EAE
ELEKTROTEKNİK

STAINLESS STEEL ELECTRICAL ENCLOSURES

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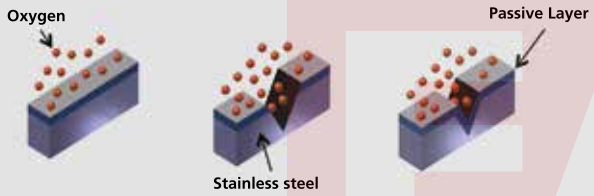
It is generally preferred that the electrical enclosures are manufactured from stainless steel material in various industrial applications where corrosion resistance is important. However, there are rules to be considered when selecting and using stainless steel materials.

Stainless Steel Enclosures
Stainless steel is a proven it's reliability in various industrial applications as electrical equipment enclosures. In the corrosion resistance of the stainless steel, the environment and its conditions of the application, the grade of steel and the surface treatment have determinant importance.

When the characteristics of stainless steel enclosures are determined for using in a project, by careful consideration of the factors stated here, the required level of corrosion protection and the overall success of the application can be possible.

Stainless steel self-repair feature



The metallic satin finish of the stainless steel makes itself passive, if a suitable environment is provided, i.e. sufficient oxygen and available rich chromium oxidation.

This reaction occurs spontaneously in very short time once the sufficient oxygen contacts on the surface, and the protective layer thus formed becomes thick over time.

The resistance against corrosion on the surface has the ability to repair itself in case of mechanical defection.

Environment and its conditions;
The climate of the area where the application will be, has a great effect on the corrosion resistance of the stainless steel material.

For example, 304 grade stainless steel is resistant to corrosion under a wide range of environment conditions and climate effects, but it is inevitable to experience corrosion in salt and other chloride environments. De facto, 304 grade stainless steel should not be used up to 10 km inside by the sea coast; but the actual length of this distance can be determined by evaluating the climatic

conditions according to the application area specifications. By this reason, it is not recommended to use 304 grade stainless steel in marine applications without taking special precautions. In cold climate zones, chlorides are used as defrosting chemicals and also, can cause point corrosion on 304 stainless steel surfaces.

In industrial environments, chlorides can be existing in smoke and flying ashes. These are dirt and debris deposits on non-washed, uncleaned surfaces and eventually they may cause point corrosion. Even if the right stainless steel is chosen, corrosive substances condensed in the accumulation of impurities in that way, may cause the protective passive layer on the stainless steel surface to be pierced. In such cases, cleaning is necessary. By this way, self-repairing of stainless steel material can be provided and the stainless steel surfaces can be prevented from condensation of sulfur-dioxide, chloride or ferrous deposits. In another particular attention should be paid not only to the general climatic conditions, but also to the specific micro-climatic conditions where the enclosure is to be mounted. The most obvious example to this, is the negative effect in the settlement areas especially in highways, where salt and chemicals are is used as de-icing, which can be carried up to a distance by the vehicles. Likewise, the effects of increased exhaust gas emission by the dense and stopped traffic on the underpass, in the tunnel or at the ticket office, can be evaluated in terms of attracting attention to the micro-climatic conditions.

Which grade of stainless steel?
304 grade stainless steel is the most widely used type in different applications where a special corrosion resistance is not required. More harsh environments require the use of 316 qualities which is more expensive grade of stainless steel. However, even for 316 grade stainless steel, chemicals, their concentration and their level of aggressiveness in the environment must be examined,

evaluated and observed in deep detail; because there may be cases where this grade is not sufficient.

304 Grade Stainless Steel
SEA 304-304L / EN 1.4301-1.4303
Classified as 304 grade by the American Society of Automotive Engineers - SAE, stainless steel contains 18-20% chromium and 8-10.5% nickel. The 304 grade sometimes referred to as '18 -8 ', is widely used as standard stainless steel grade in different industrial applications. The most common application where the use of 304 quality stainless steel is inconvenient, is the outdoor applications in the coastal areas where the salt is deposited on the surfaces by flying.

In the food and beverage industry, it is necessary for the enclosures to be washed frequently without worrying about rusting. 304 grade stainless steel is used extensively here. Due to its high resistance to various acids found in meat, milk, fruits and vegetables, 304 grade stainless steel has become the ideal raw material for control and control equipment enclosures of machines used in food and beverage processes. Nevertheless, a stronger stainless steel grade may be required, if the environment has excessive chloride usage, or cleaning procedures require high corrosion resistance solvents.

The use of 304 grade stainless steel may be sufficient in a majority of waste treatment and clean water treatment plants. However, in some clean water treatment plants, chlorine gas is used as a disinfectant and sulfur dioxide is used to remove the residues of used chlorine. When the nature of the environment with high humidity and the corrosive effect of these gases are combined together, the capabilities of 304 grade stainless steel are exceeded. Some municipalities put efforts to use less chemicals with environment friendly approaches and apply ultraviolet treatment for water treatment. 304 quality stainless steel can be used, due to no chemical usage in such facilities.

316 Grade Stainless Steel
SEA 316-316L / EN 1.4401-1.4404
The second most widely used grade of stainless steel is 316 when the limits of 304 are reached. In general, 316 quality stainless steel, which is 25-35% more expensive, has a higher nickel content and an additive molybdenum content of 2-3%. Molybdenum additive provides increase of corrosion resistance especially against chlorides.
The rate of chloride contained in water is the most determinant factor in the selection of stainless steel enclosure material for water treatment plants. 304 grade stainless steel is able to withstand against the corrosive effect of water containing up to 100 ppm of chloride. On the contrary, in the 316 grade stainless steel material,

this limit is up to 1000 ppm of chloride. In addition to chlorides, there are other substances that affect the corrosive behavior of the water. Especially, attention should be paid to halides such as bromides or iodides which are not chlorides. Another important factor is the presence of water oxidizers (e.g. ozone); the risk of point corrosion is also increasing as long as water oxidizing power increases. In such some cases, 316 grade stainless steel is also insufficient.

316 grade stainless steel commonly known as the marine standard, cannot withstand to be presented in continuous saline water (equivalent to 19,000 ppm chlorine). However, it can be used in overwater applications such as temporary and short-term salt spray applications. It should not be forgotten to take various precautions for the application areas with narrow and closed low airflow a difficult harsh environment conditions with low pH or high temperature. 316 grade stainless steel is generally considered as an adequate enclosure for marine applications such as ships and oil platforms and even for salt mines. Essentially, the stainless steel grade is 316 which should be used mainly in corrosive environments where high chloride levels are present.

316 grade stainless steel should be preferred because of having high chloride resistance in food processing plants using excessive acidic chemicals and concentrated chloride salts. 316 grade stainless steel having considerable degree of resistance against sulfuric acid solutions (<10%) and sulfur-containing gases, is used as the raw materials for the enclosures used in industries where they are frequently found. For example, 316 grade stainless steel is used in the paper industry. Similarly, in other industries such as vulcanization process for the rubber or gun powder manufacturing, it is also widely used.

Nitric and hydrochloric acid
As a general rule, 316 grade stainless steel enclosures are more resistant to aggressive chemical environments than

304 grade. Nitric acid is at the top of special cases which does not suit this rule. Nitric acid is especially used in fertilizer production, pharmaceutical industry and explosive production; also, it can be used in synthetic yarn and polymer manufacturing or in water treatment plants.

All stainless steel grades have a slight resistance to nitric acid, but in industries where the use of nitric acid is widespread, 304 grade stainless steel should be preferred due to its high resistance against this substance. In this case, the self-passive ability of the stainless steel is enhanced by the strong oxidizing effect of nitric acid and the corrosion resistance of the stainless steel is increased.

It is important to consider that neither the 304 grade nor the 316 grade stainless steel will be able to withstand against the chemical corrosion caused by hydrochloric acid. This acid destroys the passive surface and leaves the metal vulnerable.

Swimming pool environments
The swimming pool atmosphere is generally characterized by at a relative humidity approximately 60-70% together with chlorine and chlorine compounds relatively high levels. The original "pool smell" is existent due to these. These substances can be spread to the entire space as both steam and aerosol. In addition to sodium chloride, relatively high amounts of calcium and magnesium chloride are found in many applications. Typical values are 2-5% for the chloride ratio and 3-4 for the pH value. The high relative humidity rate fluctuates by depending on the intensity of swimming activity, the temperature changes during the day and resulting in the accumulation of deposits at various locations with the switched off air conditioning system in the nights. The evaporation of chloride-containing liquids and the increase of chloride concentration in the contact zones considerably increase the likelihood of corrosion.

It is necessary to pay special attention to the selection of the right material in swimming pool applications. Especially, attention should be paid to the selection of materials for enclosures placed in closed areas such as machine rooms of pools. Special precautions such as micro climate air quality, should be taken in these applications. It is obvious that the selection of 316 grade stainless steel will not sufficient alone in the presence of oxidizing substances such as ozone or where disinfectant chemicals are stored. In this case application of lacquer coating or 316 quality stainless steel or both is required.

Surface treatment
Grinding is common surface treatment for stainless steel enclosures used in industrial applications. The protective film as the purpose of masking, adhered on the outer surfaces of the enclosures is kept to the very last of the manufacturing steps, after removing the film and the possible adhesive residues are cleaned with special chemicals, the enclosure is packed with an air-permeable material before last packaging.

In addition to the surface treatment quality, the direction of grinding of the stainless steel surface is also important in terms of corrosion resistance. The vertically oriented grinding allows cleaning to be done easily and in case of outdoor applications, rain water can flow down itself with help of gravity. Some stainless steel enclosures can be painted. Especially, it is known that outdoor stainless steel enclosures exposed to intense solar radiation can be 10 degrees cooler, if they are painted with a light color. It is also possible to consider the paint as an additional layer of protection for extremely corrosive environments. Stainless steel can be painted by using standard paint process.

Hygienic applications
Stainless steel enclosures are also preferred for their superior hygienic features in addition to their corrosion resistance. It is more difficult to stick and reproduce for bacterias and microbes on stainless steel surfaces (assuming to have appropriate surface smoothness). The smooth and though surface of the stainless steel allows for easier and more effective cleaning.

Precautions for storage and construction site environment
In order to ensure that the surface qualities of stainless steel enclosures are also protected under storage and site conditions, some precautions might be needed to be taken in addition to the manufacturer's precautions such as product packaging.

Water which may accumulate during storage and transport, especially under heat shrinkage or under the plastic packaging of the stretch-film construction, may cause corrosion. This is the case when the packaged product is left in a humid environment for a long time. Strong acids (chloride based) which can be used for cleaning after ground work, especially stone or ceramic laying in new buildings, should be prevented from getting in contact with stainless steel surfaces. Any cleaning or rinsing fluid must not be interacted with the surrounding metals.

During storage, transfer, positioning and assembling in construction site environment, contamination of stainless steel enclosures' surfaces with carbon steel or iron must be avoided. For example, metal machining, grinding or welding around stainless steel enclosures should be avoided or precautions should be taken. Carbon steel metal burrs or slag splashing on the stainless steel surfaces will cause corrosion of splinters.

Cleaning before delivery
The stainless steel electrical enclosures manufactured by EAE, are delivered in an air-permeable package material, after the protective film is stripped and the surface is cleaned with flying chemicals which have protective features for stainless steel. Before the final delivery against the contamination, it is necessary to clean the surface defections which may be occurred in the workshop environment or the construction site environment. Mortars and cement particles can be cleaned with 10-15% phosphoric acid. The solution should be applied hot onto the surface, subsequently, neutralized by the ammonia solution, finally rinsed with water purified from the minerals. Cleaning products manufacturers offer some special products for this type of cleaning. The superficial light stains can be removed by gentle cleaning creams and polishing pastes which are available in the market. These cleaning products contain substances that can penetrate the surface together with calcium carbonate. Household cleaners are also based on lemon acid and suitable for cleaning.

Grinding powders containing iron adhering to the surface in a short time ago, should be cleaned with saturated solutions of oxalic acids. Firstly, it must be applied to the surface without pressing hardly with a soft cotton cloth or cotton-based polishing pad and waited for a few minutes. Thus, as a rule, it is ensured that the particles are separated from the surface without scratches and damages on the surface. Moderate level rust stains are cleaned using cleaning products containing phosphoric acid. Careful cleaning is done without damaging the surface and changing color. Alternatively, small amounts of iron particles treated on the surface are successfully cleaned with slenderized nitric acid. It is only possible to clean the surface treated with rust thoroughly with acid processing and / or passivation to be done professionally. The acid cleaning process should be considered as a thin layer removal from the surface. For this, a mixture of nitric acid and hydrofluoric acid is generally used. Passivation process is a controlled and accelerated reconstitution of the impaired passive layer on the surface in the nitric acid environment. However, first of all, the oil and organic soils on the surface must be cleaned.

Maintenance
For all stainless steel applications, periodic surface maintenance should be planned and applied during operation.

304 and 316 grades raw material discrimination test:

304 316

A fine liquid from Monil 304-316 separator solution is dropped on the surface (under room temperature). 20-25 minutes to be waited. The colour of drop is watched. On the tested surface, in 5 minutes, yellow-green-brown color changes in sequence as the proof of 316 grade stainless steel. For 316L grade stainless steel, more than 5 minutes to be waited.

Stainless Steel Product Groups

XH MODULAR OUTDOOR FLOOR STANDING ENCLOSURES

XS MODULAR INDOOR FLOOR STANDING ENCLOSURES

EAE
ELEKTROTEKNİK

XK CONSOLES

XM MONOBLOCK ENCLOSURES

XT TERMINAL BOXES

For detailed information about our stainless steel producst you can download our EX Stainless Series Catalog - ENG from our website download center.

STAINLESS STEEL PRODUCT GROUPS

E-KABİN XS	**Modular Indoor Floor Standing Enclosures**
E-KABİN XH	**Modular Outdoor Floor Standing Enclosures**
E-KABİN XM	**Monoblock Enclosures**
E-KABİN XT	**Terminal Boxes**
E-KABİN XK	**Consoles**

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