Technical Bulletin

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WORKING SAFELY WITH STAINLESS STEEL PICKLING COMPOUNDS


Stainless steel is usually treated to recover its corrosion resistance after operations such as welding, annealing, bending etc. A good and frequently used surface treatment is pickling. Pickling stainless steel is usually done with a strong acidic solution consisting of nitric acid and hydrofluoric acid. Improperly used, these chemicals can be dangerous to both people and the environment. In addition, chemical reactions take place during the pickling that release dangerous vapours. Therefore, to reduce the risk of hazardous situations arising or accidents occurring, it is important that the dangers associated with pickling products are recognised and that the safety rules are observed..

General safety rules

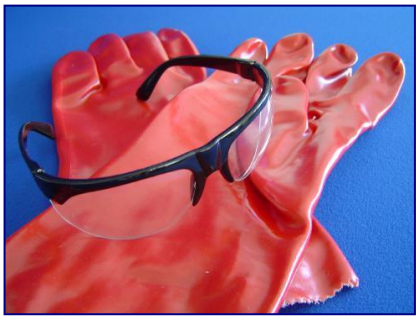
It is important that the product information sheets are always read carefully. They contain relevant information about the use of products. Unsuitable application of products can lead to hazardous situations. Product information sheets often refer to the safety data sheet (MSDS). Information provided in the safety data sheet includes personal protection requirements, the nature of the dangers involved and product physical data.


The legally required universal danger symbols on product labels make the dangers clear at a glance.

A stainless steel pickling solution consists of hydrofluoric acid and nitric acid. Acids are corrosive (irritating) chemicals that are capable of causing serious skin burns. Inhalation of acidic vapour can cause breathing difficulties and a sore throat. Acidic vapours can be identified by a pungent and irritating smell.

Hydrofluoric acid is present in diluted form in the pickling solution. In spite of this dilution, the mixture is still very poisonous. Poisoning is particularly likely to be caused by inhalation of the material. Contact with the skin can cause very serious burns and the hydrofluoric acid molecule will penetrate the skin and react with calcium in the blood or bone.

If the skin has been in contact with the stainless steel pickling solution it must be rinsed off immediately with a large quantity of clean water, and subsequently rubbed with a special HF ointment. This ointment contains calcium gluconate that binds the fluoride and limits the damage.



Personal protection equipment

Dipping. The solution is contained in a bath in which the stainless steel is immersed for a specific time. Splashes or drops of acid can cause hazardous situations when the stainless steel pieces are being placed into or removed from the bath. Acid-resistant gloves, clothing and safety goggles are the minimal essentials required with regard to personal protection equipment.

Spray application. This method uses a hand pump to spray the pickling gel onto the stainless steel surface. During the application, very high localised concentrations of acid can occur. In this case, the chemical reaction of the pickling solution takes place directly on the surface, causing release of nitrous fumes (nitrogen oxides) within a very short time. Nitrogen oxides can be recognised by their brown vapour and they are poisonous. Such activities should, therefore, take place in a well-ventilated room and be carried out by trained personnel. In addition to the PPEs mentioned above, the use of a mask to provide respiratory protection (filter type BE) is essential.

Brush application. Application by brush is only suitable for small areas such as weld seams. This method also releases vapours, but to a much lesser extent compared to pickling using a spray. However, it should also be noted that during brush application, corrosive and poisonous vapours can be released and the work should, therefore, be carried out in a well-ventilated place. Here also, the standard PPEs such as safety goggles, acid- resistant gloves and clothes are necessary.

MAC value

Because working with chemicals involves health and safety hazards, MAC values for dangerous substances have been developed. The MAC value is the maximum allowable concentration of the material concerned in the air. Working below these values is not hazardous to the health. For pickling baths, the concentrations of hydrofluoric acid and nitrogen oxides in the air will normally be lower than the MAC values. It is possible that the MAC value will be exceeded due to chemical reactions or high temperatures. Adequate extraction around the edges of pickling baths will become standard in the future, so that the health requirements will always be met.

During spraying of pickling solutions, the MAC values of both hydrofluoric acid and nitrogen oxides will be exceeded, because high concentrations of the pickling solution are present as aerosols. In addition to the health risks of spray pickling, there will be corrosive elements present in the air that may damage other materials such as carbon steel structures.

Air quality analyses give a good indication of whether the legal requirements are being met and they can be carried out *in situ*. The simplest types of measurement - Dräger tubes - are available for convenient manual operation.

Waste

The pickling process results in waste in the form of rinsing water and exhausted pickling solutions. These waste flows contain nitric acid and hydrofluoric acid as well as heavy metals (nickel and chromium) and must also be treated as dangerous waste. The acid solutions are neutralised by a detoxification, neutralisation and dewatering installation, and the heavy metals and poisonous fluorides are precipitated using calcium hydroxide so that the water to be discharged meets the official requirements.

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