Cleaning with a combination of pumice slurry and nylon brushes.

Surface cleaning with abrasive brushes can be considered "historically" obsolete. Modern circuit designs with even finer lines and spacings, have forced the industry to look for alternative cleaning methods and develop new approaches to new problems. Pumice was first used for cleaning copper surfaces in the early 70's. The combined action of the abrasive pumice particles and nylon brushes tangent to the surface, removes all contaminants and leaves a fresh virgin copper finish with a uniform surface. There is no plug effect, no smearing and no hole ovalization. The surface is in effect "sanded", one cannot even refer to the "density of scratches" since the surface is rough, uniform, and extremely peak-rich.

Cleaning with jets of pumice slurry.

Several equipment manufacturers have developed a system based on spraying the surface with jets of pumice, known as jet scrubbing. The principal advantage of jet scrubbing is the absence of brushes and hence less down time and less operator intervention, making this cleaning method particularly interesting for large volume PCB production.

Brush scrubbing with a combination of pumice slurry is still today the most popular surface preparation method, since other methods do not provide sufficient anchorage for the coating. The industry has searched for alternatives to pumice scrubbing, not due to lack of results in the actual surface treatment, but due to mechanical problems experiences on machines working on an industrial scale, but to no avail.

Jets of pumice slurry may be sufficient for altering or "hammering" a surface which is already clean. This is the case with conventional hole-passing plated circuits coming from electroless or plating operations where the surface is so clean that direct lamination of dry-films even without surface treatment is possible.
This is not the case with inner layers or multilayers when the base material comes directly from the manufacturer and is therefore contaminated with grease, oxide, fingerprints and protective coatings which cannot be removed with the weak action of pumice jets. The aggressive approach using pumice and brushes is necessary to expose a clean, 'virgin' surface, rich with peak points, for the best adhesion of dry film.

**Typical Machine for Scrubbing with a Pumice Suspension and Brushes**

This schematic vertical cross section shows how pumice is kept inside the scrubbing chamber and all residues are washed away well before they reach the bearings or the brush rotation and adjustment mechanisms.

Typical convolute roller for PCB processing with pumice
A "clever" machine for scrubbing all thicknesses of copper-clad materials

Thin inner layers of multilayer, flexible circuits, as well as rigid boards are perfectly cleaned on both sides by means of rotating nylon brushes and a suspension of abrasive and water. The PUMIFLEX-SHD/A is unique in its field thanks to its computerized "CLEVERBRUSH" system.

**THE "CLEVERBRUSH" SYSTEM**

The purpose of this system is to allow brushing of thin materials without damage. The conveyor system consists in pairs of pinch rollers and guides to support the foils during transportation.

However there are no guides or grids underneath the brushes which would be quickly worn out by the strong combined action of nylon brushes and abrasive.

A series of photocells detects the leading edge of sheets and the first pair of rollers are automatically started and stopped in order to provide the necessary spacing between one sheet and the next. An encoder connected to the conveyor drive system constantly monitors the travelling of sheets throughout the machine and the signals corresponding to sheet length and sheet position are sent to a Programmable Logic Controller (P.L.C.).

Each pair of brushes is driven by a self-braking motor which starts and stops in the proper direction and at the proper time under the control of the P.L.C. When the leading edge of a thin foil reaches the brushes, these rotate in the direction of transportation so that the foil is conveyed between them.

The action (=friction) of the brushes in the direction of transportation would damage very thin foils, as soon as their trailing edge leaves the pinch rollers before the brushes. Therefore, before this happens, brushes stop and immediately reverse the direction of rotation. In this way the sheet is always under pull by the brushes themselves.

After the trailing edge leaves the brushes, these reverse once more, ready to process the next piece.

All above steps are repeated in the same manner for each board, upon reaching each of the three pairs of brushes.

The inversion of rotation of each one of the three pairs of brushes takes place in three different positions along the same board in order to avoid non-uniform scrubbing.

**FEATURES**

Patented "CLEVERBRUSH" system which stops the brushes and/or starts them in the proper direction and at the right time in order to avoid damage to thin foils.

No guides or grids underneath the brushes.

A special transport system with guides supports the foils throughout the rest of the machine.

Computer-controlled conveyor rollers automatically ensure the required minimum distance between pieces.

Input conveyor rollers automatically stop when the situation does not correspond to the data preset in the program.

The machine automatically stops when a piece that has entered does not exit in due time.

**MAINTENANCE-FREE DESIGN**

Built in automatic rinsing system with timers for washing all spots where pumice would tend to accumulate or creep out.

Complete separation of pumice section from bearings by means of an interspace 150mm (6") wide.

No gaskets or other protections subject to wear but simple open clearances with spray shields.

One handle only for precise simultaneous adjustment of all brushes (reading of brush height on digital gauge).

Quick brush replacement.

Although originally designed for use with pumice, upon request, the machine can be equipped with a reclamation system allowing to operate with other abrasive powders such as Aluminium Oxide. The difference lies in the fact that pumice is utilized in a closed loop and the contaminants removed from the surface are collected in the slurry tank, whereas Aluminium Oxide can be continuously washed during operation of the machine allowing for a very long life of this type of abrasive slurry.

**PUMIFLEX 2000**

A "clever" machine for scrubbing flexible and rigid boards

The PUMIFLEX is the best solution to the problem of cleaning inner layers of multilayers when the base materials come directly from the manufacturer and is therefore contaminated with grease, oxide, fingerprints, and protective coatings which cannot be removed with the weak action of chemicals or jets of abrasive slurry.

No other cleaning system offers the aggressive approach with abrasive and brushes tangent to the surface which is a must in order to expose a clean, virgin surface, rich with peak points, for best adhesion of dry-film.

**PUMIFLEX-SHD/A for use with Aluminium Oxide or Pumice**

PUMIFLEX-SHD/A

Patented "CLEVERBRUSH" system which stops the brushes and/or starts them in the proper direction and at the right time in order to avoid damage to thin foils.

No guides or grids underneath the brushes.

A special transport system with guides supports the foils throughout the rest of the machine.

Computer-controlled conveyor rollers automatically ensure the required minimum distance between pieces.

Input conveyor rollers automatically stop when the situation does not correspond to the data preset in the program.

The machine automatically stops when a piece that has entered does not exit in due time.