243-1	kV/mm	18-22	20-30	23-25	23-25	20	19-24	19-23	19-24	20-24	20-24	18-20	18-20	18-20
Diffusion breakdown strenght	Temperature of specimen after test °C	class	HD 2	HD 2	HD 2	HD 2	HD 2	HD 2	HD 2	HD 1	HD 2	HD 2	HD 2	HD 2	HD 2
HV arc resistance	s		185-195	183-185	189-196	185-205	93-125	181-185	182-185	182-185	185-190	185-190	182-186	182-186	
HV Tracing and erosion resistance	Class kV														
Dielectric dissipation factor tan δ (50 Hz)	23°C % 60°C %		1.2 2.5	3 4	3 4	3 4	1.2 1.7	3 4	3.5 3.8	3 5	2 4	2 4	2 2.5	1 2	2 4
Relative permittivity ε _r (50 Hz)	23°C 60°C		4 4	4 4	4 4	4 4	4.3 4.3	4 4.5	4 4	4 4.5	4 4.5	4 4.5	4 4.5	4 4	4 4.5
Volume resistivity ρ	25°C 60°C	Ohm cm	5 x 10 ¹⁵ 3 x 10 ¹⁵	1 x 10 ¹⁵ 1 x 10 ¹⁴	1.8 x 10 ¹⁵ 6 x 10 ¹⁴	2 x 10 ¹⁵ 1 x 10 ¹⁵	1 x 10 ¹⁶ 5 x 10 ¹⁵	5 x 10 ¹⁵ 3 x 10 ¹⁵	5 x 10 ¹⁵ 1 x 10 ¹⁵	5 x 10 ¹⁵ 3 x 10 ¹⁵	5 x 10 ¹⁵ 5 x 10 ¹⁴	5 x 10 ¹⁵ 1 x 10 ¹⁵	5 x 10 ¹⁵ 1 x 10 ¹⁵	5 x 10 ¹⁵ 5 x 10 ¹⁴	5 x 10 ¹⁵ 5 x 10 ¹⁴
Tracking resistance CTI	A CTI		>600-0.0	>600M-0.0	>600M-0.0	>600M-0.0	>600-0.0	>600-0.0	>600-0.0	>600-0.1	>600-0.0	>600-0.0	>600-0.0	>600-0.0	>600-0.0
Electrolytic corrosion	grade		A-1	A-1	A-1	A-1	A-1	A-1	A-1	A-1	AN 1.2	A-1	A-1	A-1	

System	resin hardener flex accelerator filler	Araldite F HY 905 DY 040 DY 061 Silicia flour	CY 5980 HY 5980 DY 040 DY 061 Silicia flour	CY 5936 HY 5945 Silicia flour	CY 5948 HY 5945 Silicia flour	CW 229-3 HW 229-1	CY 5995 HY 5996 Silicia flour	CY 5995 HY 925 Silicia flour	CY 5995 HY 227 Silicia flour	CY 228-1 HY 918 DY 062 Silicia flour	CY 228-1 HY 918 DY 045 DY 062 Silicia flour	CY 225 HY 925 Silicia flour	CY 225 HY 225 Silicia flour	CY 225 HY 227 Silicia flour
Outdoor											•			
Indoor		•	•	•	•	•	•	•	•	•		•	•	•
Large volumen casting							•	•	•					
gas insulated switchgears								•				•		
switch components						•	•	•	•	•		•	•	•
apparatus components		•					•	•	•	•	•	•	•	•
bushings		•				•	•	•		•	•	•	•	•
insulators				•	•	•	•				•	•		
crack sensitive post insulators														
instument transformers						•		•	•		•		•	•
dry type distribution transformers		•	•	•	•	•		•	•	•				•
sensors														
encapsulation of large metal parts							•	•	•					
impregnation of high voltage coils and windings														

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System	resin hardener flex accelerator filler	CT 5900 HT 901	CT 5900 HT 903-1	CT 5900 HT 923	XB 5950 XB 5951	XB 5915 XB 5916	XB 5938 XB 5939	CY 184 HT 907	CY 184 HY 1235	CY 184 HY 1235	CY 184 HY 1235 DY 044 DY 062	CY 5622 HY 1235	XB 5918-3 XB 5919-3	XB 5957 XB 5958	
		Silicia flour	Silicia flour	Silicia flour				Silicia flour	Silicia flour	Silica W12 EST	Silica W12 EST	Silicia flour			
Type of System		Solid Bis-A EP large volume casting	Solid Bis-A EP large volume casting	Solid Bis-A EP large volume casting	Bis-A EP; alumina prefilled; toughened	Bis-A EP prefilled toughened	Bis-A EP prefilled	Cyclo-EP	Cyclo-EP	Cyclo-EP	Cyclo-EP flex	Cyclo-EP hydrophobic	Cyclo-EP prefilled toughened	Cyclo-EP prefilled hydrophobic	
Color															
Density of casting	g/cm3	1.65-1.75	1.65-1.75	1.65-1.75	2.0	1.65	1.9	1.6-1.7	1.6-1.7			1.85-1.95	1.8	1.85-1.95	
Filler content	resin %	61	60	60	60	58	66	61	60	66	66	66	61.5	66	
Mixing ratio	resin/hardener/co/filler parts by weight	100/30/200	100/40/210	100/40/210	100/100	70/100	100/100	100/90/2/3000	100/90/0.5/290	100/90/0.6/370	100/90/20/0.6/410	100/82/0.45/355	100/100	100/100	
Viscosity	resin mPas/°C	300-500/120	300-500/120	300-500/120		10-30Pa*s/40°C	6-16Pa*s/40°C	0,7-0,9Pa*s/25°C	0,7-0,9Pa*s/25°C	0,7-0,9Pa*s/25°C	0,7-0,9Pa*s/25°C	3000-5000/25	8-18 Pa*s	60-140 Pa*s	
	hardener mPas/°C					3-30Pa*s/40°C	6-35Pa*s/40°C	40-50mPa*s/40°C	70-80 mPa*s	70-80 mPa*s	70-80 mPa*s	70-80 mPa*s	2,5-5,5 Pa*s	60-100 Pa*s	
	mixture mPas/25°C	3000/110	3000/110	2600/110	3000/60	5000/60	600/60	2000/60	1000/60	1000/60	1000/60	7500/60		5000/60	
	mPas/°C	700/130	700/130	1000/130	1500/80	2000/80	200/80	1000/80	800/80	800/80	800/80	3500/80		2000/80	
Pot life	min / °C / mPas	357/120/15000	240/120/15000	70/120/15000	500/60/15000	420/60/15000	240/60/15000	100/80/15000	300/60/15000	300/60/15000	75/80/15000		300/60/15000	150/60/15000	
Gel time	min/°C	500/120	300/120	100/120	280/80	200/80	200/80	120/80	70/80	90/90	90/90	90/80	500/80	110/80	
		200/140	200/140	40/140	6/160	20/120	20/120	10/120	6/120	3/120	3/120	10/120	13/120	12/120	
						5/140	6/140	4/140	3/140	2/140	2/140	4/140	6/140	4/140	
Minimum curing time	h/°C	10-20/140	10-20/140	24/140	6/80 + 10/140	2/100+5/140+2/160	10/80+10/140	6/80+10/140	2/100+16/140	2/100+16/140	2/100+16/140	6/80+10/140	2/100+16/140	16/140	
Mould temperatur/demolding times	APG process °C/min	120-140/4-8	120-140/4-8	100-140/4-8	130-150/12-40	130-150/12-40	130-160/10-40	130-150-10-40	130-150/10-30	130-150/10-30	130-150/10-30	130-150/10-30	130-160/10-50	130-150/10-30	
	Vacuum casting °C/h				70-100/5-8	70-100/5-8	70-100/4-8	80-100/3-8	80-100/2-4	80-100/2-4	80-100/2-4	80-100/2-4	80-100/2-4	80-100/2-4	
Glass transition temperature (DSC)	°C	115-135	110-120	110-120	140-150	135-145	80-90	100-110	100-110	105-115	75-85	100-115	105-120	105-120	
Martens deflection temperature	°C			100-110		125-135		95-105	90-105	90-105	65-75				
Thermal conductivity	25°C W/mK	0.75-0.90		0.75-0.90	0.75-0.80	0.6-0.65	0.95-1.05	0.8-0.9	0.7-0.9	1.0-1.1	0.9-1.1	0.95-1.05	0.8-0.9	0.95-1.05	
Coefficient of linear thermal expansion	ppm/K	35-38@20-60°C	36-38@20-60°C	36-38@20-80°C	34-40@20-60°C	27-30@20-60°C	35-45@20-55°C	39-41@20-60°C	35-38@20-80°C	34-38@20-80°C	34-75@20-80°C	32-35@20-80°C	34-36@20-90°C	25-32@20-60°C	
Thermal class															
Flammability	UL 94 grade	HB 4mm/V1 12mm	HB 4mm/V1 12mm	HB 4mm/V1 12mm	HB 4mm/HB 12mm	HB (12mm)				HB 4mm/V1 12mm			V1 (12mm)	V0 (13mm)	
Flexural strenght	max bending stress 25°C MPa	135-145	140-155	145-155	110-120	110-120	130-140	150-165	120-130	150-160	150-160	130-150	155-165	130-150	
	surface strain failure 25°C %	1.6-1.7	1.2-1.5	1.8-2.0	1.5-1.8	1.5-1.6	1.4-1.6	1.9-2.2	1.1-1.5	1.25-1.75	1.5-2.0	1.35-1.65	2.0-2.2	1.1-1.5	
	Modulus of elasticity 25°C MPa	9900-10300	9700-10700	9600	7500-8300	8500-8800	10600-11500		12500-13000	11500-12000	11300-11800	9900-10400			
Tensile strenght	max bending stress 25°C MPa	85-95	85-95	85-95	70-80	70-80	70-80	90-100	85-95	90-100	80-90	80-105	80-95	80-100	
	surface strain failure 25°C %	1.1-1.4	1.2-1.5	1.4-1.6	1.3-1.8	1.1-1.3	1.3-1.5	1.7-1.9	1.2-1.6	0.8-1.1	1.1-1.4	1.20-1.60	1.8-2	1.0-1.4	
	Modulus of elasticity 25°C MPa	10000-11000	9700-10700	9400-9800	7800-8600	8400-9400	10200-10600	10000-11000	9900-10300	14000-15000	12000-13000	11300-11700	9600-10600	11200-11800	
Compressive strenght max.	25°C MPa		180-200	165-200				160-170							
Double torsion test															
Critical stress intensity factor (K _{1c})	Mpa*m ^{1/2}	2.1-2.4	2.2-2.4	2.3-2.5	1.9-2.1	2.6-2.8	2.6-2.8	2.2-2.5	2.15-2.35	2.4-2.8	2.8-3.2	2.40-2.60	2.6-2.9	2.4-2.6	
Specific energy at break (G _{1c})	J/m ²	420-470	460-510	530-580	440-480	720-780	580-640	510-540	470-500	410-590	540-720	490-530	610-660	420-470	
Impact strength	kJ/m ²	9-11	10-13	01. Okt			10-12	8-9	9-11	9.5-12.5	8.5-11.5		11-13		
Water absorption	23°C days / %	10 / 0.10-0.20	10 / 0.10-0.20	10 / 0.10-0.20	10 / 0.20-0.25		10 / 0.10-0.20	10 / 0.10-0.20	10 / 0.10-0.20	10 / 0.05-0.15	10 / 0.10-0.20			10 / 0.05-0.15	
	100°C min / %	60 / 0.05-0.10	60 / 0.05-0.10	60 / 0.10-0.20	60 / 0.05-0.10		60 / 0.12-0.22	60 / 0.15-0.20	60 / 0.08-0.15	60 / 0.05-0.08	60 / 0.15-0.25		60 / 0.05-0.15	60 / 0.05-0.15	
Chrackresistance shock test	°C/%				-32/50		-40/70						-60/30	-40/75	
Dielectric strenght	IEC 60243-1 Rogowski electrodes IEC 243-1	kV/mm	35-40/2	34-38/2	32-36/2	24	43-49/2	20-23	19-21	18-20	18-20		21-26	18-22	21-26
Diffusion breakdown strenght	class	HD 2	HD 2	HD 2	HD 2	HD 2	HD 2		HD 2	HD 2	HD 2	HD 2	HD 2	HD 2	HD 2
Temperature of specimen after test	°C	25-31	25-31	25-31	≤ 23	≤ 23	≤ 25	≤ 25	≤ 25	≤ 25	≤ 25	≤ 24	≤ 23	≤ 24	
HV arc resistance	s	183-194		184-193	180-185	90-135	186-198	185-190	189-193	189-193	189-193	184-186	185-190	182-186	
HV Tracing and erosion resistance	Class									1B 3.5	1B 3.5	1B3.5		1B3.5	
Dielectric dissipation factor tan δ (50 Hz)	23°C %	1.8		1	1	0,5	1	1.5	1	1	1	1	1	2	
	60°C %	3		1.5	1	1	2.1	3	1	1.8	2	2	2.5	2	
Relative permittivity ε _r (50 Hz)	23°C	4		4	4.6	4.1	4	4	4	4	4	4	4	4	
	60°C	4,5		4	4.7	4.1	4.1	4.3	4	4	4.3	4	4	4	
Volume resistivity ρ	25°C Ohm cm	5 x 10 ¹⁵		8 x 10 ¹⁵	5 x 10 ¹⁷	1 x 10 ¹⁶	5 x 10 ¹⁵	5 x 10 ¹⁵	5 x 10 ¹⁵	5 x 10 ¹⁵	5 x 10 ¹⁵	5 x 10 ¹⁵	8 x 10 ¹⁵	6 x 10 ¹⁵	
	60°C Ohm cm	1 x 10 ¹⁵		5 x 10 ¹⁵	8 x 10 ¹⁵	5 x 10 ¹⁵	1 x 10 ¹⁵	1 x 10 ¹⁵	1 x 10 ¹⁵	1 x 10 ¹⁵	1 x 10 ¹⁵	1 x 10 ¹⁵	2 x 10 ¹⁵	5 x 10 ¹⁵	
Tracking resistance CTI	A CTI	>600-0.0		>600-0.0	>600-0.0	>600-0.0	>600-0.0	>600-0.0	>600-0.0	>600-0.0	>600-0.0	>600-0.0	>600-0.0	>600-0.0	
Electrolytic corrosion	grade	A-1		A-1			A-1	A1	A1	A1	A1	A1	A-1		

System	resin hardener flex accelerator filler	CT 5900 HT 901	CT 5900 HT 903-1	CT 5900 HT 923	XB 5950 XB 5951	XB 5915 XB 5916	XB 5938 XB 5939	CY 184 HT 907	CY 184 HY 1235	CY 184 HY 1235	CY 184 HY 1235 DY 044 DY 062	CY 5622 HY 1235	XB 5918-3 XB 5919-3	XB 5957 XB 5958
		Silicia flour	Silicia flour	Silicia flour				DY 071 Silicia flour	DY 062 Silicia flour	DY 062 Silica W12 EST	DY 062 Silica W12 EST	DY 062 Silicia flour		
Outdoor								•	•	•	•	•	•	•
Indoor		•	•	•	•	•	•							
Large volumen casting		•	•	•	•	•								
gas insulated switchgears					•							•		
switch components			•	•										
apparatus components					•	•	•	•	•	•	•	•	•	•
bushings			•	•	•	•	•	•	•	•	•	•	•	•
insulators					•	•		•		•	•	•	•	•
crack sensitive post insulators							•							
instument transformers			•	•			•	•		•	•	•	•	•
dry type distribution transformers			•	•										
sensors												•		•
encapsulation of large metal parts			•											
impregnation of high voltage coils and windings			•											

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