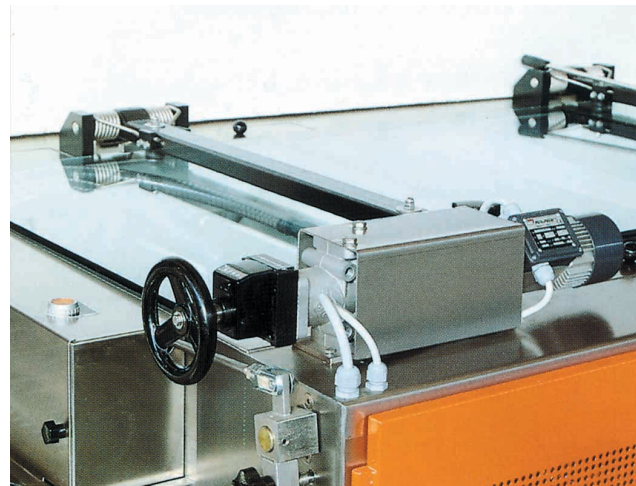


Further optional extras

- **Automatic brush pressure regulation**

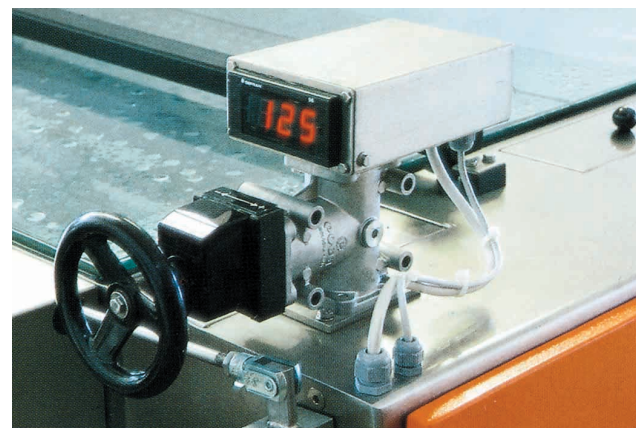
Each pair of brushes is driven by its own individual motor and a D.C. motor is fitted behind the conventional brush adjustment hand wheel as shown in the picture. The exact working pressure of the brushes is obtained by the elaboration of two data: board width and power absorption of the motor which drives the first pair of brushes. The operator must preset the width of the pieces to be processed and the desired working pressure. Sensors on the input conveyor detect the arrival of each board and an encoder monitors their position throughout the machine. As the leading edge of a board reaches the first pair of brushes, a Programmable Logic Control automatically adjusts brush height is maintained, waiting for the next piece. Brush height is altered only in the presence of boards to correct any variation in the preset values and maintain constant pressure irrespective of brush wear and thickness of boards.



- **Slurry Analyser: please refer to "PUMEX-SHD/A" leaflet for description and photographs.**

- **Brush pressure reading**

This can be supplied as an alternative to the above: a wattmeter measures the power absorption of one of the brush motors and gives an indication of brush pressure.



- **Thick Board Option**

The standard machines can process boards with a maximum thickness of 3.2 mm. Separate adjustment of upper and lower bushes by means of two hand wheels with separate reading of upper and lower height on digital gauges allows for processing boards with thicknesses up to 12.7 mm.

NOTE: This modification and the option "Automatic brush pressure regulation" cannot be applied together on the same machine, but only as an alternative to each other.

- **Board alternator on input conveyor**

This device automatically distributes the boards across the entire conveyor width to optimize brush wear. See picture on the SCRUBBEX-2000 leaflet.

- **Exit conveyor with centering device**

The boards, staggered across the conveyor by the board alternator, are automatically centered after they exit the last processing station.

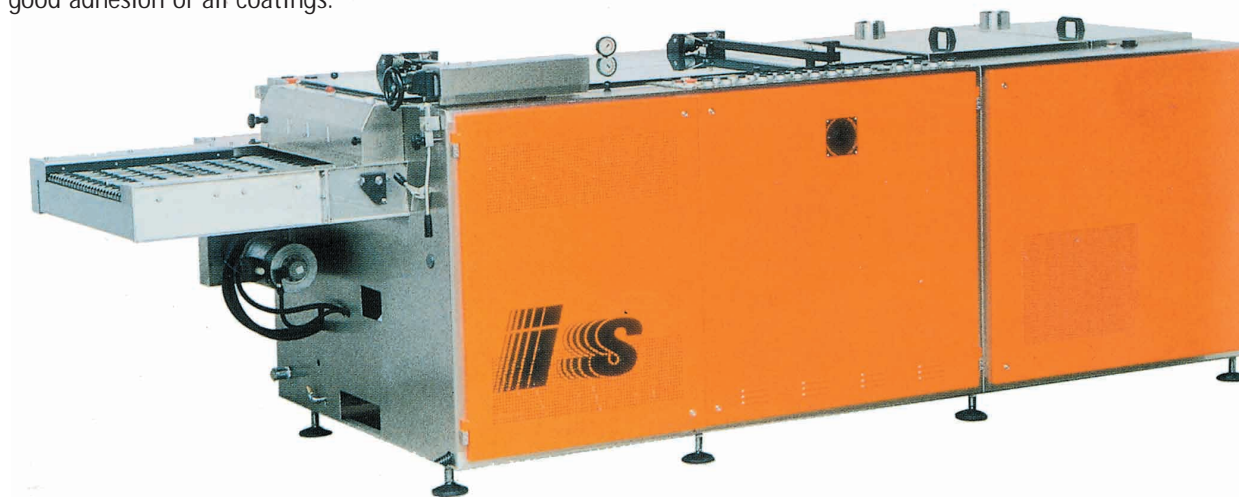
- **Exit conveyor**

This is added upon request only, since in most cases our pumice scrubbers are installed in line with other conveyorized processing equipment (such as dry-film laminators) or automatic unloaders.

- **Separate electrical console** with cables for connection to the machine body. Normally the electrical console is incorporated in the basic machine body. Upon request this can be supplied as an optional extra. In some other cases the electrical console must be fitted and therefore is delivered as a standard item.

CELEPPO
PUMEX

Highly efficient scrubbers of modular design for surface preparation prior to dry-film lamination or other printing operations. This answers the increasingly challenging requirements in the production of fine line high quality circuitry, where the absolute absence of any contaminants from surface and holes must be guaranteed, whilst the surface topography must be perfectly suitable for good adhesion of all coatings.



Main features

- The best surface preparation
- Removal of all contaminants and foreign particles
- Modular design
- Maintenance-free construction

Main uses

The major suppliers of dry-films and solder masks emphasize the need to prepare the board surface by scrubbing (with nylon brushes and a slurry of pumice or of other abrasive powders) prior to coating so as to ensure consistent quality of the surface in almost all environmental conditions irrespective of the time lapses between the various manufacturing steps of the printed circuit board. The nature of the residues left on the boards by the base material suppliers or by other processes in manufacturing, are continuously evolving. This means that the mechanical action of the brushes tangent to the board surface is a must to obtain repetitive yields. The copper surface is perfectly cleaned and the resulting topography is the most suited for adhesion thanks to the peak-rich area obtained. This method of preparation is the industry standard.

The narrow processing window of other methods, such as chemical cleaning or jet scrubbing, do not at all guarantee the same consistency in all the different conditions which may arise (see inside for more details). The 2000 SERIES scrubbers have been developed in the light of new approaches to producing fine line circuitry. Surface preparation plays the most important role out of all the manufacturing steps to be performed. The versatility of this cleaning method and the wide range of abrasive powders which can be employed in these scrubbers allow to control and adapt the surface profile (roughness) according to the standards required by today's and tomorrow's technology.

We reserve the right to carry out modifications without prior notice.

PUMEX-PUMIFLEX
WET SERIES 2000 SERIES

BRUSH SCRUBBING
AND DEBURRING MACHINES FOR
PRINTED CIRCUIT BOARDS

The best surface preparation

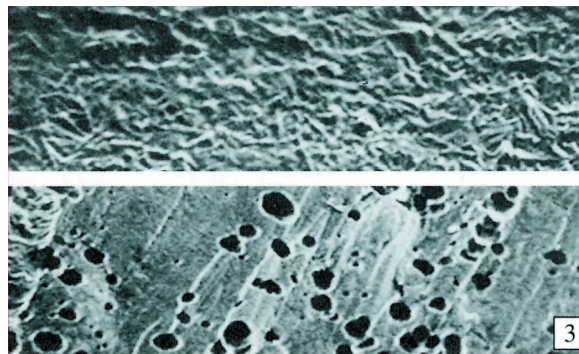
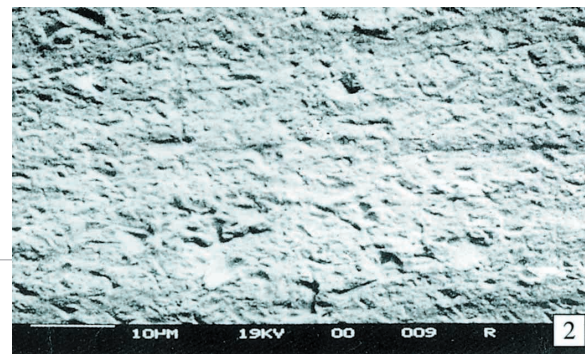
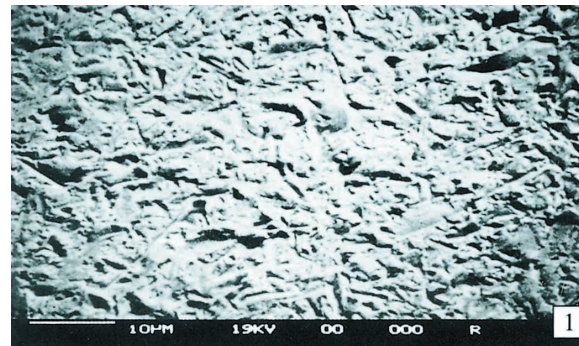
Picture 1 shows the copper surface after scrubbing with nylon brushes and pumice suspension. Similar results can be obtained by using a suspension of other abrasive powders such as aluminium oxide, quartz, etc. The combined action of the abrasive particles and nylon brushes is tangent to the surface: all contaminants, irrespective of their nature, are mechanically removed and the fresh virgin copper underneath them is uncovered. The copper has a homogeneous, rough, deeply attacked surface and the microscopic action of the abrasive particles has created a rough, peak-rich surface, which is ideal for good adhesion of all coatings. This is particularly the case when using the dry-films whose suppliers clearly call for pumice scrubbing in their specifications.

Picture 2 shows the surface obtained with the hammering action of the jet cleaning technique. Note the absence of high peaks necessary to "lock" the coating into place for fine-line circuit production. This kind of preparation only alters the surface topography and there is no mechanical action tangent to the surface to uncover clean virgin copper.

Picture 3 highlights the results obtained with chemical cleaning. The photograph shows two areas on the same board where the nature of the contaminant was obviously different than the one the chemical solution was supposed to attack; thereby proving the selective surface treatment obtained in such cases. Many manufacturers will recall similar experiences in which at the first change in the nature of the contaminants present on the board surface, chemical cleaning fails to perform.

As a conclusion it can be stated that the aggressive approach with a suspension of abrasives and nylon brushes is a must in order to expose a clean, virgin surface, rich with peak points, for best adhesion of dry-film. Many laboratory tests as well in-depth industry studies, clearly indicate that this cleaning method consistently provides the best surface treatment for highest resist performance in fine line applications.

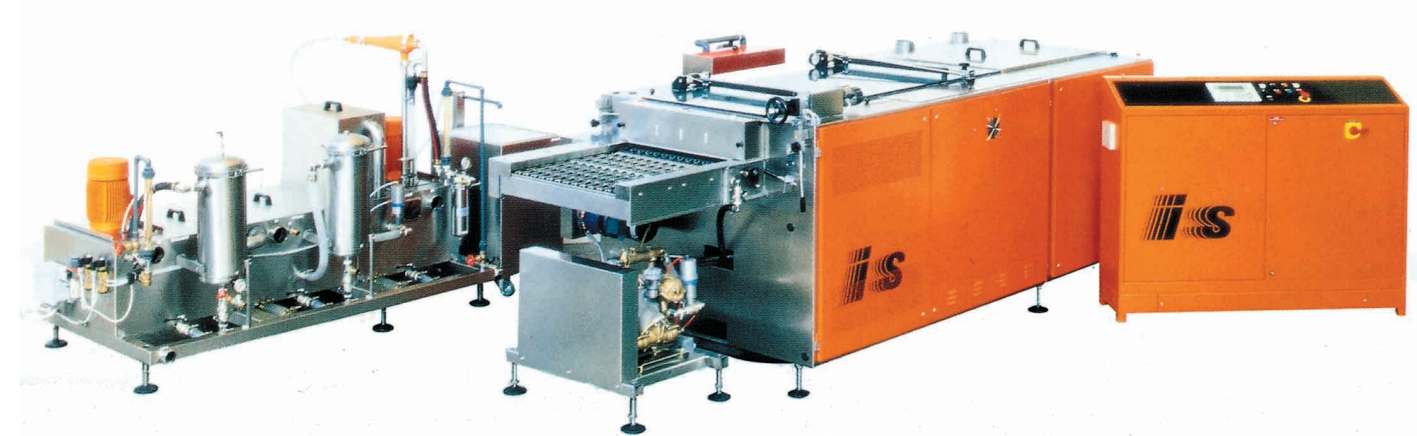
Please ask for our printed technical report on surface preparation, where all cleaning methods are compared and analyzed in detail.



Type, life and disposal of the abrasive media

Traditionally, International Supplies has always promoted the use of brushes and a pumice suspension in total recirculation to obtain the best surface preparation. The alternative offered to the industry by other equipment manufacturers was a jet spray machine with a pumice suspension only.

In an attempt to overcome the insufficient mechanical action of such a system on the board surface, some manufacturers promoted the use of similar jet spray machines with a harder abrasive powder: Aluminium Oxide. The Pumex and Pumiflex 2000 models are perfectly suitable to operate with either pumice or aluminium oxide. Both offer some advantages versus the other, and it is important to note here that the well-known proven advantages inherent in our unique system – the mechanical action of brushes tangent to the board surface – is ensured in both cases.



The picture shows a typical configuration including separate electrical console (see following page) as well as a Filtrix 2000 system.

FILTREX 2000

A complete system of modular design for water recirculation, filtration and recovery of abrasives. All modules are mounted on a frame with adjustable feet. Electrical, mechanical and hydraulic connections between the different modules are included so that the unit only needs connection to utilities and to the scrubber. All electrical controls and push buttons are located inside the electrical console of the scrubber itself.

Description of standard modules

The picture and schematic drawing on the left show a typical combination of modules as an example only: the customer can choose among a variety of options by combining any number of the standard modules described below.

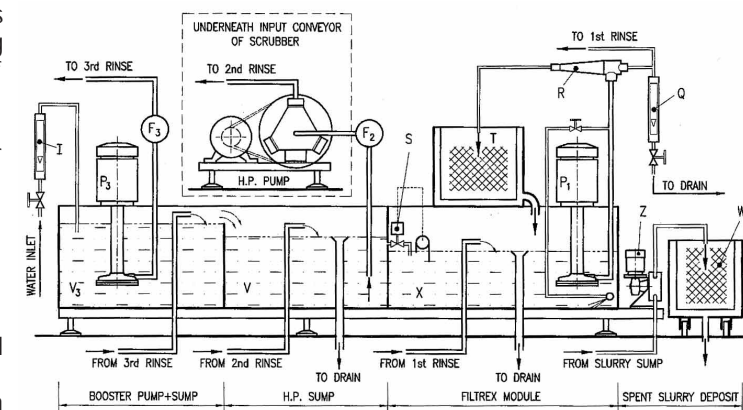
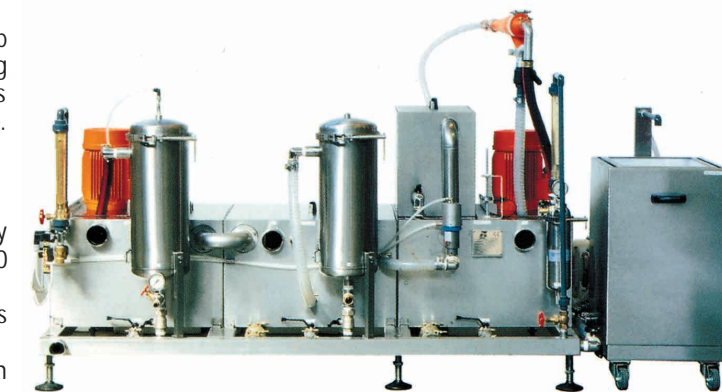
Filtrix Module: Rinsing water is pumped through a cyclone and is sprayed in the 1st rinsing chamber. The abrasive particles are forced towards the tip of the cone (R) and return to the sump in a relatively small quantity of water. A small adjustable amount of water bleeds to drain through a flowmeter (Q) and adjustment valve at outlet. Water level is automatically maintained by a level control which actuates a solenoid valve allowing an equivalent amount of water to cascade backward from the sump of the following rinse section.

Spent slurry deposit: Whenever necessary peristaltic pump (Z) empties the slurry tanks of the scrubber into dumping tank (W) with filter bag. This tank is mounted on wheels to facilitate extraction, bag replacement and maintenance.

High Pressure Rinse: A diaphragm pump with a 7.5 kW motor is located underneath the input conveyor of the scrubber. This is connected to the sump and large capacity bag filter. Water is sprayed at a pressure of 100 bar/1.450 p.s.i. (24") and 80 bar/1.160 p.s.i. (30") through one upper and one lower spray pipe with 2" high impact" nozzles in the central rinse chamber of the scrubber. Water cascades backwards from the following rinse section into the tank. Some water overflows to the sump of the previous

Section through (S) while all exceeding water overflows to the sewer. This unit is highly recommended for cleaning through holes and fine lines in the case of soldermask application. A more powerful system with two diaphragm pumps is available: in this case the relative rinse chamber is equipped with a total of four spray bars with high pressure nozzles instead of two.

Booster Pump and Sump: Water recirculation sump with a 4 kW and a large capacity filter bag on pump outlet with pressure gauge. A flowmeter with solenoid valve at inlet ensures great savings by adjusting the water flow to the minimum necessary for renewing and cascading the recirculated water. This unit can be combined with more units of the same type for connection to more than one rinse section.



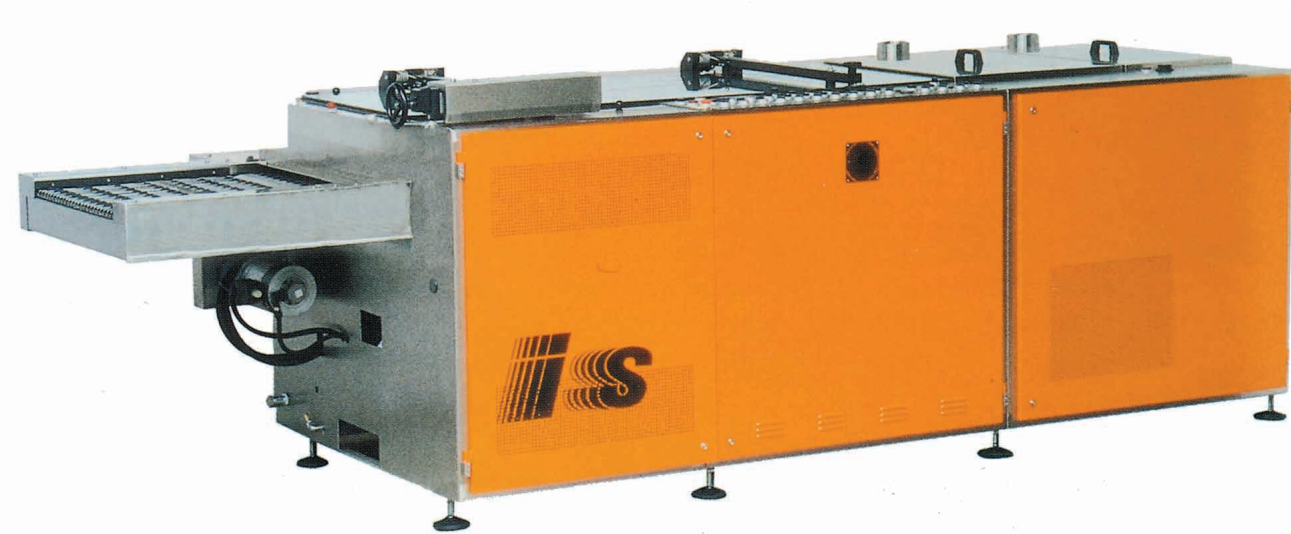
CONVEYORISED MACHINE FOR SCRUBBING RIGID BOARDS

This machine is ideal for scrubbing prior to Primary Imaging and Solder Mask coatings.

The picture shows the most popular combination of modules: PUMEX-2000, with SHD/A Drying Module (see leaflet "SHD/A drying" for further details).

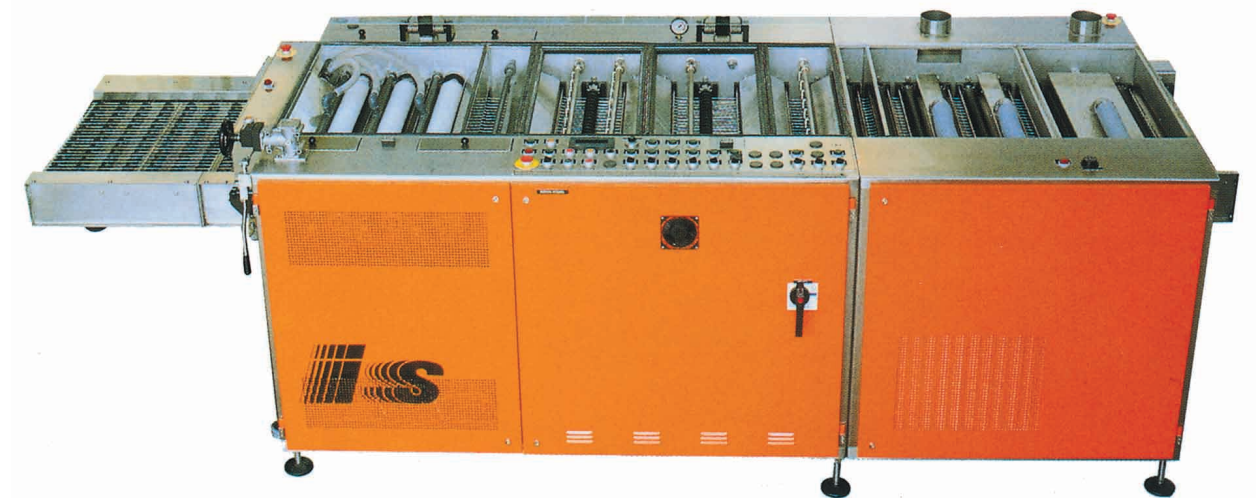
Maximum thickness of boards: 3,2 mm (for "Thick board option" see page 8).

Minimum thickness of boards: 0.8 mm (for thinner foils see Pumiflex on front page).



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 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 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 adhesions of dry-film.



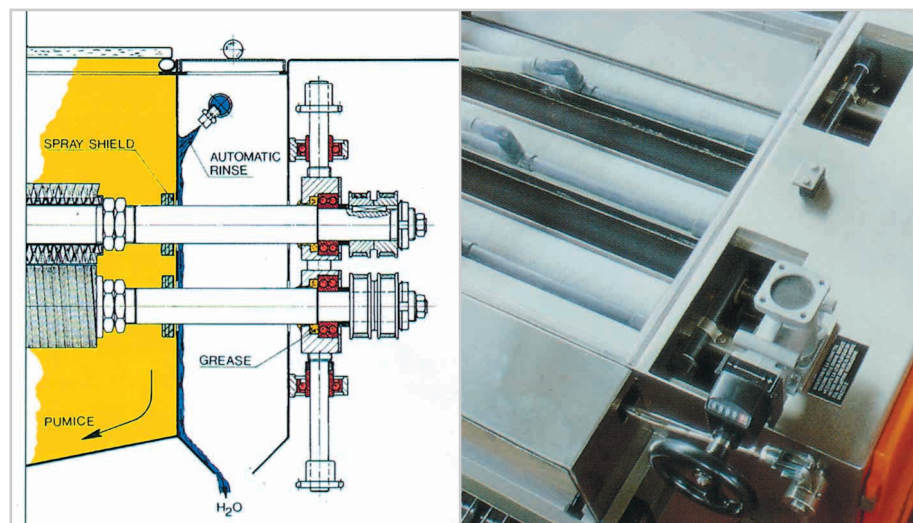
Maintenance-free construction (for PUMEX and PUMIFLEX models)

Pumice was the enemy n° 1 of mechanics and the very first pumice scrubbers were referred to as "self-destroying". The main reasons for seeking alternatives to pumice scrubbing were not for lack of results in the actual surface treatment, but because of mechanical problems on machines working on an industrial scale. If the first pumice scrubbers developed had been adequately constructed, then other surface treatments would probably never have found a place in this industry.

With the I.S. maintenance-free design all gaskets and other similar protections subject to wear are eliminated: only simple spray shields prevent the abrasive suspension slurry from flowing through the shaft opening on the side walls. The scrubbing section is completely isolated from bearings and brush mechanisms by means of two separation chambers along each side of the machine where a built-in automatic rinsing system with timers washes away abrasive residues before they accumulate or creep out.

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

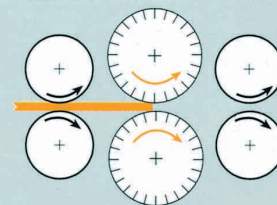
The picture shows a top view of one of the separation chambers.



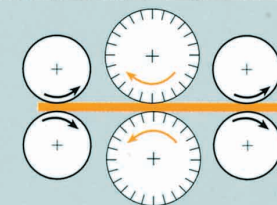
The "CLEVERBRUSH" system

THE "CLEVERBRUSH" SYSTEM

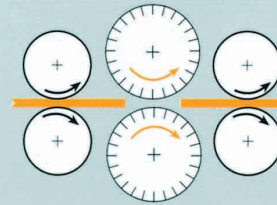
Leading edge of foil is conveyed under the brushes.



Brushes stop and reverse



Brushes reverse once more, ready to process the next piece



The purpose of this system is to allow brushing of thin materials without damage. This 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 and abrasive.

The sheets are placed onto the input conveyor one after the other, with their edge parallel to the direction of transportation.

- 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 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 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.

Modular design

This offers the possibility of combining various modules to build processing lines to comply with different requirements and special requests.

Both basic machines (Pumex 2000 and Pumiflex 2000) include:

- Input conveyor with a suitable number of rollers.
- Scrubbing: the boards are processed on both sides by three pairs of fast rotating nylon brushes sprayed with abrasive in suspension in water. This suspension is recirculated by a pump in a suitable tank where it is automatically and constantly stirred.
- Pre-rinse chamber.
- Three stage washing with water sprays.

DESCRIPTION OF ADDITIONAL MODULES

PVC Acid Rinse

Ideally suited for an acid rinse to remove heavy oxides, conversion coatings, chromates, etc.

Ultrasonex for hole cleaning

Ultrasonic energy is applied to water through which the board are conveyed in immersion (see picture in the "Scrubex-2000" leaflet).

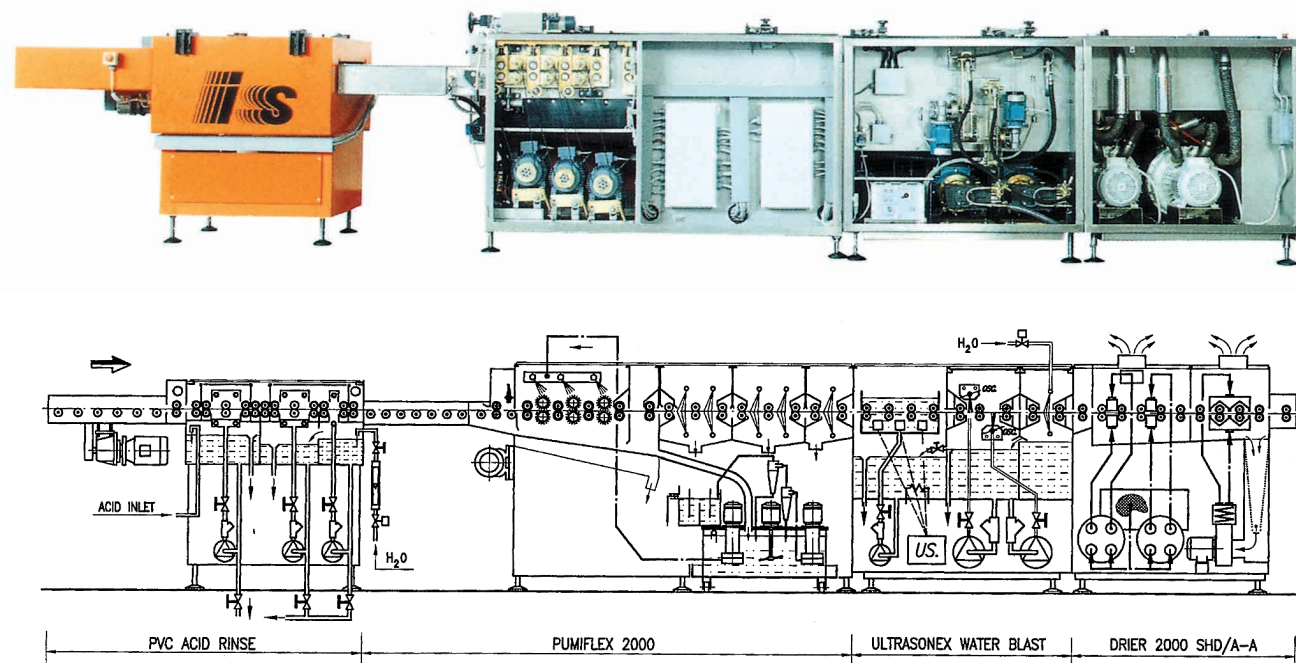
Water Blast

Four upper and four lower knife-shaped nozzles, in staggered position, very close to the boards, oscillate to cover the whole conveyor width and thoroughly clean the holes with strong jets of water at pressure of 115 bar/1.670 p.s.i. (for the 24" version) or 90 bar/1.300 p.s.i. (for the 30" version). The strong mechanical action thus applied to the boards (=impingement) ensures complete through-hole washing. For further details and picture see the "SCRUBBEX-2000" leaflet).

Drier-2000 SHD/A (or SHD/A)

The main features of these innovative modules are: lint-free design (no cotton or other materials which may leave foreign particles on the boards), total filtration of the air and sealed construction so that no dust or other particles can accumulate inside (see leaflet "SHD/A Drying" and "rolly shd/a" for further details).

Front view (all doors removed) of a high production surface preparation line including: PVC Acid Rinse Module at input for the removal of deep oxides and other heavy contaminants, PUMIFLEX-2000 brush scrubber, Ultrasonic/Water Blast module to ensure thorough cleaning of holes and spacings between conductors, final drying module.



PUMICE

Pumice offers the highest quality results when used in combination with the mechanical action of brushes. The pumice slurry is agitated and recirculated in a closed loop. Before proceeding into the first rinse section, the boards pass through a pre-rinse chamber where they are washed with "cyclone separated water" which comes from the pumice slurry tank itself. In this way, the pumice drag out the first rinse is reduced to a minimum. The rinse water is relatively clean and contains practically none of the contaminants which have been kept back

inside the system. The highly contaminated slurry is disposed of in solid form. The life of the pumice slurry can range from 18 to 24 hours of effective production under normal conditions. **Brush Scrubbing with pumice** is still by large the most popular surface preparation method. The wide processing window ensuring consistent quality in all environmental conditions and the availability of equipment of low-maintenance design, such as our PUMEX and PUMIFLEX, are the main reasons for the long lasting success of this process.

Aluminium oxide

The high specific weight allows for continuous and efficient separation from water so that Aluminium Oxide is totally reclaimed and kept back inside the slurry tank. Filling with this abrasive is done initially and then additions are only occasionally required to compensate for drag out. Water continuously flows through the slurry tank keeping it clean while contaminants from the board surface such as oxides and metallic copper leave the system with the water.

Aluminium Oxide is much harder than pumice (9 on the Mohs' scale, compared to 5.5 of pumice) and is not subject to breaking down. The previously mentioned advantage of the high specific weight and the consequent possibility of using Aluminium Oxide for long periods of time is further enhanced by the fact that the sharp edges of its particles do not show any considerable deterioration caused by usage.

This is an important advantage for the larger volume manufacturers where the disposal of large quantities of spent pumice would add considerable costs to the process.

Another advantage offered by Aluminium Oxide is that it is an artificially produced abrasive and therefore the grain size is available in a much tighter "window" than pumice powder which is a natural product: based on the characteristics of the boards to be produced (width of conductors and spacings, diameter of holes) and on the desired surface treatment (preparation of copper to dry-film lamination, preparation to solder mask application, etc.) the end user may choose the proper size of particles. Although tests in the field have clearly shown that the results obtainable are not as good as those obtainable with pumice, the use of this abrasive in our brush scrubbers is gaining in popularity. This is mainly due to the environmental advantages created in regard to reduced waste disposal requirements, specially for the larger volume manufacturers.



Slurry tank mounted on wheels, equipped with reclamation system, suitable for operation with different kinds of abrasive mediums such as pumice and aluminium oxide.

