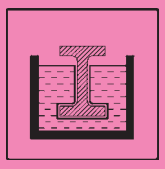
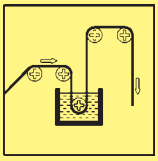
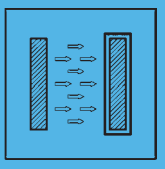
NIEDAX GROUP

Galvanizing Processes

Liquid Dip Process		Electrolytic Process
F 	S 	V G 
Process standard		
Hot Dip Galvanizing (HDG) after fabrication according to DIN EN ISO 1461 (DIN EN ISO 10684 for hardware)	Continuous Strip Galvanization (Sendzimir Process) according to DIN EN 10 346	Electrolytic Galvanizing (Electroplating) according to DIN EN ISO 2081 (DIN EN ISO 4042 for hardware)
Structure and composition of the coating		
Alloying with the base material	Alloying with the base material	Laminated coating
Usual thickness of the zinc layer		
Depending on the thickness of the material to be galvanized, up to 1.5 mm thickness approx. 45 µm, up to 3 mm thickness approx. 55 µm, up to 6 mm thickness approx. 70 µm	Layer thickness Z 140: 10 µm ± 3 µm Layer thickness Z 275: 20 µm ± 5 µm according to DIN EN 10 346	Approx. 2.5 to 20 µm, in undercuts and recesses (thread flanks) the layer thickness is less than on open surfaces
Special features		
Each component is individually dipped in the liquid zinc bath. The zinc washes over the entire surface. Hollow sections are protected on the in- and outside. Rigid corrosion protection	The corrosion protection layer is applied to the surface by passing the steel as a continuous ribbon through a bath of molten zinc.	The zinc layer is deposited from an aqueous electrolyte by means of DC current. Post-treatment is generally applied to improve the protective effect. Decorative visual appearance, smooth surface with no edges and burrs. 3
Distinguishing features		
The surface is relatively rough, and solidified zinc may block small holes. Newly galvanized surfaces are bright shining; high temperature galvanized part such as screws are grey.	Smooth surface depending on the process, slightly greased. Holes and cut edges expose “bare metal”. Corrosion protection of “bare” edges up to 2 mm material thickness is provided by the by cathodic protection effect. 1	Iridescent shimmer, bright and shiny surface after passivation.
Usage - Application		
Welded components, equipment exposed to the weather.	Non-welded components up to 2 mm thick, especially for interior building work.	For parts in almost all shapes and sizes, corrosion protection and decorative finish. Recommended for dry, indoor areas only.
Corrosion Protection (typical annual degredation for Central Europe)		**Corrosion Protection**
Depending on the atmospheric conditions and the local environment. Rural 0.1 - 1.0 µm Suburban 1.0 - 2.0 µm Marine 2.0 - 4.0 µm 2	Annual degradation almost unmeasurable in dry indoor areas without pollution.	Salt spray tests according to DIN EN ISO 9227 NSS show up to 360 hours before rusting depending on the thickness of the zinc layer and the passivation method.

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 CO_2 flue gases.

3 Chromating process is ROHS compliant.

Material and Finish

AVAILABLE STANDARDS

STEEL	
Type	ASTM A-1011 CS Type B (14 Gauge Plain Steel)
	ASTM A-1008 CS Type B (16 and 18 Gauge Plain Steel)
	ASTM A-510 Gr. 1008 (Plain Wire)
	ASTM A-653 G90 (Pre-Galvanized Steel)
Characteristics	Various Finishes (ASTM B-633, ASTM A-653, ASTM A-123), Good Electric Shielding, Low Thermal Expansion, Limited Deflection

STAINLESS STEEL	
Type	AISI Type 304 (1.4301) and AISI Type 316/316L (1.4571/1.4404)
Characteristics	High Corrosion Resistance, Wide Operable Temperature Range, Low Thermal Expansion, Limited Deflection

STEEL

Steel cable trays are fabricated from continuous roll-formed structural quality steel. By roll-forming steel, the mechanical proper-ties are increased allowing the use of a lighter gauge steel to carry the required load. This reduces the dead weight that must be carried by the supports and makes the system easier to inslall for the contractor. By using structural quality steel, Niedax assures that the material (steel) will meet the minimum yield and tensile strengths of appilicable ASTM standards. All cable tray side rails, rungs and splice plates are numbered for material identification purposes. The corrosion resistance of steel can vary widely, depending on types of coatings and alloy used.

STAINLESS STEEL

Stainless Steel cable trays are fabricated from continuous roll-formed AISI Type 304 and 316 stainless steel. They are nonma-gnetic and belong to the group called austenitic stainless steels. Like carbon steel, they exhibit increased strength when cold worked by roll-forming or bending. Several important factors make the use of stainless steel imperative. Considerations such as: long term maintenance costs, corrosion resistance, appearance and locations where product contamination is undesirable, are key factors in determining the necessity of Stainless Steel Material. Stainless Steel exhibits stable structural properlies such as yield strength and high creep strength at elevated temperatures. Niedax Stainless Stell cable trays are welded using stainless steel welding wire to ensure that each weld exhibits the same corrosion resistant characteristic as the base metal. A detailed study of the corrosive environment is recommended when considering a stainless steel design.

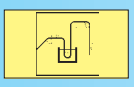
ZINC COATINGS

Zinc protects steel in two ways. First, it acts as a protective coating and secondly, as a sacrificial anode to repair bare areas such as cut edges, scratches, and gouges. The corrosion protection of zinc is directly related to its thickness and the environment. i.e, a .2 mil coating will last twice as long as a .1 mil coating in the same environment. Galvanizing also protects cut and drilled edges.

ELECTROGALVANIZED ZINC V G

Electrogalvanized Zinc (also known as zinc plated or electroplated) is the process by which a coating of zinc is deposited on the steel by electrolysis from a bath of zinc salts. This finish is standard for cable tray hardware and some accessories for pre-galvanized systems. When exposed to air and moisture, zinc forms a tough , adherent, protective film consisting of a mixture of zinc oxides, hydroxides, and carbonates. This film is in itself a barrier coating which slows subsequent corrosive attack on the zinc. This coating is usually only recommended for indoor use in relatively dry areas, as it provides limited protection (ninety-six hours of protection insalt spray testing per ASTM 8117).

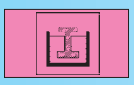
PRE-GALVANIZED ZINC S



(Mill galvanized, hot dip mill galvanized or continuous hot dip galvanized)

Pre-Galvanized steel is produced by coating coils of sheet steel with zinc. This process is accomplished by continuously rolling the material through molten zinc at the mills. This procedure is also used to produce mill galvanized and hot dip mill galvanized material. The coils are then slit to size and fabricated by roll forming, shearing, punching, or forming to produce Niedax pre-galvanized cable tray products. The G90 specification calls for a coating of .90 ounces of zinc per square foot of steel. This results in a coating of .45 ounces per square foot on each side of the sheet. This is important when comparing this finish to hol dip galvanized after fabrication. During fabrication, cut edges and welded areas are not normally zinc coated; however, the zinc located near the uncoated metal becomes a sacrificial anode to protect the bare areas within a short period of time.

HOT DIP GALVANIZED AFTER FABRICATION F



(Hot dip galvanized or batch hot dip galvanized)

Hot Dip Galvanized After Fabrication cable tray products are fabricated from steel and then completely immersed in a bath of malten zinc. A metallic bond occurs resulting in a zinc coating that completely coats every surface, including edges and welds. A key advantage of this method is coating thickness. Cable trays that are hot dip galvanized after fabrication have a minimum thickness of 1.50 ounces per square foot on each side, or a total of 3.0 ounces per square foot of steel, according to ASTM A123. The zinc thickness can be controlled by the amount of time each part is immersed in the molten zinc bath as weil as the speed at which it is removed.

The layer of zinc which bonds to the steel provides a dual protection against corrosion. It protects first as an overall barrier coating. If this coating happens to be scratched or gouged, zinc‘s secondary defense, galvanic action is called upon to protect the steel.

Hot dip galvanized after fabrication is recommended for prolonged outdoor exposure and will protect steel for many years in most outdoor environments as well as in many aggressive industrial environments.

Thermoset resins K23

Thermoset resins reinforced with glassfi ber mats and glassfi ber 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 glassfi bers, 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 fi re resistance, with self-extinguishing and fl ame retardant properties, without the addition of halogenated products by the use of mineral materials. It can be possibly used for specifi c 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 fi nd 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 fi re and smoke standards, particularly in the case of underground long tunnels where the requirement for non-fl ammable 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.

NIEDAX GROUP

Select your resins according to your technical specifications

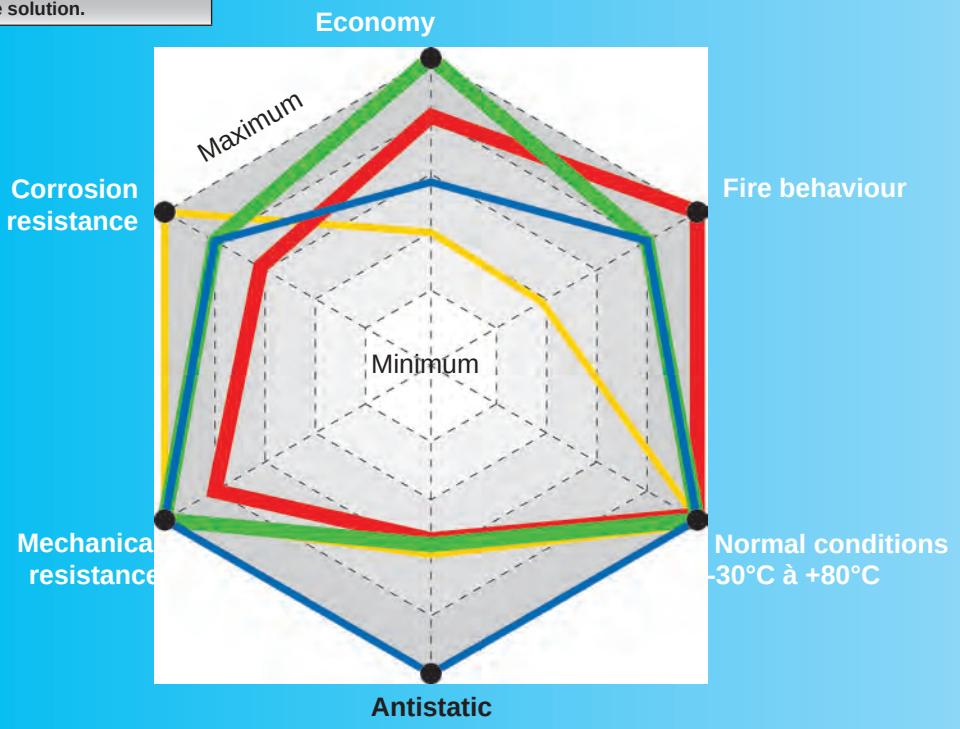
Current corrosive atmosphere

	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 avrylic 0% halogen

Specific corrosive atmosphere

	Environnemental features ex: mine gas groups I	Environnemental features ex: in the galvanazing environment
Environnement:	Highly exploding atmosphere (ex: mines, gas groups I)	Strong content of highly corrosive chemical agents (ex : H_2SO_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	Abbrevi-ation	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**	POLYVYNIL CHLORIDE	-20°C to 65°C	compact holding hardness, shear sensitive	Plastic trunking	low
K10	**SOFT-PVC**	SOFT POLYVYNIL 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 tempera-tures, 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**	POLYOXYME-THYLENE	-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 resi-stance 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 weathe-ring, 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 resi-stance and temperature	Cable trays and ladders, profile construction, hand rail	low

Resistance to chemicals

Symbol catalog	Water:	Acids (10 %):	Base (10 %):	Alcohl (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.	-	0	-
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 0 = medium performance - = low performance N.R. = no rusult

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.

Corrosion

All metal surfaces are affected by corrosion. Depending on the physical properties of the metal and the environment to which it is exposed, chemical or electromechanical corrosion may occur.

ATMOSPHERIC CORROSION

Atmospheric corrosion occurs when metal is exposed to airborne liquids, solids or gases. Some causes of atmospheric corrosion are moisture, salt, dirt and sulphuric acid. This form of corrosion is typically worse outdoors, especially near marine environments.

CHEMICAL CORROSION

Chemical corrosion takes place when metal comes in direct contact with a corrosive solution. Some factors which affect the severity of chemical corrosion include: chemical concentration level, duration of contact, frequency of washing, and operating temperature.

STORAGE CORROSION

Wet storage stain (White rust) is caused by the entrapment of moisture between the surfaces of closely packed and poorly ven-tilated materials for an extended period of time. Wet storage stain is usually superficial, having no affect on the properties of the metal.
Light staining normally disappears with weathering. Medium to heavy buildup should be removed, in order to allow the formation of the normal protective film.
Proper handling and storage will help to assure stain-free material. If product arrives wet, it should be unpacked and dried before storage. Dry material should be stored in a well ventilated “low moisture“ environment to avoid condensation. Outdoor storage is undesirable, and should be avoided whenever possible.

GALVANIC CORROSION

Galvanic corrosion occurs when two or more dissimilar metals are in contact while in the presence of an electrolyte (ie. moisture). An electrolytic cell is created and the metals form an anode or a cathode depending on their relative position on the Galvanic Series Table. The anodic material will be the one to corrode. Whether a material is anodic depends on the relative position of the other material. For example: If zinc and steel are in contact, the zinc acts as the anode and will corrode; the steel acts as the cathode, and will be protected. If steel and copper are in contact, the steel is now the anode and will corrode.

The rate at which galvanic corrosion occurs depends on several factors:

1. The amount and concentration of electrolyte present – Material stored in an indoor, dry environment will have little or no galva-nic corrosion compared to a wet atmosphere.
2. The relative size of the materials – A small amount of anodic material in contact with a large cathodic material will result in greater corrosion. Likewise, a large anode in contact with a small cathode will decrease the rate of corrosive attack.
3. The relative position on the Galvanic Series Table. The farther apart in the Galvanic Series Table, the greater the potential or corrosion of the anodic material.

It is very important to consider the effects of electrolytic corrosion when selecting the assembly hardware. Ideally the finish of cable tray and hardware should be identical. But if this is not possible the relatively small hardware should always be higher grade than the large volume tray, e.g. use stainless steel bolts for hot dip galvanized tray but not the other way round.