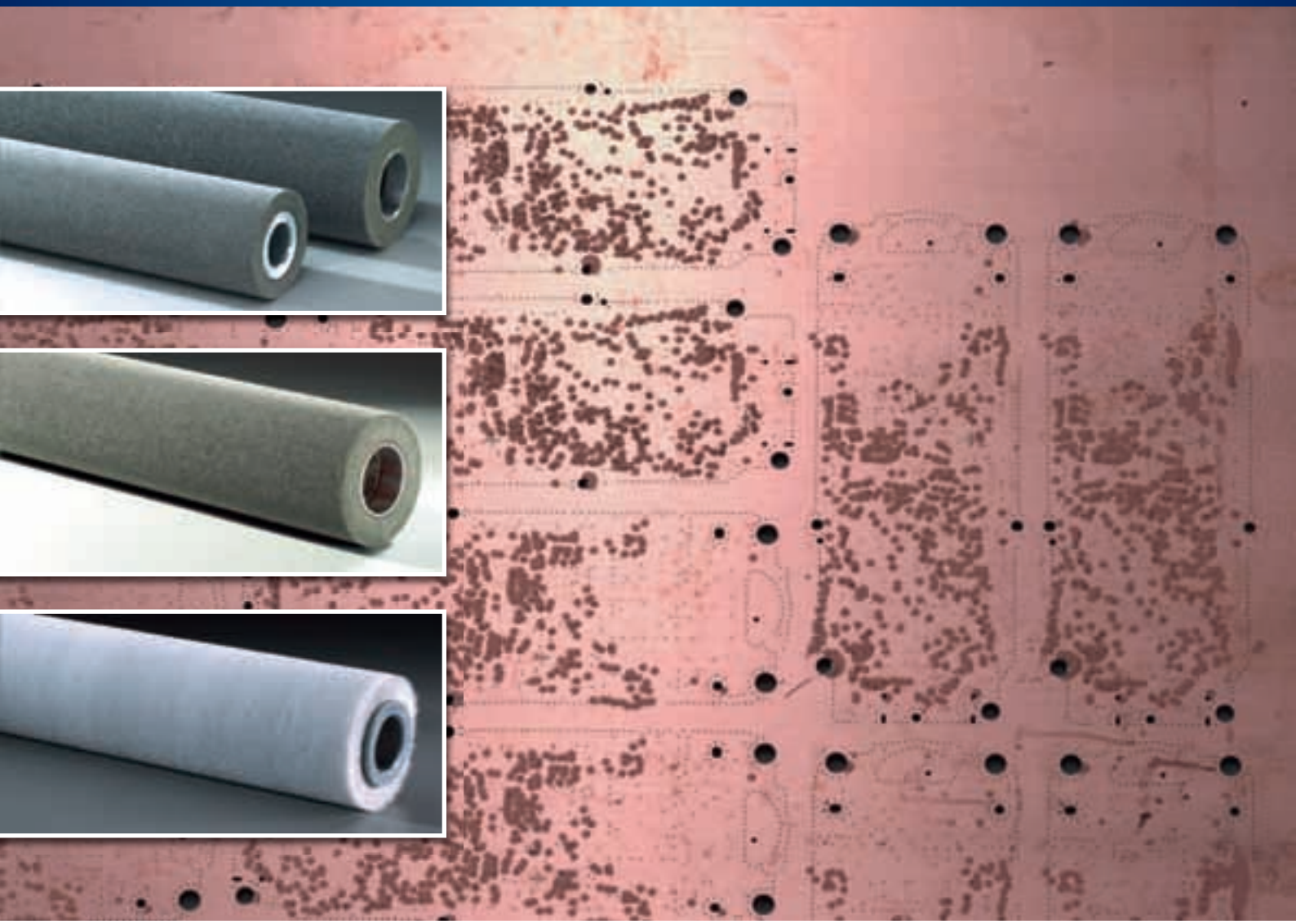
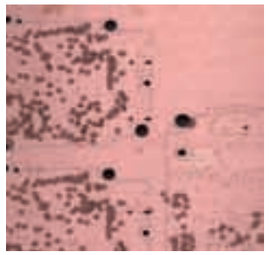


INNOVATIVE SOLUTIONS

FOR PRINTED CIRCUIT BOARD PROCESSING

- Deburring
- Cleaning/Deoxidising
- Resin Removal
- Finishing
- Pressplate Cleaning

PRINCIPLES IN MANUFACTURING AND DEVELOPING SURFACE FINISHING ROLLERS



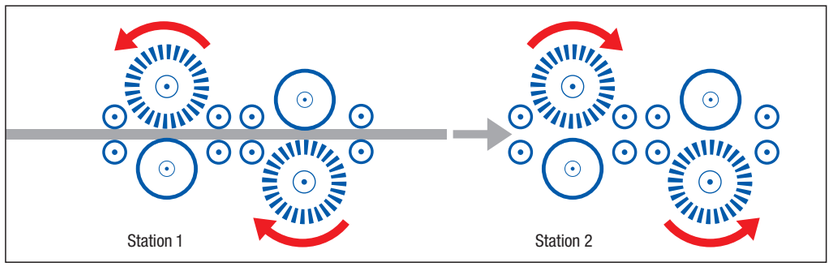
Printed Circuit Board manufacturing has changed dramatically in recent years and production processes can no longer be simply described as: deburring, cleaning or finishing.
We have not only had to broaden our vocabulary but also extend and develop the range of brushing rollers used for mechanical surface processing.

Highly competitive global markets dictate that only the fittest survive hence high reliability, stability and long durability have become a necessity.

We have a range of brushing rollers to meet these goals, all producing the same uniform performance, throughout a long service life. High quality materials tightly packed to maximum density offering the necessary "bite". The three dimensional open web construction ensures a "self-cleaning action", it prevents loading of contamination and the generation of excessive heat or "baking".

New abrasive particles are continually exposed to produce a consistent and uniform finish. Special treatments ensure that, even when wet, the rollers remain hard and resilient.

To the proven range of LIPPROX® Clean Deburring Rollers, there have been added the LIPPRITE® Super Cut Rollers, LIPPRITE® High Resolution Finishing Rollers and LIPPRITE® Soldermask Finishing Rollers. The LIPPRITE® Pressplate Cleaning Rollers complete this range.



Station 1:
Top roller rotates with the board.
Bottom roller rotates with the board.

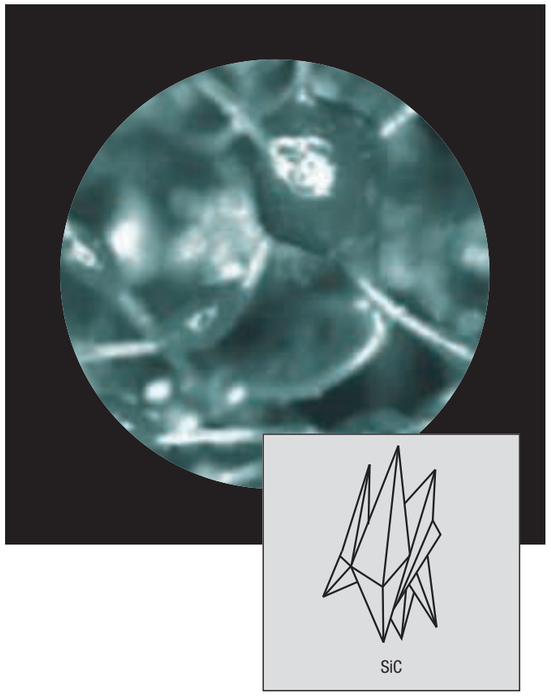
Station 2:
Top roller is counter rotating.
Bottom roller is counter rotating.

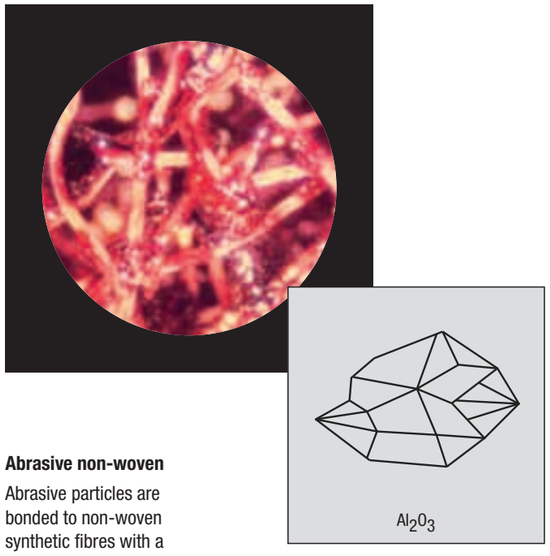
A brushing machine with **4 heads** is highly recommended for all brushing operations!

The alternating direction of rotation is the distinct advantage of this set-up. Drilled holes are consistently deburred in the brushing direction. This set-up permits a considerable increase in feed rate. Brushing against feed direction on station 2 ensures that copper particles and brush debris are thrown behind the board.

Operating Parameters

Cutting speed:	12 – 18	[m/s]	Brush speed is generally determined by the machine manufacturer
Feed rate:	1.5 – 2.5	[m/min]	
Pressure:	1.0 – 1.5	[kW]	Ishi Hyoki, Marugen, Seiko, Pola & Massa, I.S:
	40 %	[load]	Schmid, HMS Höllmüller
Oscillation frequency:	240 – 500	[strokes/min]	
Oscillation path:	3 – 10	[mm]	
Coolant:	wet	[water]	
Rinsing on PCB:	up to100	[bar]	
Rinsing on brush:	max. possible	[bar]	i.e. full flow as determined by machine
No. of brushes:	4 – 8		2 top / 2 bottom or 4 top / 4 bottom





Abrasive non-woven

Abrasive particles are bonded to non-woven synthetic fibres with a resin adhesive.
Different combinations of adhesive and abrasive together with nylon web generate diverse products to meet different demands.

Available grit sizes

LIPPERT-UNIPOL specification	Quality (FEPA)	International specification		Cu		St. 1.4542	
				Rz [µm]	Ra [µm]	Rz [µm]	Ra [µm]
S4	SiC 120	MEDIUM S	MED S	5.0 – 7.0	1.20 – 2.50		
S6	SiC 180 / 240	FINE S	FN S	3.0 – 5.0	0.70 – 1.20		
S7	SiC 320	VERY FINE S	VFN S	2.0 – 3.0	0.30 – 0.45		
S8	SiC 500 / 600	SUPER FINE S	SFN S	1.5 – 2.5	0.25 – 0.35		
S9	SiC 800 / 1000	ULTRA FINE S	UFN S	1.0 – 2.0	0.15 – 0.25		
S10	SiC 1200 / 1500	MICRO FINE S	MFN S	0.7 – 1.2	0.10 – 0.15		
A4	Al_2O_3 120	MEDIUM A	MED A			1.60 – 2.50	0.15 – 0.30
A5	Al_2O_3 150 / 180					1.20 – 2.00	0.14 – 0.25
A6	Al_2O_3 240	FINE A	FN A			1.00 – 1.60	0.13 – 0.15
A7	Al_2O_3 320	VERY FINE A	VFN A			0.60 – 1.20	0.08 – 0.14

Surface Roughness Measurements

Rz	Results (measured values) are calculated as mean values from 5 consecutive measurements
Ra	The arithmetic average of the absolute values of the roughness profile ordinates
Rt	Maximum roughness, the distance between the highest peak and the lowest valley within the evaluation length

LIPPROX® CDR
CLEAN DEBURRING ROLLER

LIPPROX®

A convolute non-woven roller. Non-woven material is wound around a tube and polymerised.
LIPPROX® rollers are ideal for deburring since they offer considerably longer life and higher performance than comparable flap rollers.

Roller Construction

Important:

Every LIPPROX® Roller is clearly marked with a directional arrow, rollers must rotate in the direction shown.

LIPPROX® – burr removal prior to plating

Despite the introduction of high speed drills, an entirely burr free hole is rarely possible. To avoid subsequent errors, shorts or missing connections, it is necessary to ensure that the geometry of the hole edges is as precise as possible. Especially for this process, LIPPERT has developed the roller type LIPPROX®, already proven throughout the world.

Your advantages:

- uniform surface quality
- intense cleaning performance
- perfect preparation for electroplated copper coating
- minimal radiusing of the edges
- minimal brush debris
- drilled holes are not blocked by contamination from the boards or rollers
- no damage to the edges of the bore
- no clogging of brush surface
- extremely long life
- regular hardness and abrasion throughout the entire service life
- dynamic balancing available
- metal flanges for a perfect fit (no tolerance problems) and concentric run

PCB made of Teflon base material.

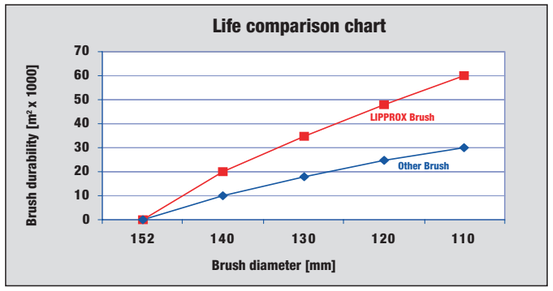
Deburred with LIPPROX® and perfectly metallized.

Cross-section of a bore of 0.30 mm – enlarged 500 : 1.

Base copper only 5–9 µm. Deburred with LIPPROX® and perfectly metallized.

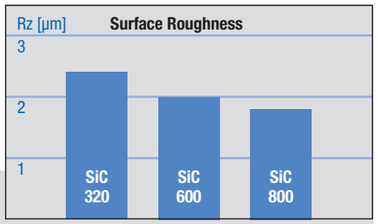
Cross-section of a bore of 0.50 mm – enlarged 100 : 1.

Base copper only 18 µm. Deburred with LIPPROX® and perfectly metallized.

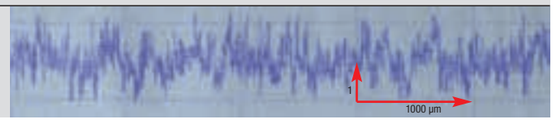


Durability

LIPPROX® Clean Deburring Roller is enhanced by the special LIPPERT bonding system that ensures a high service life of over 50,000 m² panel surface.



Surface Roughness

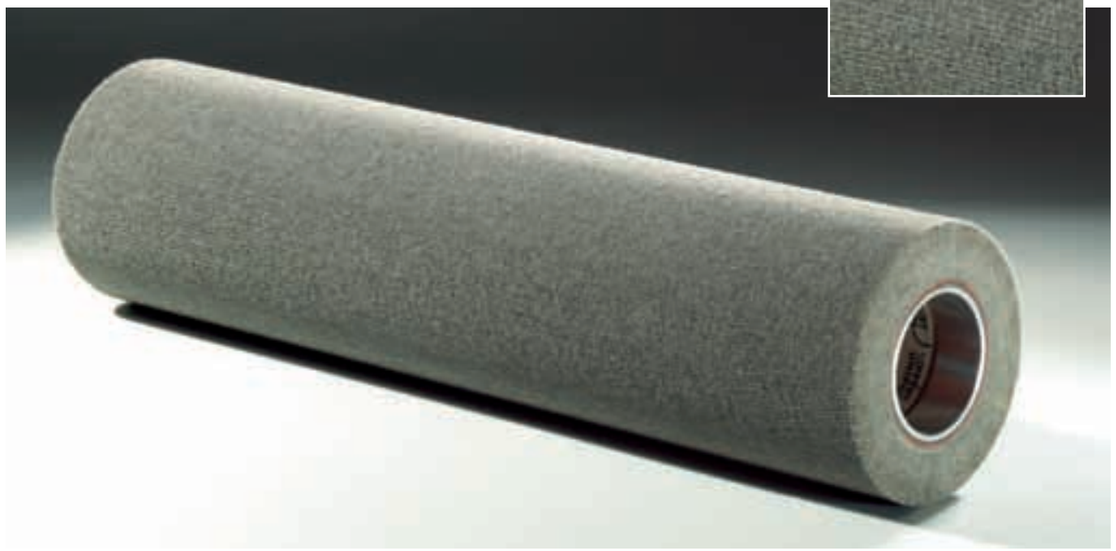
Brushing Roller Type	Expected surface roughness Rz (µm)	Roughness Profile
LIPPROX® CDR S8 H7 (super fine SiC 500/600)	2.0	

Product Recommendation

LIPPROX® Clean Deburring Roller	**S8* C2 H6**	super fine SiC 500/600 med. density	Rz = 2.0 µm
LIPPROX® Clean Deburring Roller	**S8* C3 H7**	super fine SiC 500/600 high density	Rz = 2.0 µm

*also available in **S7 SiC 320/400** and **S9 SiC 800/1000**

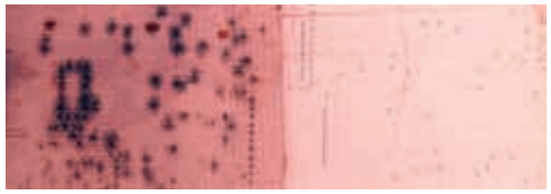
LIPPRITE® SCR
SUPER CUT ROLLER

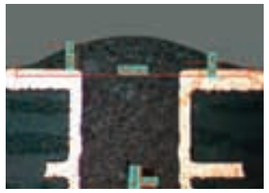


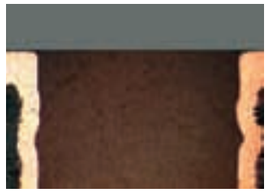
LIPPRITE® SCR

- **Removing residual copper “nodules” after plating (surface preparation prior to lamination)**

  After the panel plating process there may be copper “nodules” sticking to the surface. LIPPRITE® Super Cut Roller will reduce nodules to a minimum and smooth the gritty appearance.







- **Removal of built-up resin ink spots in SBU process**

  To protect through plated holes from etchant used in the subsequent etching process, holes are filled with ink resin (UV-hardened or heat hardened). Intensive scrubbing power is required to remove mushrooms of resin from the boards. LIPPRITE® Super Cut Rollers produce a uniform, smooth and flat surface structure.

- **Finishing for BGA process**

  This process demands the removal of excessive ink resin, either conductive or insulative, whilst increasing micro roughness for perfect adhesion of laminate.

- **Removing black oxide from IVH and BVH process**

  After the black oxide process for internal via holes (IVH) and blind via holes (BVH), the black oxide must be removed. LIPPRITE® Super Cut Rollers provide maximum cleaning performance and uniform surface quality.

- **Burr removal prior to plating**

Your advantages:

- uniform surface quality
- intense cleaning performance
- increased micro roughness
- increased adhesion of ink resist
- remains hard under wet conditions
- low risk of hole blockage
- no damage to the bore edges
- no clogging of brush surface
- dynamic balancing available
- metal flanges for a perfect fit (no tolerance problems) and concentric run

Flap Construction

Abrasive non-woven flaps are bonded radially to a phenolic core. Treatment with synthetic resin stiffens the LIPPRITE® Roller improving performance and extending its suitability for a range of applications.

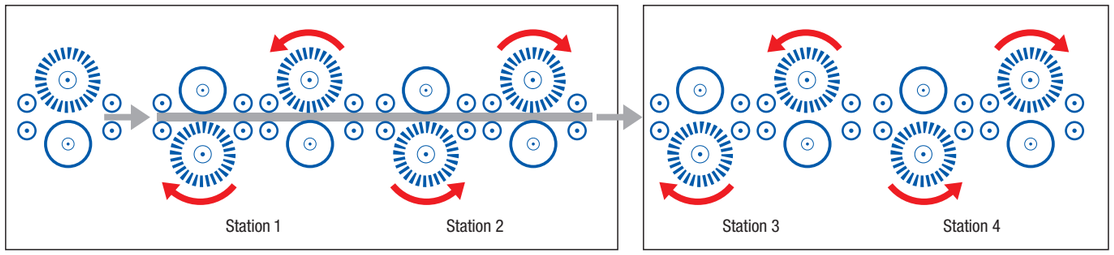
Direction of brush rotation

Station 1 (and 3):
Top roller must rotate with the board.
Bottom roller must rotate with the board.

Station 2 (and 4):
Top roller must counter rotate.
Bottom roller must counter rotate.

Machine set-up for:

- Removing built-up resin ink spots
- Finishing for BGA process

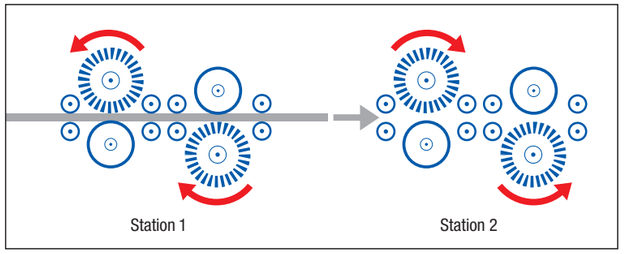


Process/Product Recommendation

Surface levelling:	**Ceramic roller**			
Station 1:	**Ceramic roller**			
Station 2:	**LIPPRITE® Super Cut Roller**	S7 D109 I22	VFN (SiC 320)	Rz = 2.5 µm
Station 3:	**LIPPRITE® Super Cut Roller**	S8 D109 I22	SFN (SiC 600)	Rz = 2.0 µm
Station 4:	**LIPPRITE® Super Cut Roller**	S9 D109 I22	UFN (SiC 800)	Rz = 1.5 µm

Machine set-up for:

- Removing residual copper “nodules” after plating (surface preparation prior to lamination)
- Removing black oxide from IVH and BVH process



A brushing machine with **4 heads** is highly recommended!

Process/Product Recommendation

Station 1:	**LIPPRITE® Super Cut Roller**	S8 D109 I22	SFN (SiC 600)	Rz = 2.0 µm
Station 2:	**LIPPRITE® Super Cut Roller**	S9 D109 I22	UFN (SiC 800)	Rz = 1.5 µm

LIPPRITE® HFR
HIGH RESOLUTION FINISHING ROLLER

LIPPRITE® HFR

With finer circuitry, the dry film lamination process has become very common. Dry film must adhere perfectly to the copper surface of the laminate to ensure that there is neither contact failure nor under-etching during the subsequent etching process.

Prerequisites include a clean, matt surface with no oxidation and minimal reflection properties.

LIPPRITE® High Resolution Finishing Rollers guarantee a defined and reproducible surface roughness.

Multi Purpose

LIPPRITE® High Resolution Finishing Rollers are ideal for:

- **cleaning and deoxidising prior to dry film resist**
- **finishing prior to screen printing**
- **finishing prior to liquid resist**
- **finishing of inner layer**
- **finishing of flexible printed circuit boards**

Flap Construction

Abrasive non-woven flaps are bonded radially to a phenolic core. Treatment with synthetic resin stiffens the LIPPRITE® Roller improving performance and extending its suitability for a range of applications.

Your advantages:

- uniform surface quality
- intense cleaning performance
- increased micro roughness
- increased adhesion of ink resist
- suitable for fine line technology
- low risk of hole blockage
- no damage to the bore edges
- no clogging of brush surface
- dynamic balancing
- metal flanges for a perfect fit (no tolerance problems) and concentric run

High Reliability

The three dimensional open web construction ensures a “self-cleaning action”; it prevents loading of surface contamination and generation of any excessive heat or “baking”. Resilient brush construction allows the brush to follow an irregular surface.
New abrasive particles are continually exposed to the copper surface for a consistent and uniform finish.

Stability and Durability

LIPPRITE® High Resolution Finishing Roller is enhanced by our own synthetic resin based treatment: I20. This special impregnation ensures improved cleaning performance, a better cushioning effect and longer service life. A further advantage: the Printed Circuit Boards can be processed more quickly and there is a subsequent increase in productivity.

Surface roughness on copper

Experience
On a perfectly flat surface (with no waviness included in measurements), the values should lie between Rz 1.5 – 3.0 µm.

Values determined in the transverse direction i.e. at 90° to the surface structure, are the most meaningful.
In the PCB industry this is the most common method of measurement, although seldom specifically mentioned.

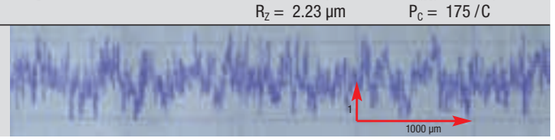
Measurements determined in longitudinal direction (parallel to the surface structure) are generally lower than those in transverse direction and are usually only taken for control purposes.

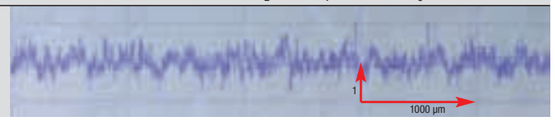
These values are imprecise since it is almost impossible for measurements to be taken parallel to the brushing structure.

Surface Roughness

Brushing Roller Type	Expected surface roughness Rz (µm)	Roughness Profile	R_A = 0.50 µm R_Z = 3.36 µm	R_{MAX} = 3.83 µm P_C = 158 /C
LIPPRITE® High Resolution S7 (very fine SiC 320)	2.5			

Note: Due to waviness of the surface, surface roughness values appear higher than they really are

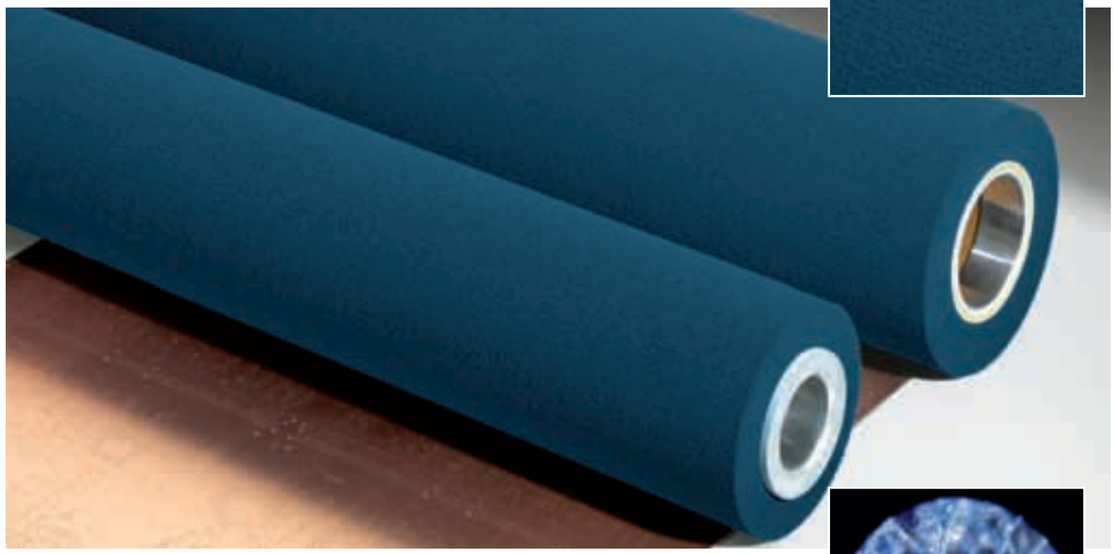
Brushing Roller Type	Expected surface roughness Rz (µm)	Roughness Profile	R_A = 0.31 µm R_Z = 2.23 µm	R_{MAX} = 2.52 µm P_C = 175 /C
LIPPRITE® High Resolution S8 (super fine SiC 500/600)	2.0			

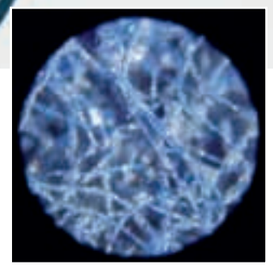
Brushing Roller Type	Expected surface roughness Rz (µm)	Roughness Profile	R_A = 0.24 µm R_Z = 1.61 µm	R_{MAX} = 1.70 µm P_C = 65 /C
LIPPRITE® High Resolution S9 (ultra fine SiC 800/1000)	1.5			

Product Recommendation

LIPPRITE® High Resolution Finishing Roller	S7 Di 107/109 I20	SiC 320	Rz = 2.5 µm
LIPPRITE® High Resolution Finishing Roller	S8 Di 109 I20	SiC 600	Rz = 2.0 µm
LIPPRITE® High Resolution Finishing Roller	S9 Di 109 I20	SiC 800	Rz = 1.5 µm

LIPPRITE® HFR*BLUE*
HIGH RESOLUTION FINISHING ROLLER





LIPPRITE® HFR*blue*

With finer circuitry, the dry film lamination process has become very common. Dry film must adhere perfectly to the copper surface of the laminate to ensure that there is neither contact failure nor under-etching during the subsequent etching process.

Prerequisites include a clean, matt surface with no oxidation and minimal reflection properties.

LIPPRITE® High Resolution Finishing Rollers guarantee a defined and reproducible surface roughness.

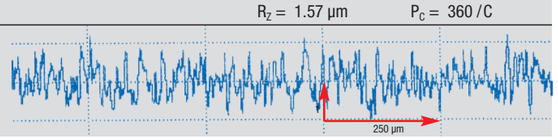
Your advantages:

- extra uniform surface quality without scratches
- intense cleaning performance
- increased adhesion of ink resist
- suitable for fine line technology
- low risk of hole blockage
- no damage to the bore edges
- no clogging of brush surface
- dynamic balancing
- metal flanges for a perfect fit
  (no tolerance problems) and concentric run

Flap Construction

Abrasive non-woven flaps are bonded radially to a phenolic core. Treatment with synthetic resin stiffens the LIPPRITE® Roller improving performance and extending its suitability for a range of applications.

Surface roughness on copper

Brushing Roller Type	Expected surface roughness Rz (µm)	Roughness Profile	R_A = 0.24 µm R_Z = 1.57 µm	R_{MAX} = 1.78 µm P_C = 360 / C
LIPPRITE® HFR*blue* (super fine SiC 500/600)	< 2.0			

Note: Laminate type FR4 with 7 µm copper layer

LIPPRITE® SFR
SOLDERMASK FINISHING ROLLER

LIPPRITE® SFR

- **Scrubbing prior to applying solder resist**

  Solder resist is applied by screen printing or through a photolithography method. It serves as insulation to protect the surface of circuitry and prevent deterioration or solder bridging. In this process, scrubbing must not be allowed to damage circuitry nor cause micro bridges.

- **Finishing of flexible Printed Circuit Boards**

  Due to their light weight, flexibility and bending properties, flexible printed circuit boards have been increasingly used, in recent years, for wiring interconnections in confined spaces.

- **Finishing of thin copper foils**

  Thin copper foils of just 50 – 100 µm thickness can be mechanically processed on a reverse brushing machine. Any risk of stretching, warping or folding is avoided.

- **Cleaning after tin lead solder**
- **Removing residue after remelting**
- **Gold tab processing**

Your advantages:

- uniform surface quality
- intense cleaning of circuitry
- increased micro roughness
- increased adhesion of ink resist
- suitable for fine line technology
- low risk of hole blockage
- no damage to the lines
- no clogging of brush surface
- dynamic balancing
- metal flanges for a perfect fit
  (no tolerance problems) and concentric run

Flap Construction

Abrasive non-woven flaps are bonded radially to a phenolic core. Treatment with synthetic resin stiffens the LIPPRITE® Roller improving performance and extending its suitability for a range of applications.

Product Recommendation

LIPPRITE® Soldermask Finishing Roller	**S8 D107 I20**	SiC 500/600	Rz = 2.0 µm
LIPPRITE® Soldermask Finishing Roller	**S9 D107 I20**	SiC 800/1000	Rz = 1.5 µm
LIPPRITE® Soldermask Finishing Roller	**S8 D107**	SiC 500/600	Rz = 2.0 µm
LIPPRITE® Soldermask Finishing Roller	**S9 D107**	SiC 800/1000	Rz = 1.5 µm

LIPPERT ABB
ABRASIVE BRISTLE BRUSH

Scrubbing prior to solder resist

Abrasive Bristle Brushes are an alternative to LIPPRITE® Soldermask Finishing Rollers if the main focus is the maximum elimination of brush debris. LIPPERT Abrasive Bristle Brushes are guaranteed not to leave any brush particles that could create a short on the PCB.

Your advantages:

- long brush life
- bent board edges or broken drill bits will not damage the roller
- chemical resistance

Product Recommendation

LIPPERT Abrasive Bristle Brush	**BD21 D2 0,45**	SiC 600	Rz = 1.5 – 2.0 µm
LIPPERT Abrasive Bristle Brush	**BD21 D2 0,25**	SiC 800	Rz = 1.0 – 1.5 µm

Burr removal prior to plating

Although Abrasive Bristle Brushes are not recommended for high end PCB, they can be used for consumer electronic PCBs with lines and spaces > 200 µm.

Abrasive Bristle Brushes produce a less uniform and more reflective surface than the finish created by an abrasive non-woven roller.

Product Recommendation

LIPPERT Abrasive Bristle Brush	**BD41 D2 0.75**	SiC 240	Rz = 2.5 – 5.0 µm
LIPPERT Abrasive Bristle Brush	**BD41/21 D2 0.55**	SiC 320	Rz = 2.0 – 3.5 µm

Specification:

Grit type	**SIC**				
Grit size	240	320	500	600	800
Filament dia. [mm]	0.75	0.60	0.50	0.45	0.25

LIPPERT NAB
NYLON CLEANING BRUSH

Your advantages:

… in a pumice system!

- non directional finish
- matt surface with minimal reflection properties
- increased micro roughness
- suitable for fine line technology (lines 50 µm apart)
- precise concentricity

Your advantages:

… in a wet system!

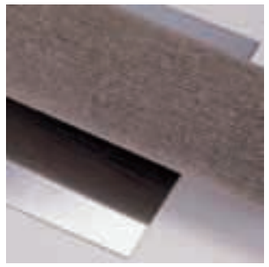
- perfect for cleaning of Liquid Crystal Display screen (LCD)
- suitable for cleaning of glass
- no scratches on the glass surface (LCD)
- minimum life of 60 operating days
- cleaning after Hot Air Levelling (HAL)

Product Recommendation

LIPPERT (NAB) Nylon Cleaning Brush	Nylon 0.30 [mm]
also available in Nylon	0.05 / 0.08 / 0.12 / 0.15 / 0.20 / 0.35 / 0.40 / 0.50 [mm]

LIPPRITE® PCR
PRESSPLATE CLEANING ROLLER

LIPPRITE® Pressplate Cleaning Rollers



Will remove resin that has become attached to the surface of the plates after pressing laminate or multi-layers. In the course of this process, the original surface roughness must remain unchanged.

LIPPRITE® Pressplate Cleaning Rollers have shown that in over 1,000 passes a constant brushing quality is maintained.

Your advantages:

- top brushing quality, clean surface
- no contamination of the pressplate
- precise abrasion over entire life of roller
- minimal brush debris
- no clogging of machine filter system
- concentric run
- dynamic balancing
- metal flanges for a perfect fit (no tolerance problems)

Flap Construction

Abrasive non-woven flaps are bonded radially to a phenolic core. Treatment with synthetic resin stiffens the LIPPRITE® Roller improving performance and extending its suitability for a range of applications.

Surface Quality of Pressplates

Surface finish	Quality	Rz [µm]	Ra [µm]
No. 1	ground grit 80	8.0 – 15.0	1.20 – 2.50
No. 2	ground grit 180	5.0 – 8.0	0.70 – 1.20
No. 3	ground grit 240	2.5 – 5.0	0.30 – 0.70
No. 4	fine ground grit 320	1.6 – 2.5	0.15 – 0.30
No. 5	**fine ground grit 400**	**1.0 – 1.6**	**0.13 – 0.15**
No. 6	finest ground grit 500	0.6 – 1.0	0.07 – 0.13
No. 7	bright polished	0.2 – 0.4	0.03 – 0.04
No. 8	mirror polished	0.1 – 0.2	0.01 – 0.03

Product Recommendation

LIPPRITE® Pressplate Cleaning Roller	**A4 D109 I22**	Al_2O_3 120 MED	Rz = 1.6 – 2.5 µm
LIPPRITE® Pressplate Cleaning Roller	**A5 D109 I22**	Al_2O_3 180 MED-FN	Rz = 1.2 – 2.0 µm
LIPPRITE® Pressplate Cleaning Roller	**A6 D109 I22**	Al_2O_3 240 FN	Rz = 1.0 – 1.6 µm

Note: Rz on stainless steel 1.4542

INFORMATION

A selection of standard sizes available:

Dia. [mm]	Width [mm]	Bore	Machine Type
90	610	1”	Billco, Marseco, Somaca
90	610	35 mm	Dilg
102	610 – 622 – 768	1”/1.25”	Chemcut
125	450	50 mm	Wesero Junior / Höllmüller 45 / Schmid 450
125	550	50 mm	Höllmüller 55
125	610	50 mm	IS Scrubbex-SHD / Wesero 600 / Schmid 600
125	650	50 mm	Schmid 650 / IS Scrubbex-2000 / Höllmüller 65 / Wesero U 600-1 / Pola & Massa
125	670	50 mm	Pola & Massa
125	750	50 mm	Wesero U700-1
125	770	50 mm	Schmid 770 / IS Scrubbex-2000
140	610	2”	Chemcut, Marseco
152	610	2”	TTM, Billco, Somaca, Chemcut
152	610 – 650 – 710	3”	Seiko, Marugen, IML SD-1400, Ishi Hyoki, Pioneer
152	762	2”	Billco, Marseco, Chemcut
170	585	3”	Bunkyo
170	610 – 710	3”	Ishii Hyoki
254	1143	5.75”	Pioneer
300	1100 – 1500	5.75”	Century, Somaca
305	1270	180 mm	Aiki
350	1100 – 1500	190 / 200 mm	Wesero, Curtin Hebert

This catalogue is intended to be an introductory summary of LIPPERT-UNIPOL products for manufacturers of Printed Circuit Boards.
The information provided is believed to be reliable, however, due to the wide variety of intervening factors, we do not warrant the information or results of usage.

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