

ITALIAN MACHINE TOOLS, ROBOTICS & AUTOMATION INDUSTRY ~ NEWS

Feb 2024

PIATTAFORMA INDIA PROJECT

NEWSLETTER NO. 86



UCIMU-SISTEMI PER PRODURRE



Need Buyer Credit Finance to buy machine?

We can help you!

please write to us – italianmachinery@indiaitaly.com

METAL CLEANING TECHNOLOGY - HOW TO SELECT THE CLEANING PROCESS

Introduction

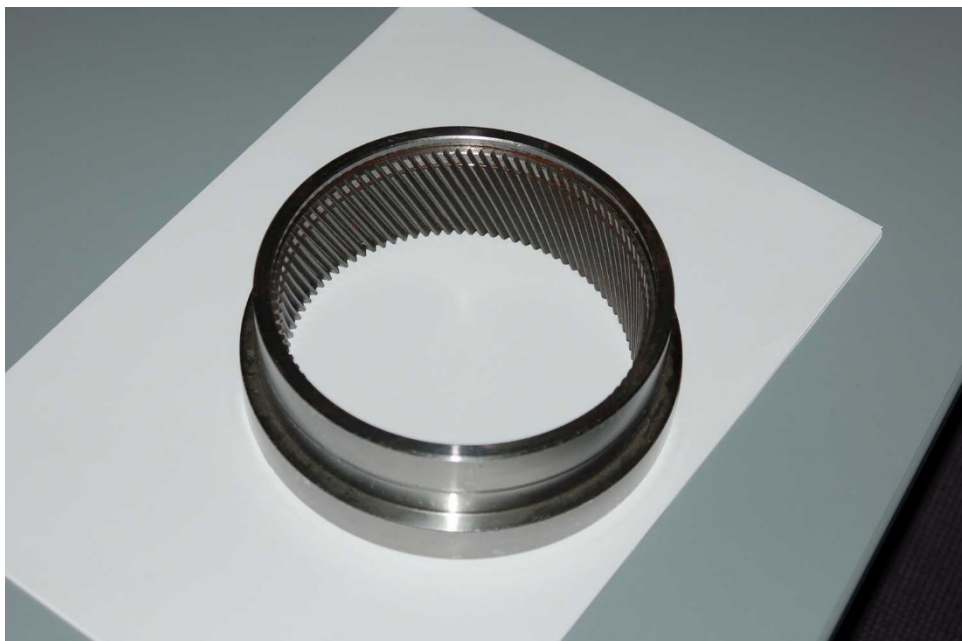
Facing a problem and trying to solve it without knowing, or at least with only partial knowledge, of the factors that generated it and those that determine its solution rarely leads to positive results.

However, this is often the condition in which those who have to face and try to solve a problem of washing mechanical parts or technical surfaces find themselves.

An apparently simple operation that, in practice, turns out to be complex due to the wide range of knowledge it requires and the many variables to be defined. Starting with “dirty” and “clean”. Two adjectives that even when they become nouns (dirt, clean) remain opinions and nothing more: In fact, **what is "dirt"?** and **how clean is clean?**

In these notes we limit ourselves to illustrating the factors to take into account for the selection of the cleaning process and the basic methods for applying it.

The choice of the process is in fact a prerequisite for the choice of the machine which is given the task of carrying it out to achieve the result of cleanliness determined.



Preliminary information to be acquired

When selecting a metal cleaning process it is necessary to consider in advance many factors which constitute variables that are essential for accessing the subsequent phases.

It is therefore necessary in the first instance to acquire basic information by identifying and defining:

- The previous operations that generated the dirt (mechanical work in the production or maintenance process, repair, overhaul)
- The nature and characteristics of the contamination to be removed
- The part(s) to be cleaned, the nature of the material as well as the state of the surface (substrate)
- Subsequent operations to be performed, such as machining, assembly, storage, packaging or to be applied in or after the process, such as passivation, protection, phosphating, painting
- The degree of cleanliness required and the verification method
- The production process where the process must be inserted

Although the possibility of choosing between different solutions with similar results the choice of a cleaning procedure must depend on the degree of cleaning required and from the subsequent operations to be performed.

The size and shape of the part(s) along with the required production volume are also necessary elements to establish the cleaning procedure, the characteristics of the equipment and the handling techniques it involves.

A further aspect to consider is the potential impact on the environment. Environmentally friendly cleaning methods that minimize the use of hazardous chemicals and waste production shall be preferred.

The dirt to be removed

The types of dirt, despite their wide variety and diversity of use, can be substantially classified based on their characteristics and the production processes that use them:

- Oil and grease, identified according to the specific characteristics and actual state if altered by previous use as happens for the parts being overhauled.
- Cutting fluids, oil and emulsions, and machining chips or particles
- Pastes and oil used for lapping with the micro particles generated by processing
- Compounds for drawing and moulding
- Abrasive and polishing pastes
- Resins and paints
- Rust, scales and encrustations, carbonized oil residues
- Residues from NDT by magnetic particle inspection.
- 3D printing residues



The substrate not to be damaged

Once the substrate has been identified and defined, the choice of the cleaning process must be based on its nature and characteristics to prevent damages.

- \$ Metals such as aluminum and magnesium require special consideration due to their sensitivity to chemical attack: aluminum is attacked by both strong alkalis and acids; magnesium is resistant to alkaline solutions, but is attacked by many acids.
- \$ Copper is stained by alkalis, but attacked by oxidizing acids and only slightly by others.
- \$ Steels are highly resistant to alkali and attacked by all acidic materials, albeit in different ways. In particular, treated steels are subject to hydrogenation and embrittlement.
- \$ Stainless steels have high resistance to both acids and alkalis, but must be precisely defined as the degree of resistance depends on the alloying elements. Titanium and zirconium have excellent chemical resistance to both alkalis and acids, with the exception of acid fluorides. Zinc and cadmium are attacked by both acids and alkalis.



How cleaning products work

Knowing the working mechanism of the cleaning process can help you choose an appropriate method.

Solvent cleaning is the dissolution of the contaminant by a liquid, which can be water, alcohol, hydrocarbons or other depending on the solubility of the contamination to be removed. This can be achieved by brushing, immersion, spraying or condensation of the vapor phase.

A possible disadvantage of solvent cleaning is the possibility of leaving insoluble residue on the surface which often requires additional cleaning. It should also be considered that the dissolution capacity of each solvent is only effective against some substances.

Apart from the use of water, it is necessary to pay close attention when choosing the solvent, especially in the case of mixtures, considering both environmental safety and the risk of fire and explosion.

Water-based alkaline cleaning is certainly the most widespread process underlying industrial cleaning. It acts with both physical and chemical action. These detergents contain combinations of ingredients such as surfactants, sequestering agents, saponifiers, emulsifiers and chelators, as well as inhibitors, stabilizers and passivators. These ingredients, with the exception of saponifiers, are physically active and work by reducing surface tension, forming emulsions, and suspending or floating insoluble particles.

Cleaning with acidic agents is mostly used in conjunction with other steps than alone. Acids have the ability to dissolve oxides, which are usually insoluble in other solutions. Mineral acids, such as hydrochloric, sulfuric, and nitric, are used for most acid cleaning, but organic acids, such as citric, oxalic, acetic, tartaric, and gluconic, have an important role in cleaning.

Industrial cleaning methods

there are essentially two methods: immersion and spraying with the relative variations and articulations considering also that the two basic methods can be integrated into a multi-stage process.

Immersion.....

It is the process by which the parts to be cleaned are placed in the solvent or detergent solution to allow contact with the entire surface to be treated. It is the most effective method, although not the fastest one, and can be used with any type of cleaner for any process, hot or at room temperature. The immersion process is preferred for parts placed in baskets and for processes that require prolonged contact times due to the contamination to be removed or the shape of the parts. Performance can be enhanced by moving the parts inside the liquid or by agitating the liquid itself, mechanically or with the addition of ultrasonic energy.

..... with agitation

agitating the materials inside the liquid is the simplest and most economical method to increase its effectiveness and efficiency without increasing emissions or generating energy consumption that characterize other methods such as agitating the liquid using pumps or, even worse, the inflation of compressed air.

.....with ultrasonic energy

the addition of ultrasonic energy increases effectiveness and reduces process time which, except for particular applications, fluctuates between 70 and 180 seconds.

The action is created by converting electrical energy into acoustic energy which, generating the cavitation of the liquid, combines with the action of the detergent or solvent.

The implosion of the bubbles generated by cavitation constitutes the functional principle of ultrasound with temperatures that can reach 5500°C and a pressure that generates a jet of water that impacts the surface at a speed of 400 km/h. The size of the bubbles depends on the frequency. A low frequency generates larger bubbles while a high frequency generates a greater number of smaller bubbles. A low frequency generates more noise than a high one which can still be limited to 70 db(A).

Selection of the type of ultrasound requires specific knowledge, given the variables involved relating to frequency and power, as well as the configuration of the system and the characteristics of the liquid.

Spray

it is the process by which the mechanical action of the jet, the chemical action of the detergent and the temperature are combined to obtain cleaning. It can be carried out at pressures from 0.2 up to 100 bar and above. However, the pressure generally used in in-booth or in-line spray cleaning processes with water-based detergents is approximately 2-3 bar combined with high volumes, while the use of high pressure is limited to specific areas and functions. Spray washing is used to remove insoluble particles such as dust and processing residues combined with oil and allows the reduction of washing times even by using less aggressive and low percentage solutions.

The high productivity associated with a high degree of flexibility have made spray washing the most widespread method in industrial production cycles.

Conclusion

The information provided here is intended only as a guide and aid in choosing the cleaning process, preventing, if possible, errors that are easy to make. The individual topics may be discussed in depth in another publication.

The choice of the machine shall only come **after the process has been defined** and its task is to carry it out as best as possible by interacting with the production process:

Because a cleaning problem never has a single solution, even if only one is the best for each specific application.

Please visit our website: <http://www.passaponti.com/>



The project Piattaforma India has been promoted by UCIMU – Association of Italian Machine Tools Manufacturers and AMAPLAST – Italian Plastics and Rubber Processing Machinery and Moulds Manufacturers Association. The two associations agreed on the idea that promoting a network of associations and entrepreneurs who have developed knowledge and experience on the Indian market, can be useful in favoring of new paths of development for business. The Indian companies who are interested to form JV, cooperation, technical tie up, purchase machinery etc from/with Italian companies can contact below mentioned address for any assistance:

Contact information of Piattaforma India desk:

Mr. Nilesh Joshi
Manager - Italian Machinery Desk in India



C/o The Indo Italian Chamber of Commerce and Industry
11th Floor, Tower - A, Urmi Estate 95, Ganpatrao Kadam Marg,
Lower Parel (W), Mumbai 400013, Maharashtra

P: +91 22 67728186

Mob : +91 7666795385

Fax. : +91 22 67728191

Email : italianmachinery@indiaitaly.com