

# Working safely with stainless steel pickling agents

It is very important to recognize the risks of the pickling products and to comply with safety rules

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 sheets (MSDS), which are provided by the supplier of the products in question. 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 GHS 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 toxic.

The toxicity with dilutions as used in pickling baths (0.5-7% HF) mainly relates to contamination through the skin. 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. The effects of this can be very serious and even a fatal outcome is possible. 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. Medical assistance must then be requested immediately. Information about hydrofluoric acid is available on the Eurofluor website: [www.eurofluor.eu](http://www.eurofluor.eu)



## Personal protection equipment

*Immersion application.* 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 work clothing, safety shoes 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 toxic. 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 full face mask with (in)dependent respiratory protection (filter type ABEK or breathing air) and a chemical suit are required.

*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 toxic 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, safety shoes and acid-resistant gloves and clothes are necessary.



*Spray pickling of a stainless steel tank*

## Working conditions

Because working with chemicals can involve health and safety hazards, limit values for dangerous substances have been developed (source: SER). The limit value is the maximum allowable concentration of the material concerned in the individual



breathing zone of employees. 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 limit values. It is possible that there are temporary, short-term exceedances of the limit value due to chemical reactions or high temperatures. During spraying of pickling solutions, the limit values of both hydrofluoric acid and nitrogen oxides can 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 toxic fluorides are precipitated and removed using calcium hydroxide so that the water to be discharged meets the official requirements.

## Interested and want to know more?

For further information and/or questions about this subject or in case you have other questions, please contact one of our specialists via +31 10 59 30 258 or go to our website.