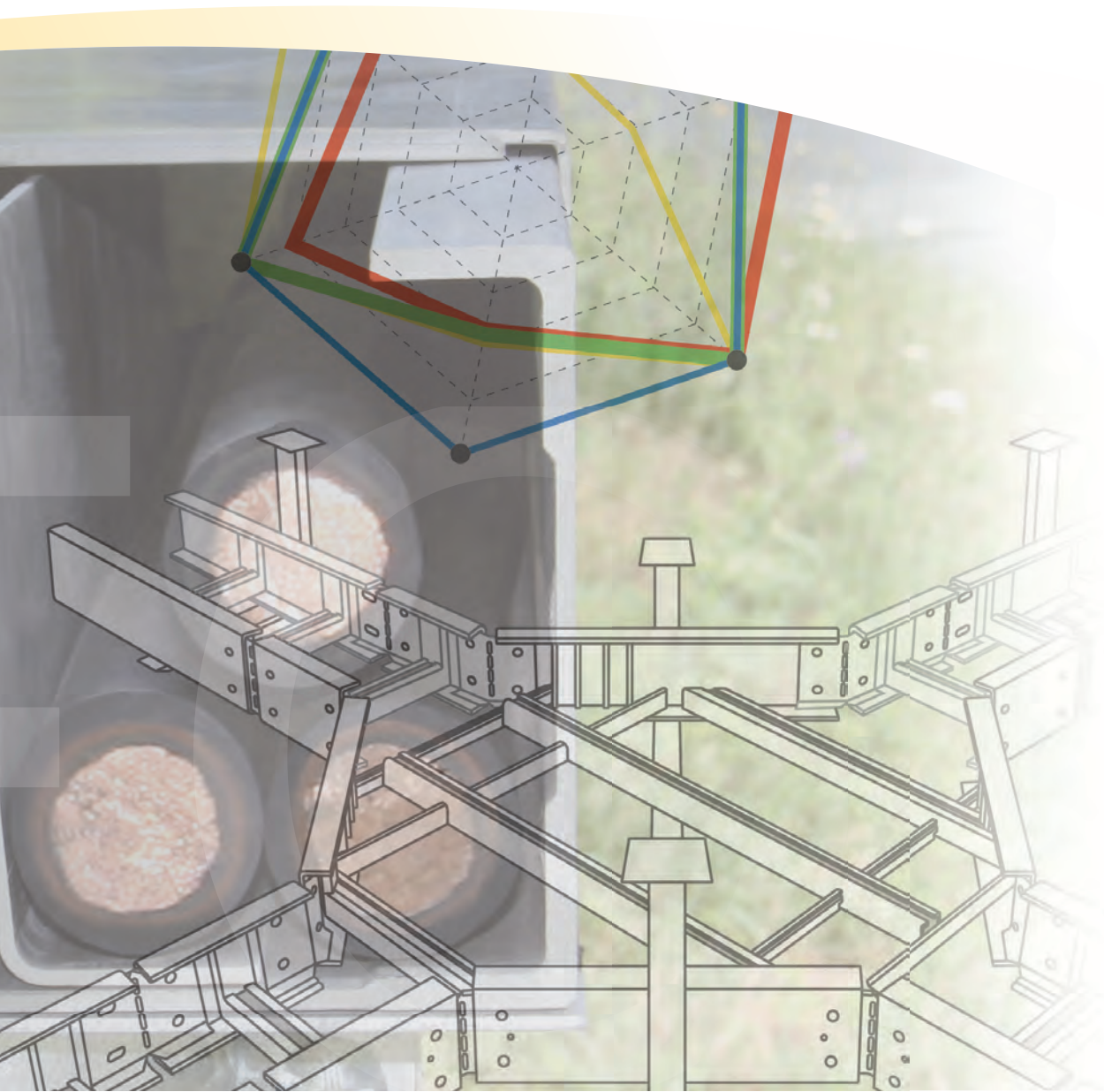




Information

- Thermoset resins
- Plastic
- Galvanizing process



On the following pages are gathered for you the most important information on GRP cable tray systems with EBO Systems brand.

For more information you can contact us by calling +33 3 82 44 01 07 or by sending an email to: info@ebo-systems.com

Thermoset resins

- Thermoset resins reinforced with glassfiber mats and glassfiber rovings allow to obtain products of a very high holding strength and mechanics. Thermoset plastics after processing can not be deformed under the effect of heat. The thermoset resins used by Ebo Systems have very high chemical and physical properties. The use of these polyester resins, charged with glassfibers, allow to obtain composite products, highly resistant to corrosion, electrically insulating with excellent mechanical characteristics, highly heat-resistant in comparison with other plastics (PVC , ABS). This material has a very high fire resistance, with self-extinguishing and flame retardant properties, without the addition of halogenated products by the use of mineral materials. It can be possibly used for specific applications and EBO Systems has the possibility to adapt these recipes based on other requirements (special colors, special antistatic properties, etc ...).

Ebo Systems exists for over 50 years and has developed its recipes to achieve these properties while maintaining high quality and innovative products.

The expertise of Ebo Systems is its ability to always find new recipes, develop new products which comply with the customer requirements at the fairest price.

- ### Polyester Resin

For the standard product range, a polyester resin is often used. This allows to reach the main requirements in force and with many adjuvants, up to 21 different, Ebo Sytems can meet some properties with a price / quality / level of service / very high report.

- ### Carbon loaded polyester resin

The carbon loaded polyester resin is used in explosive environments where it is necessary to prevent the accumulation of electrostatic charges by connecting the cable tray to the ground, when the humidity is below 50%.

- ### Acrylic resin

This acrylic resin is used in niche markets to meet the most stringent fire and smoke standards, particularly in the case of underground long tunnels where the requirement for non-flammable products is very high. This is the case of special tunnels as the Channel Tunnel where cable trays provided by Ebo Systems were made exclusively with an acrylic resin.

- ### Vinylester resin

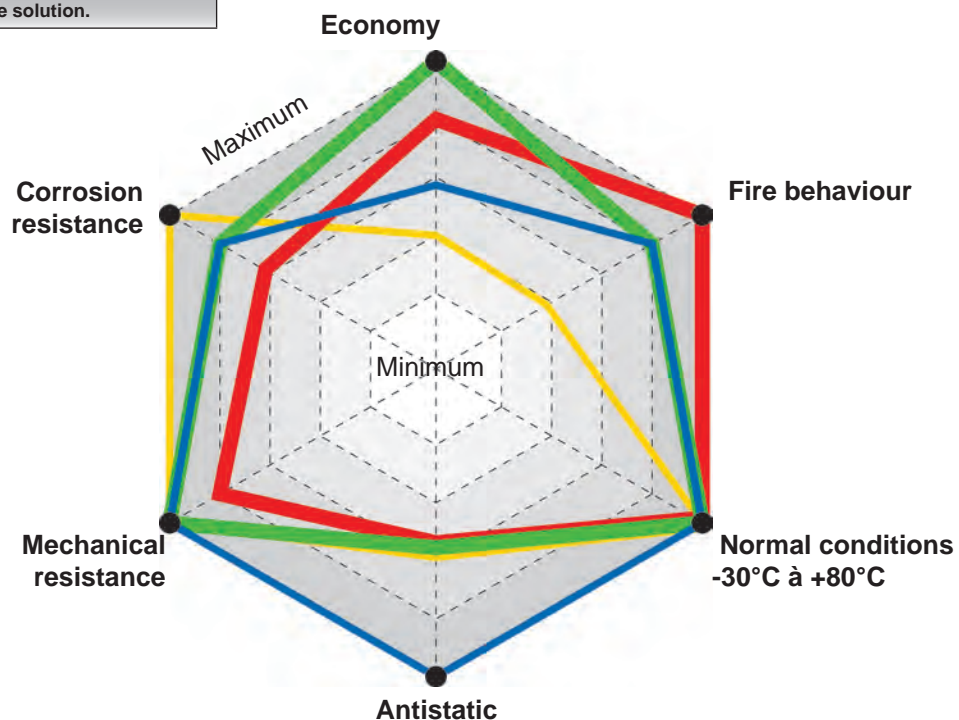
This resin is used in highly corrosive environments and in highly concentrated chemical environments.

Select your resins according to your technical specifications

Current corrosive atmosphere		
	Environmental features ex: side of the sea, plateforme de forage	Environmental features ex: tunnel
Environnement:	Strong atmospheric type corrosion (ex.: side of sea)	Risk of fire in enclosed and corrosive environment (ex.: long tunnels)
Avantages:	A very good holding in the time, a good behavior to fire, without risk, for an optimal cost	An excellent resistance to fire for a maximal security
Our recommendation:	Polyester resin Self-extinguishing polyester 0% halogen	Acrylic resin Self-extinguishing acrylic 0% halogen

Specific corrosive atmosphere		
	Environnemental features ex: mine gas groups I	Environnemental features ex: in the galvanizing environment
Environnement:	Highly exploding atmosphere (ex: mines, gas groups I)	Strong content of highly corrosive chemical agents (ex : H ₂ SO ₄ , HCl, ...)
Avantage:	The antistatic properties	A high resistance to the chemical corrosion
Our recommendation:	Carbon loaded polyester 0% halogen	Vinylester 0% halogen

The nearer the curve to the outside of the hexagone, the better the solution.



Plastic materials

Modification of plastic

To ensure the installation it is best to store the paths Ebo Systems cable before installing to temperatures higher than 0° C and less than 40° C. However, the cable tray may be stored at temperatures - 40° C to over 150° C

Symbol catalog	Abbreviation	Material name	Temperature zone, always	Mechanical properties	Application (Exemples)	Stress cracking
K01	PA	POLYAMIDE	-30°C to 80°C	compact, hard, very hard, very sharp, abrasive	Attaching cables, shims maintains fixing cables, mounting clip	low
K02	PS	POLYSTYRENE	-30°C to 60°C	deformable inner drive, compact, very hard	Attaching cables, mounting clamps, against fixing	intense
K03	PE	POLYETHYLENE	-40°C to 80°C	soft to hard, sharp, low behavior	Protective caps, against fixing	intense
K04	PP	POLYPROPYLENE	-40°C to 90°C	compact form, hard, full, slightly malleable	Bottom bracket, clamp, needle attachment	possible
K05	PC	POLYCARBONATE	-40°C to 120°C	high hardness, hardness and elongation, impact resistance	A fi xing clip	possible
K06	SBR/ NBR	STYRENE BUTADIENE RUBBER/ NITRILE BUTADIENE RUBBER	-30°C to 100°C	good abrasion resistance and weather	Toric seal	no
K07	CR	CHLOROPRENE RUBBER	-40°C to 120°C	good resistance to chemicals and aging	Toric seal	no
K08	NBR	NITRILE BUTADIENE RUBBER	-40°C to 120°C	flexible cold, high elasticity, low resistance to extreme conditions	Toric seal	no
K09	PVC	POLYVINYL CHLORIDE	-20°C to 65°C	compact holding hardness, shear sensitive	Plastic trunking	low
K10	SOFT-PVC	SOFT POLYVINYL CHLORIDE	0°C to 50°C	flexible, soft, good sliding properties	Protective cap	no
K11	ABS	ACRYLONITRILE BUTADIENE STYRENE	-30°C to 80°C	very hard even at low temperatures, scratch resistant hard	Mounting plate, to form part of the plastic ducts	low
K12	ASA	ACRYLONITRILE STYRENE ACRYLATE	-30°C to 85°C	shockproof cold holding equivalent to the ABS	Box reserves	low
K13	PC/ABS	POLYCARBONATE/ACRYLONITRILE BUTADIENE STYRENE	-30°C to 90°C	high impact and notched impact strength, good heat defl ection	NX-Office	low
K14	POM	POLYOXYMETHYLENE	-40°C to 100°C	high shear stability and shock, good heat resistance	A fi xing clip	poor
K15	SBR	STYRENE BUTADIENE RUBBER	-50°C to 100°C	hard, thick, compact, even at high temperatures, good elastic behavior	Toric seal	no
K16	CR/NBR	CHLOROPRENE RUBBER/ NITRILE BUTADIENE RUBBER	-20°C to 100°C	good wear resistance, good resistance to cold and hot temperatures	Toric seal	no
K17	CR/SBR	CHLOROPRENE RUBBER/STYRENE BUTADIENE RUBBER	-20°C to 70°C	good elasticity, impact resistance to improved weather	Toric seal	no
K18	TPE	THERMOPLASTIC ELASTOMER	-40°C to 120°C	good wear resistance, poor resistance to heat and cold	Toric seal	no
K19	FS 31	PHENOLIC RESIN	to 125°C	excellent resistance to weathering, ozone and aging	Versions proposées	low
K20	SI	SILICON RUBBER	-40°C to 180°C	good wear resistance, high hardness, good heat resistance	Toric seal	no
K21	PUR	POLYURETHANE	-25°C to 60°C	good resistance to scratching, to abrasion and torsion	Industrial pipes, glue seal	low
K22	PET	POLYETHYLENE TEREPHTHALATE	-40°C to 190°C	high hardness, low moisture absorption	proposed versions	low
K23	UP-GF	GLASSFIBER RE-INFORCED POLYESTER	-50°C to 80°C	good hardness, good wear resistance and temperature	Cable trays and ladders profile construction, hand rail	low

Resistance to chemicals

Symbol catalog	Water:	Acids (10 %):	Base (10 %):	Alcohol (Ethanol):	Benzine:	Benzol:	Mineral oil:	Vegetable and animal fat:	Chemical products
K01	+	o	+	+	o	+	o	+	o
K02	+	o	+	+	-	-	o	o	+
K03	+	+	+	+	o	-	o	+	-
K04	+	+	+	+	o	o	+	+	o
K05	+	o	-	+	-	-	+	+	o
K06	+	o	o	+	-	-	o	o	o
K07	+	-	-	+	o	+	o	o	o
K08	+	o	+	+	+	o	+	o	o
K09	+	+	+	+	+	-	+	+	-
K10	+	+	o	+	-	N.R.	-	o	-
K11	+	o	N.R.	+	-	-	+	-	-
K12	+	o	o	+	-	-	+	+	-
K13	+	+	+	o	o	-	+	o	-
K14	+	o	o	+	+	+	+	+	-
K15	+	+	+	+	-	-	-	-	o
K16	+	o	o	+	o	-	+	+	o
K17	+	o	o	N.R.	-	-	o	N.R.	N.R.
K18	+	+	+	N.R.	+	N.R.	+	N.R.	-
K19	+	o	o	+	+	o	+	N.R.	o
K20	+	o	o	+	o	-	+	+	o
K21	+	-	-	N.R.	+	N.R.	+	+	o
K22	+	+	o	+	+	o	+	N.R.	o
K23	+	+	+	+	+	o	+	+	+

+ = good performance o = medium performance - = low performance N.R. = no result

References: Table of contents, eg manual Plastic Author: Franck, Publisher: Vogel-Buchverlag

The data in the table are approximate values for product selection and are based on known results to date.

The qualities can negatively change depending on the geometry and external conditions.

Detailed data will be submitted with the offer price. To check the resistance of a product must achieve a specific test in the outdoor environment.

INFORMATION

Polyester resin 0% hologen

Properties	Standard references and Standard designations	Country of origin (Lab)	PRESS type resin R96 Tests Output	PULTRUSION type resin R6204 Tests Output	Units
Fire behavior					
Inflammability	ASTM D 6194 / IEC 60695-2-12 Glow wire test	USA / International (CREPIM, Bruay)	960	960	°C
Inflammability	UL 94 Test for flammability of plastic materials	USA (LNE)	V0	V0	-
Fire propagation	NF P 92-507 Fire behavior of building materials	France	not tested	not tested	-
Flame Spread & Smoke Developed Index	ASTM E84 / UL 723 Surface burning characteristics of building Uniforme Building Code class (SDI max = 450)	USA (Underwriters Lab.)	FSI = 25 SDI = 350 Class I	FSI = 35 SDI = 450 Class II	Index Index -
Spread of Flame	BS 476 Part 7 Surface spread of flame test for materials	England (Uni. Gent)	Class 2	Class 2	-
Fire propagation	BS 476 Part 6 Fire propagation test for materials	England (WFR)	18,3	14,1	Index
Flammability & Smoke Index	NF F 16-101 Fire behavior of materials for rolling stock	France (CREPIM, Bruay)	I2 F0	I2 F1	Index Index
Smoke Developed Index	BS 6853 App B52 Fire precautions in the design and construction of rolling stock	England (WFR)	Ao(on max) = 10,47 Ao(on end) = 9,89 Ao(off) = 11,23	Ao(on max) = 17,34 Ao(on end) = 14,79 Ao(off) = 18,75	Index Index Index
Limiting Oxygen Index	ASTM D 2863 / ISO 4589-2 Results of the fire resistance according to the oxygen index	USA / International (CREPIM, Bruay)	> 32%	> 32%	%
Fire protection Index	VKF Association of cantonal fire assurances	Switzerland (Swissi Basel)	5.3	5.3	Index
Fire Standard	DIN 4102 (Not operational as per 12: Fire resistance of materials and parts, class level)	Germany (FMPA, Stuttgart)	B2 Classe d'indice	B2 Classe d'indice	
Fire Standard	DIN 5510-2 Preventive Fire Protection in railway vehicles Part 2: Fire behaviour and fire side effects of materials and parts Appendix C: FED (30 min) < 1	Germany (RST, Henningsdorf)	S4/SR2/ST2 FED(30 min) =0,13	S4/SR2/ST2 FED(30 min) =0,03	Index Index

Mechanical behavior					
Tensile Strength at break point	ISO 527-5	International (Serma Technologies)	~ 55	~ 187	MPa
Modulus of Elasticity	ISO 527-5	International (Serma Technologies)	~ 7200	~ 11900	MPa
Accelerated Ageing Test exposure	ISO 4892-2 / ISO 527-5 Mechanical and UV resistance	International (Serma Technologies)	Good mechanical and chromatic behaviour	Good mechanical and chromatic behaviour	-
Accelerated Ageing Test by salt spray exposure	ISO 9227 / ISO 527-5 Mechanical and salt spray resistance	International (Serma Technologies)	Good mechanical and chromatic behaviour	Good mechanical and chromatic behaviour	-
Accelerated Ageing Test by UV and salt spray exposure	ISO 4892-2 / ISO 9227 / ISO 527-5 Mechanical, UV and salt spray resistance	International (Serma Technologies)	Good mechanical and chromatic behaviour	Good mechanical and chromatic behaviour	-

Properties	Standard references and Standard designations	Country of origin (Lab)	PRESS type resin R96 Tests Output	PULTRUSION type resin R6204 Tests Output	Units
Electrical behavior					
Surface Resistivity & Measure of the discharge from a charged surface	IEC 60079-0 : Suitable with gas groups	International (LCIE)	~ 4.10 ⁹ IIA, IIB, IIC	> 10 ¹¹ IIA, IIB, IIC	Ω -
Breakage Voltage	IEC 60243-1 :	International (IPH)	> 15	non-tester	kV/mm
Comparative tracking index	IEC 60112 :	International (LCIE)	575	600	V

Passenger ship					
Acceptance in passenger ship	ABS	(ABS)	approuvé K ²	approuvé KP - UL	

Others					
Density			1,8	1,8	g/cm ³
Thermal conductivity			0,3	0,3	W/m.K
Linear Thermal Dilatation	DIN 53752 - Détermination du coefficient de dilatation thermique	Germany	~ 36 x 10 ⁻⁶	~ 8 x 10 ⁻⁶	cm/cm/K
Water Absorption	ISO 62 Determination of water absorption	Germany	0,16	0,3	%

Press resin applies for the K2 (previously called KK) and BK range

Pultruded resin applies for the KP and UL ranges.

Conformity according EN 61537 / IEC 61537:

Impact test: K², KP, UL, ML series have successfully passed the shock test with an energy of 20 J (Degree of protection: IK10)

Flame propagation test: K², KP, UL, ML series are non-flame propagating.

CE marking: Our products comply with the directive BT/73/23/CEE according to the harmonized standard EN 61537 : 2001

Galvanized steel - the perfect material

Steel

the material with the many positive characteristics: non-flammable, high mechanical resilient, magnetized, shielding effect (Faraday), no static electricity, fire load-free, halogen-free, 100% fully recyclable.

This exceptionally good, constructive, technological, mechanical and physical properties contribute towards the high utility value and quality of the produced Niedax of cable laying systems.

The many benefits precludes a weak point: steel can rust.

With a well-conducted galvanizing However, this weakness is effectively and cost to overcome. Steel and zinc complement each other perfectly.



Good all-round protection

is due to the formation of protective, adherent coatings on the zinc. On the new products initially forms a zinc oxide film, which is converted to zinc hydroxide or zinc carbonate under the influence of humidity and carbon dioxide (zinc patina). These protective layers are formed, depending on the surrounding atmosphere, in a few days to several weeks.

Cathodic protection

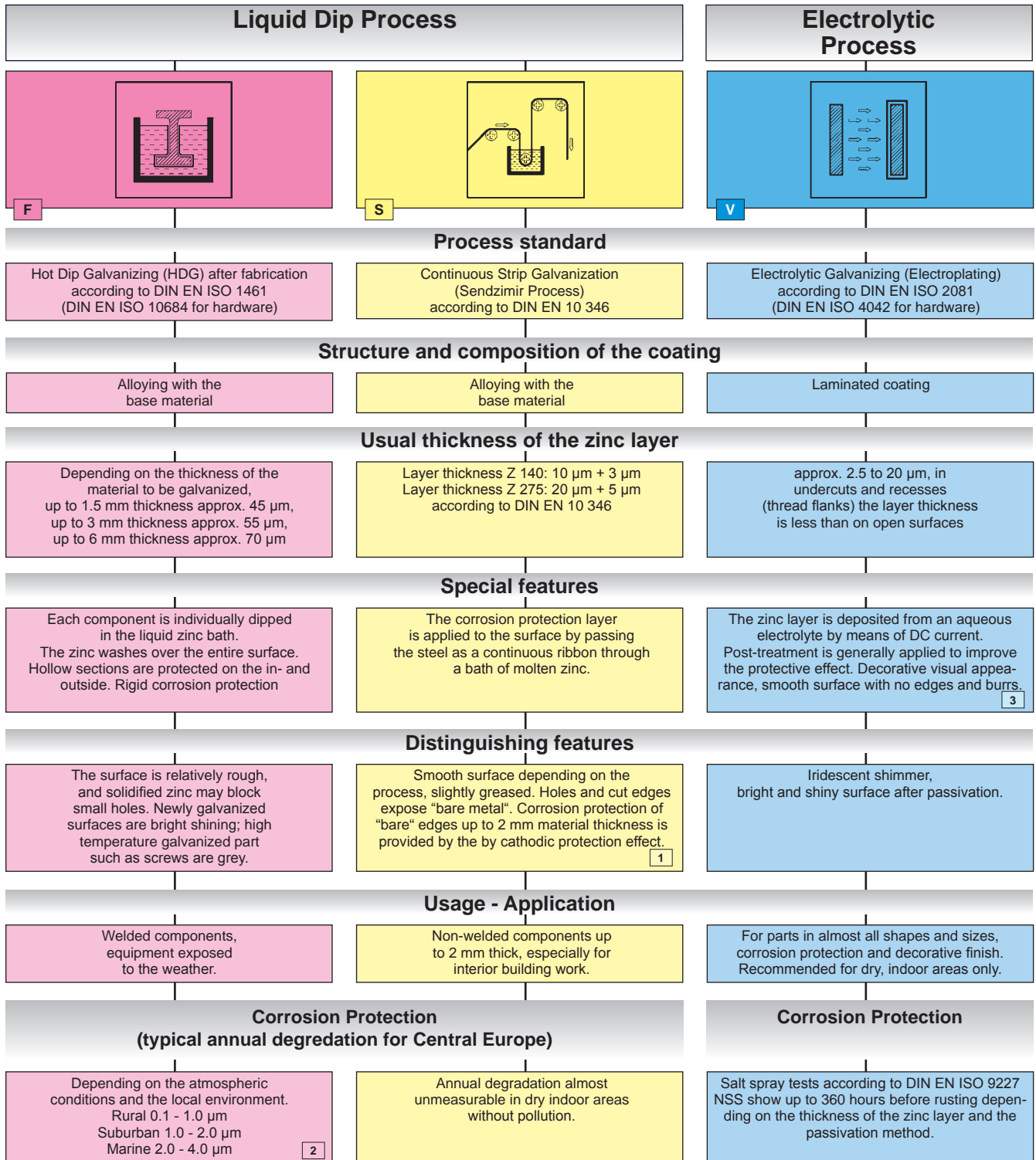
or surface protection mean refers to the ability of zinc to protect the cutting surfaces or other surface damage upon exposure to moisture to corrosion. This capability is based on the more negative of the zinc compared to zinc in the iron status of the „electrolytic voltage range“. A galvanizing can not rust for the same reason. The cut surface protection is effective up to a material thickness of 2 mm.

Adequate ventilation galvanized components is mandatory. Under unfavorable storage and transport conditions (humid conditions, little or no airflow) may form on freshly galvanized surfaces known as white rust (loose porous zinc hydroxide). White stains may also appear by a dry storage and an insufficient air access to all surfaces (possibly with stacking wood shims use). Outdoor storage under sheets or tarpaulins should be avoided.

Niedax cable laying systems made of steel are generally used only in a galvanized finish.*) This term corrosion protection saves valuable natural resources and is thus a significant contribution to environmental protection. As corrosion protection for the Niedax cable laying systems come, operational and manufacturing reasons, the galvanizing process described in more detail in the following summaries are used.

*) For exceptional, aggressive environmental conditions cable laying systems are made of stainless steel or fiberglass reinforced Plastic available.

Galvanizing Processes



1 Components over 2 mm in material thickness are hot dip galvanized at Niedax

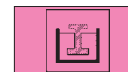
2 Local environmental conditions would be for instance the direct corrosive effect of a chimney with CO₂ flue gases.

3 Chromating process is ROHS compliant.

Galvanizing

Batch galvanizing F

(Hot-dip galvanisation) according to DIN EN ISO 1461 (DIN EN ISO 10684 for hardware)



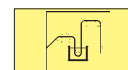
By immersion in liquid zinc (hot-dip process, ca. 450° C), the entire surface, including all corners and edges lapped. On the steel is an iron-zinc alloy layer forms with an overlying layer of pure zinc. The layer thickness depends on the material thickness and is according to DIN EN ISO 1461 to 1.5 mm material thickness 45 microns, up to 3 mm thick 55 microns and up to 60 mm material thickness 70 microns. Due to the very hard iron-zinc alloy layer can batch-galvanized components, without damaging the zinc surface, not deformed.

Application examples from the Niedax program:

All components with welded joints, for example, suspension struts, cable and pipe clamps as well as products with more than 3 mm thick, cable trays / ladders, wide span cable trays / ladders and many more, as far as increased demands on the corrosion resistance (weathering without rain shield).

Strip coating S

(Sendzimir Process) according to DIN EN 10346



The zinc coating is on both sides, applied by a zinc bath on broadband in the run. The project uses the modified Sendzimir. On the steel is an iron-zinc alloy layer forms with an overlying layer of pure zinc. The layer thickness of the Sendzimirbandes used for Niedax cable laying systems is under consideration of the test method according to DIN EN 10346 according to three surface sample depending on the product group 10 - 20 microns.

Strip galvanisation is used for components up to max. 2 mm material thickness, as up to this strength, a sufficient edge protection is achieved by „cathodic protection“. The process-related „bare iron“ interfaces of the components are in use in dry interiors, by the cathodic protection effect is not a disadvantage. Strip galvanized components can be formed without damaging the zinc surface.

Application examples from the Niedax program:

Cable trays / ladders, wide span cable trays / ladders, cable ladders, cable protection ducts, light boom, rails up to 2 mm thickness. In dry indoor areas without aggressive media, the strip galvanizing provides permanent corrosion protection.

Zinc coating V G

Selon DIN EN ISO 2081 (DIN EN ISO 4042 for hardware)

The zinc coating is applied in aqueous electrolytes by means of direct current. To improve the corrosion protection can be carried out by an aftertreatment thick layer passivation and blue passivation according to DIN 50961.

The zinc coating is 2.5 to 20 microns. Parts with undercuts, such as C-shaped armature rails, due to the process less heavily coated inside than outside (Faraday cage).



Application examples from the Niedax program:

Small parts (screws, washers up to max. 6 M), mounting rails and screws for distribution board, but with additional thick layer passivated.

Additional plastic coating **C1** Hot Dip Galvanizing components with a polyester epoxy resin coating

The products marked with C1 are hot-dip galvanized and polyester resin with an epoxy coating in a thickness of 60 - 80 microns provided. When using indoors this plastic coating ensures excellent corrosion protection as well as high mechanical resistance and is resistant to most chemicals.

The zinc coating is thus protected by the overlying coating from atmospheric and chemical influence. A removal of metallic zinc is avoided, so that the zinc coating remains intact for a long time under the coating in mint condition.

For special use in the outdoor area, we are pleased to offer other coatings

Coat with zinc dust paint



The zinc-rich paint shall be such that in the dry film more than 90% zinc is included. To avoid the formation of cracks in the coating, the coating is applied in several steps.

Application examples in connection with the Niedax program:

Improvements, particularly assembly-related injuries of the zinc surface by welds or the like.