

## Precision cleaning « swash » The winning system

The A3 (isoparaffine) removes oil perfectly; water based detergent dissolves salts and other polar soils. This is the solution to your cleaning problems. Ionbond uses the Amsonic *swash* technology for surface preparation prior to PVD – CVD.

### Degreasing and precision cleaning

Ionbond (Olten, Switzerland) is one of the world leaders in PVD and CVD coatings. The surface preparation of tools or decorative parts is important to ensure the adhesion of the layers. The cleaning system used till 1991 consisted in degreasing with water detergent and drying using R113. After the ban on R113 the system has been modified and used the following sequence of cleaning in line:

- water based degreasing
- rinsing
- final rinsing with isopropanol and hot air drying.

The compact equipment *swash* allows to increase the capacity of the currently used system. It ensures a high performance cleaning and drying, higher than the former equipment.

The Amsonic Egaclean concept is based on hydrocarbon used at high temperature. It has been the first on the market and is in use since 1997. It has proven its superiority over chlorinated solvents when used at high temperature by immersion, then with a vapour phase and vacuum drying. The continuous distillation allows to keep a constant quality of the solvent. It must not be changed, as the distillation purifies the solvent perfectly, without limitation in the time. This is an advantage against chlorinated solvents but also against modified alcohols.

The non polar soils are then perfectly removed. Salts are present when water based emulsions –including 95% of tap water– are used and dry on the parts. They are generally covered by anti-corrosion oil, that protects them against corrosion. These salts are not soluble in isoparaffine, modified alcohols or chlorinated solvents. The only usable solvent is a water detergent. This is the *swash* concept combining a first phase using isoparaffine, dissolving all non polar soils. The solvent remains efficient by continuous distillation. This is not the case of water detergents which are polluted by oils. The preceding equipment used acetone in a pre-degreasing step.

Remaining salts can then be dissolved in a second cleaning step, using a low concentration water based detergent that will dissolve salts in this second cleaning step, followed by rinsing. A vapour phase with deionized water can be introduced. Vacuum drying ends the cleaning process.

The water detergent is a product of Borer Chemie. It uses a low alkaline salt free combination of tensides. Its low concentration and the optimization of the tensides allows easy rinsing.

This concept makes it possible to degrease and clean perfectly any type of parts. Its name *swash* stand for lipophile (oil solving) and hydrophile (water soluble) and indicates that it is able to dissolve practically any type of soils.

The cleaning cycle will include a last vapour phase using isoparaffine, if the metal has to be protected against corrosion. Such a very thin layer of solvent will protect parts during four weeks approximately.

The concept is patented.

The flexibility of programming the machine allows to use only one step, isoparaffine or water.

The remaining carbon residues have been measured in a laboratory shows that the remaining pollution leads to variable concentrations. This makes it possible to use the cleaning system *swash* for bio-medical applications.

	Isoparaffine cleaning	Combined cleaning <i>swash</i>
Pollution in mg C	0.032	0.01
Pollution in mg C/m <sup>2</sup>	10.8	3.0
Hydrocarbon-film in µm	0.0138	-



### **A programmable quality**

The requested cleaning quality covers a broad range of parts and soils. Drills with thin cooling channels with an overall length of 200 mm and recess holes require perfect cleaning and drying.



Some steel parts are cleaned using isoparaffine only. The cleanliness measured in surface tension shows values over 52 mN/m after cleaning and drying. Such a quality is perfectly adapted to PVD or CVD coatings. A supplementary control uses a clean white paper with isopropanol rubbed on the surface of the parts and in recess holes. The cleaning is accepted if no mark is visible under the microscope with 20 times enlargement.

Parts of complex geometry with multiple recess holes show traces of grease after water based cleaning using acetone, water detergent rinsing and isopropanol drying. Swash removes these soils efficiently.

Hard metal parts often show cobalt leaching, when cleaned with water based systems.

This is avoided in the swash equipment using A3 solvent. An important part of this technology lays in the various sequences of cleaning –freely programmable by the operator– and parameters of distillation of the solvent.

Finally rinsing with deionized water and an aqueous vapour phase give drying qualities equal to HFE and HFC drying systems. The drying control method uses a visual check under 20x microscope enlargement. Some polished parts with electroless nickel layer are dried in an equivalent quality using this method in comparison with isopropanol drying.

#### **Productivity, economics and ecology**

The **swash** process has low operational costs and best environmental values.

The following table shows the significant cost and performance data of the system.

<b>Parameters</b>	<b>Swash</b>	<b>Water based line</b>
1. Investment	index 100	index 250
2. Cleaning costs in Euro/kg	0.09	Approx. 0.50
3. Productivity Basket dimensions	approx. 200 à 300 kg/h 670x480x320 mm	Apporx. 50–80 kg/h 300x300x200 mm 18 liters

	100 liters	
4.Environment data 4.1. emissions VOC or DOC/year	A3 solvent .approx.200 liters VOC emissions =0 approx. 30 kg detergent or 2 kg DOC	Aceton : 5000 l VOC emissions =2000 kg 1250 kg detergent or 87 kg DOC
4.2. Energy in kWh/year	approx. 35'000	approx. 40'000
4.3. Water consumption in m <sup>3</sup> /year	approx. 150	approx. 550
4.4.Ecological balance sheet (low value is best)	850 ecopoints	2150 ecopoints

### A new generation of cleaning equipment

Cleaning problems are related to various soils. Polar or non polar pollution represent the overall range of pollutions met in the metallurgical productions.

Polar soils like salts can be eliminated from the surface of parts using water based detergents or having a polar molecule. Non polar soils like oil and grease are dissolved by hydrocarbon solvents better than by water detergents. This is due to the fact that tensides will be consumed by the oil particles. The hydrocarbon solvent can be distilled continuously and keeps therefore its solving capabilities. The advantage of cleaning in two steps is that the degreasing one leaves only salts or polar soils on the parts. These can be eliminated by a water detergent with low concentration (below 1%). In some cases the rinsing with deionized water may be sufficient to eliminate the salt pollution remaining from water emulsions leaving Ca and Mg salts.

The cleaning quality is also related to the geometry of the. Vacuum allows a better penetration in recess holes. The high temperature of the A3 solvent is also a guarantee of better solvency of oils and grease. The progressive elimination of chlorine additives in cutting oils and their replacement by other additives not compatible with chlorinated solvents speaks for the efficiency of A3 cleaning instead of tri or perchlorethylene..

**Swash** is the result of applied research using non chlorinated solvents since 1993. It is part of the growing importance of efficient and environmental friendly cleaning and drying technologies.