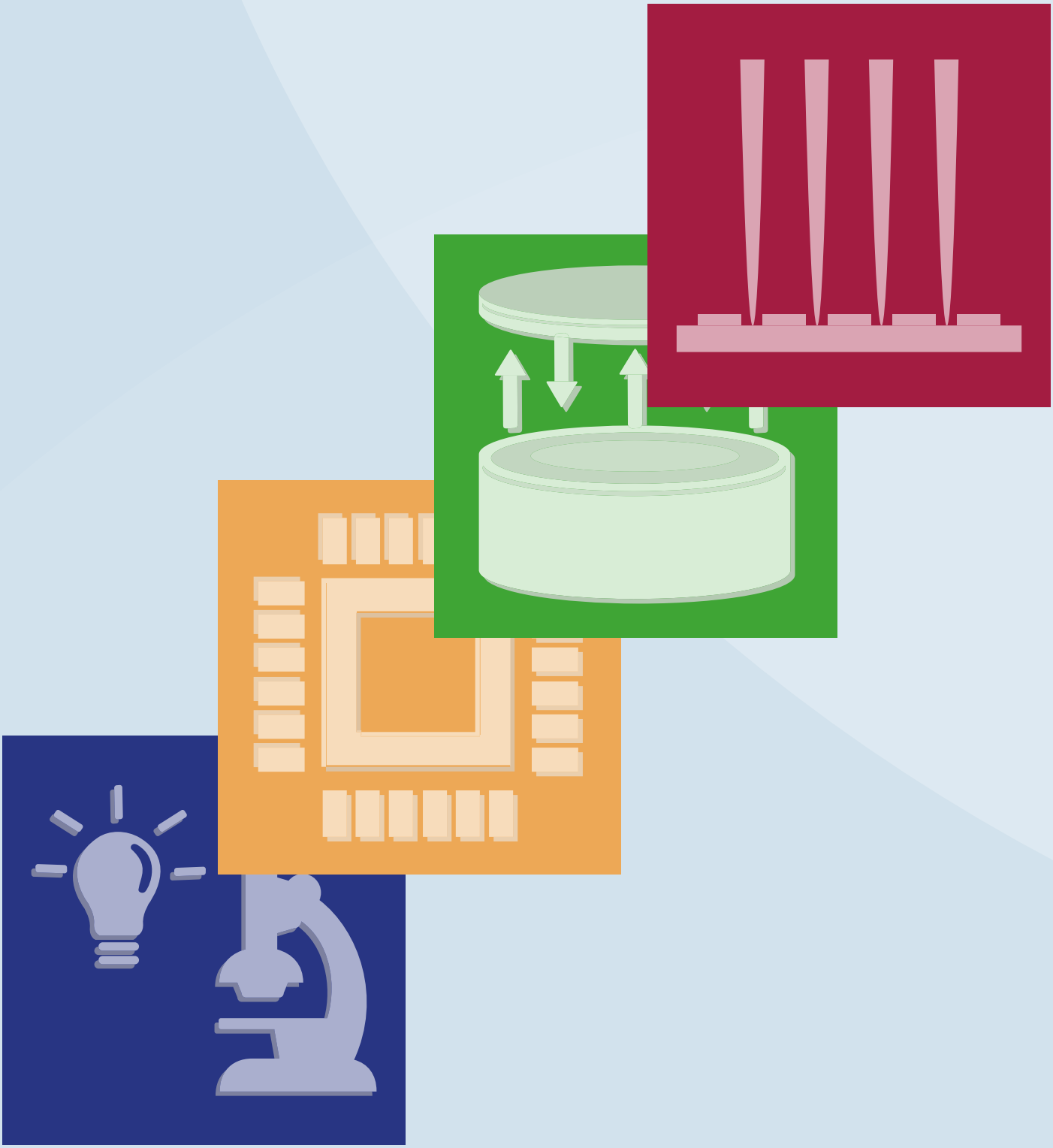
international
TEST SOLUTIONS

IMPROVING YIELD THROUGH INNOVATION.

Cleaning Solutions for Frontend, Backend and Packaging

CONTENT



ABOUT ITS

ITS innovations have led to industry wide recognition as being “the cleaning experts” based on the foundation of a strong IP portfolio which includes more than 50 domestically and internationally issued and filed patents.

International Test Solutions supports customers with award winning technical services and comprehensive expertise. The ITS global network includes research, testing capabilities, and manufacturing operations in Reno, Nevada. Customers benefit from an applications support infrastructure of ITS branch offices worldwide. In addition, a comprehensive sales network of highly experienced representatives provide our customers with unmatched on-site support and service.

Innovative technology, industry-leading R&D investment, and continuously evolving capabilities as well as a deep understanding of customer application requirements: International Test Solutions can uniquely provide our customers with products and services continuously focused on reducing overall test costs through improving yields and extended tooling performance.

Mission

Our mission is to provide the best quality products and services to the highest standards that meet and exceed our customer needs and expectations.

Vision

Our vision is to continuously innovate new products and explore new technologies to satisfy our customers future requirements. Develop and foster process improvements with close collaboration and customer partnerships to solve advanced challenges through innovation, research, discovery, and knowledge.

PRODUCT OVERVIEW

Probe Card Cleaning Products: ITS PCC products control and stabilize contact resistance allowing customers to maximize first pass yield while maintaining the probe tips. This allows the prober optics to perform more efficiently improving up time. ITS materials have a wide range of thermal stability.

Test Contactor Cleaning Products: ITS TCC Products are engineered to perform under demanding test conditions to improve first-pass yield, facilitate greater throughput, reduce overall cost of test, and enhance profitability.

Chuck Cleaning Wafer Products: ITS CCW products enable in-situ cleaning of vacuum wafer chucks and ESCs on fab process tools without opening the process chamber.

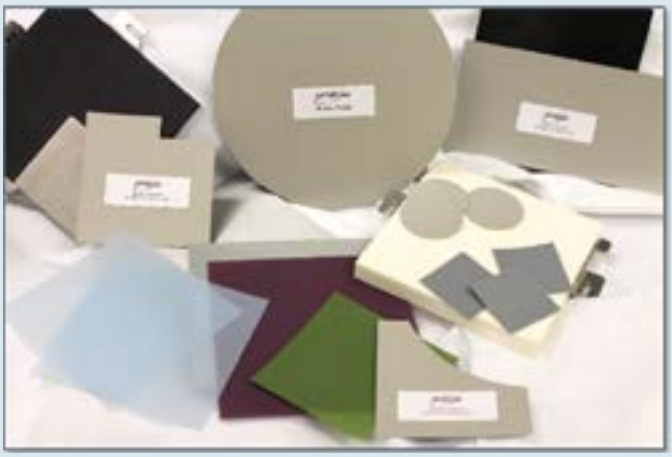
Application & Engineering Services: ITS has built an award winning, state of the art engineering lab with innovative tools designed for characterization of new and custom cleaning materials required to meet the semiconductor customer needs.

Probe Card Cleaning (PCC)

Improved equipment utilization: Eliminate prober optical recognition errors, reduce operator intervention, and reduce probe card inventories

Increased wafer yield: Controlled and stable contact resistance, reduced site-to-site dependent failures, with thermal stability across -55°C to +200°C

Increased throughput: Minimize the need for offline cleaning, extend probe card life, and maintain tip shape



Probe Card Cleaning Product Families

Probe Polish®, Probe Form® and LCxK are designed to clean and maintain shaped probe tips.

Probe Lap® and Probe Scrub® are developed to clean flat tip probes with minimal wear.

Probe Vertical™ is an innovative material that cleans and maintains pointed probe tips.

Chuck Cleaning Wafer (CCW)

Chuck Cleaning Wafer cost-effectively reduces tool downtime during unscheduled and scheduled tool maintenance service for greater throughput.

HOW IT WORKS

The Chuck Cleaning Wafer (CCW) product was developed to trap and remove loose debris from wafer chucks, stages and handling hardware.

The CCW is built using a highly cross-linked, sticky polymer mounted on wafers that are then cycled through the process tool.

This unique cleaning material does not outgas (ASTM E595) nor is it observed to transfer any metallic or organic material (ICP-MS and XPS).

The CCW product has an upper working limit of 300°C.

Low Cost of Ownership: The CCW product can be used up to 20 times before becoming saturated with particles.

ITS has developed a cleaning kit effective for extending the typical operating lifetime by 5X.

Test Contactor Clean (TCC)

Test and burn-in socket contactors build up contaminants and debris which can cause miscontact and reduced first pass yields.

ITS Test Cell Conditioner™ (TCC) is an engineered Surrogate Cleaning Device™ designed for cleaning and debris collection to control contact resistance and maximize contactor electrical performance.

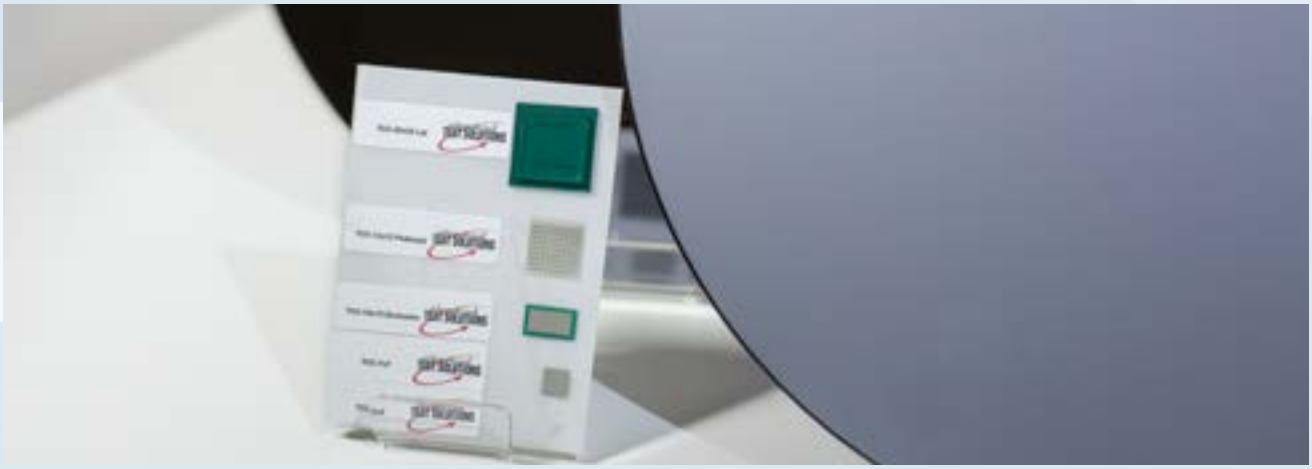
- Engineered solution matched to handler, device, socket, and thermal requirements
- Thermal performance well-suited for demanding tri-temperature test conditions
- Critical for stable first pass yields, reduced retest, and high final yields.

Improved First Pass Yield: Controlled and stable contact resistance, reduced site-to-site dependent failures, with thermal stability across -55°C to +200°C

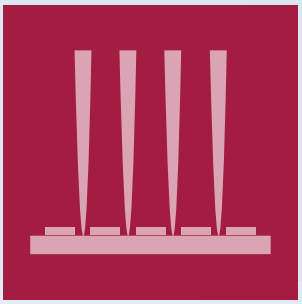
Greater Throughput: Minimize off-line cleaning, maintain high units per hour for high volume testing

Reduced Cost of Test: Auto-contactor cleaning (ACC) for low downtime for tri-temperature test applications

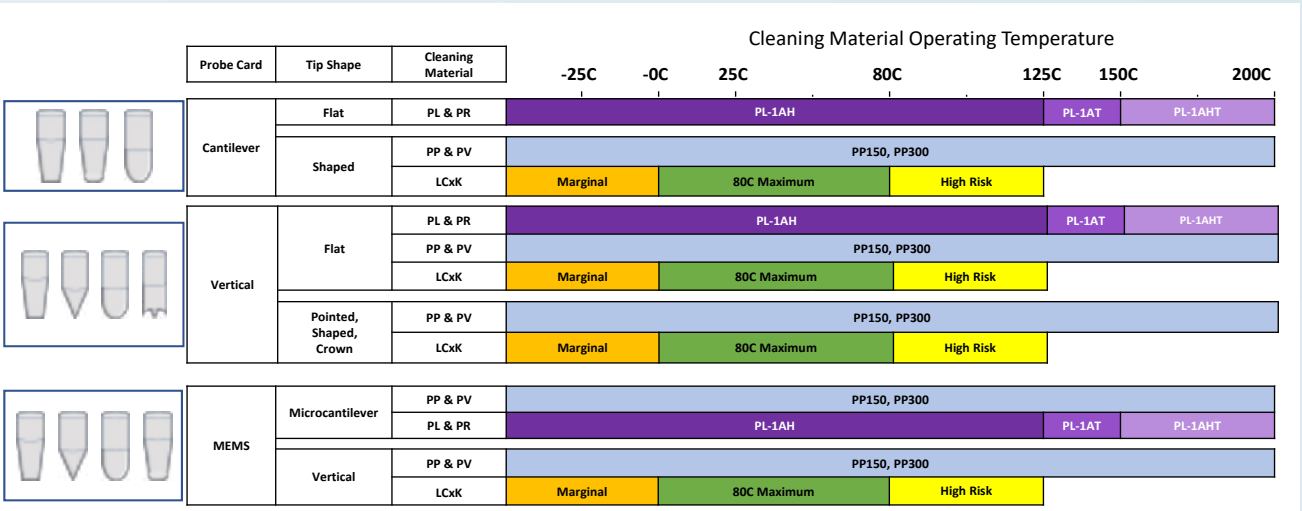
Higher Profitability: Reduced capital equipment, space, and operational costs.



PROBE CARD CLEANING



Probe Card Cleaning Materials



Probe Card	Tip Shape	Cleaning Material	Cleaning Material Operating Temperature
Cantilever	Flat	PL & PR	PL-1AH / PL-1AT / PL-1AHT
	Shaped	PP & PV	PP150, PP300
		LCxK	Marginal / 80C Maximum / High Risk
Vertical	Flat	PL & PR	PL-1AH / PL-1AT / PL-1AHT
		PP & PV	PP150, PP300
		LCxK	Marginal / 80C Maximum / High Risk
	Pointed, Shaped, Crown	PP & PV	PP150, PP300
		LCxK	Marginal / 80C Maximum / High Risk
MEMS	Microcantilever	PP & PV	PP150, PP300
		PL & PR	PL-1AH / PL-1AT / PL-1AHT
	Vertical	PP & PV	PP150, PP300
		LCxK	Marginal / 80C Maximum / High Risk

- **PL** – Probe Lap
- **PP** – Probe Polish
- **PC** – Probe Clean (non-abrasive)
- **PR** – Probe Lap with cushion under layer
- **PV** – Probe Vertical
- **PF** – Probe Form (Probe tip Forming)
- **LCxK** (Low-Cl) materials have comparable morphology, structure, cleaning-performance and operating temperature limits as the standard "–SWE" Foams

Before Clean Residuals on Flat Vertical Tips

Tip area textured and residual removed

After Vertical Option Clean using Probe Lap®

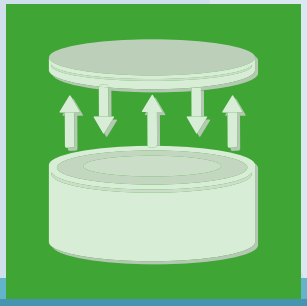
Cantilevered Probe Tips Debris Build-up due to Poor Cleaning

Debris from DUT

No debris on tip

ITS Materials Implemented On-line Cleaning to Control Debris

CHUCK CLEANING WAFER

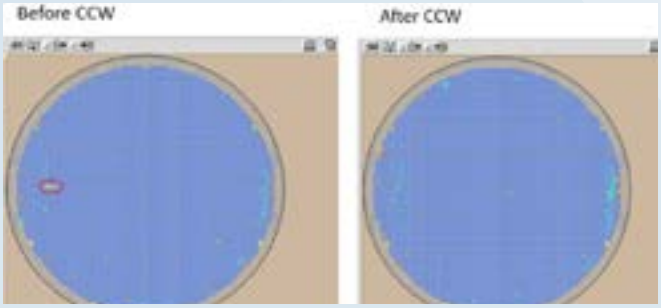


Wafer Test Applications - Particle Removal on Prober Chuck

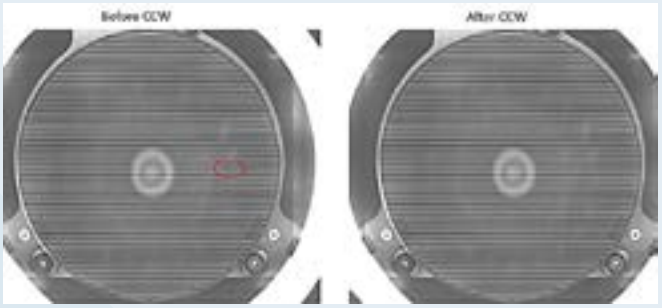
During wafer test, particles on the prober chuck can cause device damage, yield loss, or thin wafer breakage. Manual cleaning requires long downtimes, particularly for high or low temperature prober chuck conditions.

Prober Applications - Customer Results

Yield Loss due to particle scratches fixed by CCW



Infrared reverse image of wafer - Note damaged area



Chuck Cleaning Wafer improved device yield by removing particles on chuck that damaged wafers.

ESC (Electrostatic Chuck) Applications

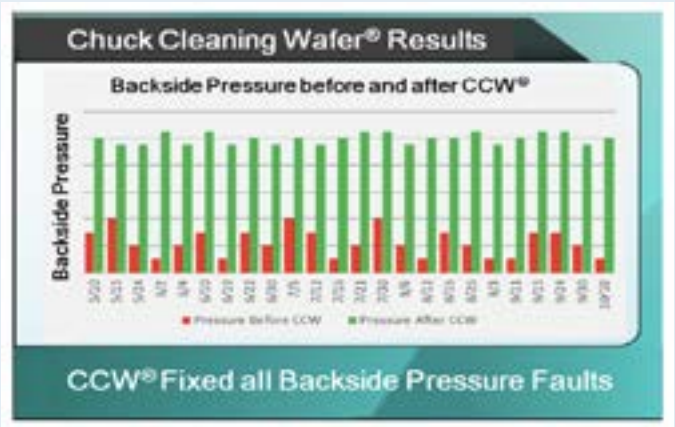
Etch and PVD chambers have scheduled wet cleans with extended tool downtime. Particles on the electrostatic chuck (ESC) cause backside leaks forcing early wet cleans and unplanned downtime for more than twelve hours.

Vacuum Chuck Applications

Particles on lithography tool chucks can cause “Hot Spots”, or defocus areas due to particles under the wafer. To remove hot spots, the tool is taken offline and either opened for manual chuck cleaning, or the chuck is “stoned” to break down or remove the particles. Both procedures interrupt critical tool availability for up to two hours.

Etch Application - Customer Results

For 3-months, CCW was cycled through the tools whenever the ESC He flow rate was high. More than 75% of the time, the He leak was resolved without opening the chamber.



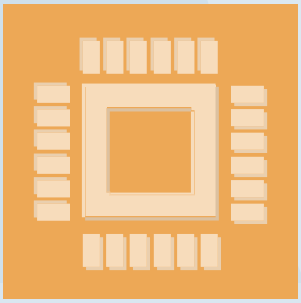
PVD Application - Customer Results

For 5-months, CCW was cycled through the tools whenever the backside pressure was too low. In every instance, the backside pressure was resolved without opening the chamber and the system was put back in production.

Litho Application - Customer Results

Integrated defect measurement was used to identify hot spots on multiple systems. CCW was run through the tool when defects greater than 120 nm were detected. More than 70% of the time, the defects were eliminated without opening the chamber for unscheduled downtime.

TEST CONTACTOR CLEANING



Engineered Socket and Contactor Cleaning Solution

Cleaning Devices that are cycled through a handler to maintain stable socket performance by regularly removing debris and contaminants for minimal downtime and maximized profitability.

Test Contactor Cleaning (TCC) cleaning units are custom designed to emulate high volume package types.

Device Package Type	Cleaning Unit Design
Quad-Flat-No-Lead	*Leadless TCC Unit*
Package-on-Package	*POP TCC Unit*
Quad-Flat-Package	*Leaded TCC Unit*
Bumped Array Package	*BGA TCC Unit*

Turnkey Design and Construction

TCC Cleaning Units are "turn-key" cleaning surrogates fabricated to match device package geometries. As the cleaning units are regularly cycled through a handler, they effectively maintain stable socket performance by removing debris and contaminants with minimal downtime.

On-line Cleaning to Maximize Profitability

- Turnkey solution for tri-temperature handling requirements
- Precision engineered substrates and patented cleaning materials for immediate installation.
- FR4 and metallic substrates for elevated temperature requirements as high as 200°C.
- Polishing efficiency for pin cleaning and tacky surface for debris collection.

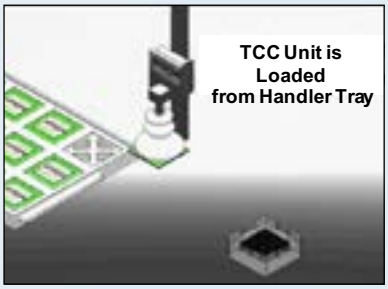
TCC Polymers (M, L, and HL) are engineered to perform under demanding test conditions.

Two types of patented cleaning materials are available – (1) polymer material for sockets with spring pin type contactors; and (2) tacky abrasive materials designed for sockets that utilize sliding type contactors. Both cleaning material types are engineered to collect debris from the contact area, remove debris accumulated within the bed of the socket, and polish the contactor surface to recover electrical performance.

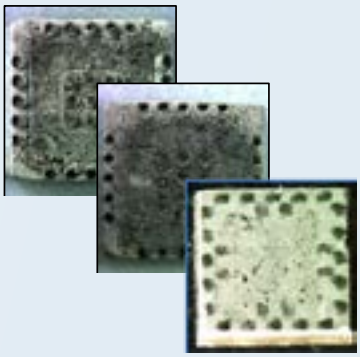
		M type	L Type HL Type
Performance	Debris Collection	Y	Y
	Abrasion	Low	Medium
	Polishing	Low	Medium
Thermal Performance	-45C to 155C	Y	Y
Contactor Type	Spring Pin (spear, crown)	Y	Y
	Sliding / Wiping	N	Y
Package Type	Non-Leaded (QFN, etc.)	Y	Y
	Ball Grid Array (BGA, etc.)	Y	Y
	POP Package	Y	Y
	Leaded (QFP, SOIC, etc.)	Y	Y
Handler Type	Low Volume Manual	Y	Y
	High Volume Manufacturing	Y	Y

All major handler suppliers have incorporated the auto-contact-clean (ACC) capability to maximize uptime and throughput of high value devices.

How does it work?



Used TCC Cleaning Units
Collect Contamination

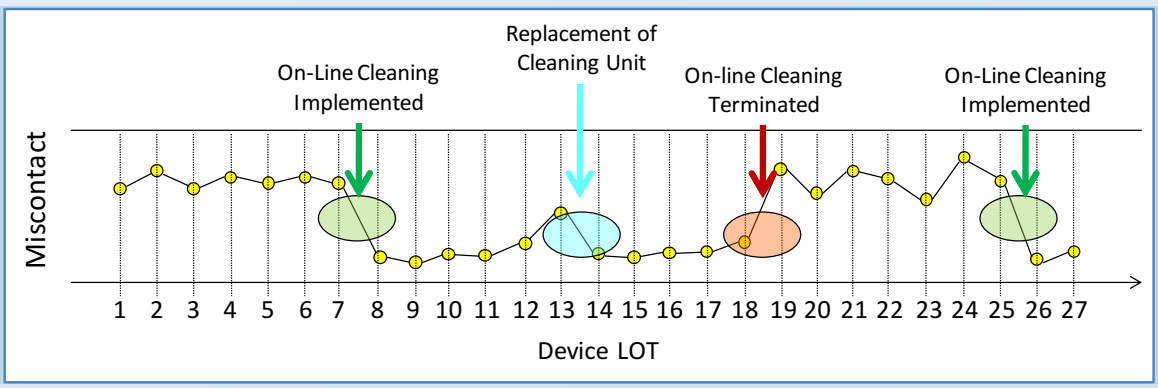


Implementation for Reduced Cost of Test

For efficient on-line cleaning, the handler stores the cleaning devices and the user defines cleaning recipes based upon the test process requirements. Handler software tracks cleaning material usage and is wholly compatible with yield management software.

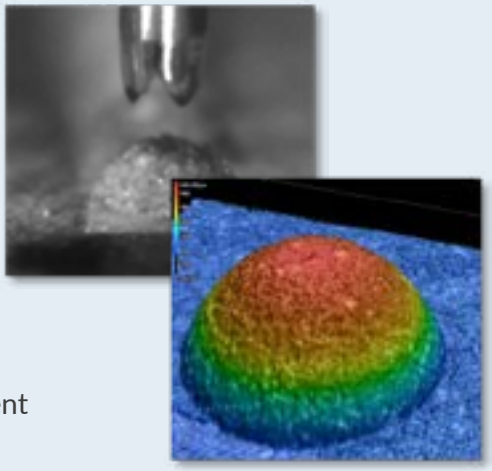
On-line Cleaning using TCC cleaning devices dramatically reduces mis-contacts and substantially improves First Pass Yields to maximize OEE. Multiple cleaning insertions are possible; however, the cleaning efficiency will be affected by excessive usage. “Saturated” cleaning devices units will have poor cleaning efficiency.

Reduced Miscontact for Increased First Pass Yield



SPECIAL SERVICES

Center for Cleaning Materials Expertise (CCME)



Technical Capabilities

- Custom Benchtop Test Systems w/High Speed Imaging
- Hitachi Tabletop SEM with EDS Elemental Analysis
- Keyence VK-3D Laser Microscope
- Prober and Tester Platform

Cleaning Materials Performance Testing

- Visualization of cleaning material and probe interaction.
- Wear testing and probe tip shape change assessment
- Off-line cleaning process and cleaning materials development

Process Optimization

- Develop key insights into cleaning material performance and contactor interaction.
- Investigate material performance, refine abrasiveness, and design surface features / structures.
- Provide customers with cleaning options matched to demanding application requirements.

Custom Coating, Lamination, and Consulting Services

Services

- Development
- Consulting
- Full Scale Manufacturing
- Prototyping
- Electronics
- Solar
- Healthcare
- Food
- Laser cutting and dicing
- Industrial & many other custom applications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APPENDIX: DOCUMENTS

TEST CONTACTOR CLEAN (TCC)®
PRODUCT DESCRIPTION: M-TYPE

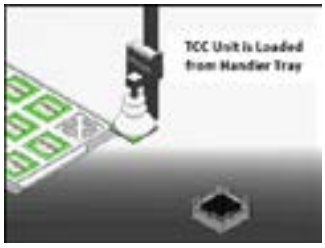
TEST CONTACTOR CLEAN (TCC)®
TCC PD-SCD001

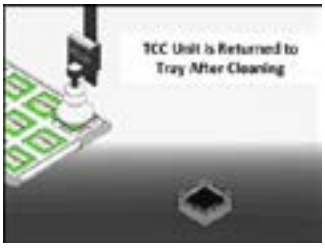
GENERAL

Test Contact Clean (TCC) cleaning unit are "turn-key" cleaning surrogates fabricated to match device package geometries. As the cleaning units are regularly cycled through a handler, they effectively maintain stable socket performance by removing debris and contaminants with minimal downtime.

For efficient on-line cleaning, the handler stores the cleaning devices and the user defines cleaning recipes based upon the test process requirements. Handler software tracks cleaning material usage and is wholly compatibility with yield management software. On-line Cleaning using TCC cleaning devices dramatically reduces mis-contacts and substantially improves First Pass Yields to maximize OEE.

HOW DOES IT WORK?





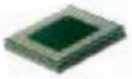
TCC UNITS ARE ENGINEERED TO BE TURN-KEY

- Turnkey solution for tri-temperature handling requirements.
- Precision engineered substrates and patented cleaning materials for immediate installation.
- FR4 and metallic substrates for elevated temperature requirements as high as 200C.
- Polishing efficiency for pin cleaning and tacky surface for debris collection.

Device Package Type

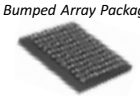
Quad-Flat-No-Lead

Package-on-Package



Quad-Flat-Package

Bumped Array Package



Cleaning Unit Design

Leadless TCC Unit

POP TCC Unit

Leaded TCC Unit

BGA TCC Unit

Units Perform Under Demanding Test Conditions

		M type	L Type HL Type
Performance	Debris Collection	Y	Y
	Abrasion	Low	Medium
	Polishing	Low	Medium
Thermal Performance	-45C to 155C	Y	Y
Contactor Type	Spring Pin (spear, crown)	Y	Y
	Sliding / Wiping	N	Y
Package Type	Non-Leaded (QFN, etc.)	Y	Y
	Ball Grid Array (BGA, etc.)	Y	Y
	POP Package	Y	Y
	Leaded (QFP, SOIC, etc.)	Y	Y
Handler Type	Low Volume Manual	Y	Y
	High Volume Manufacturing	Y	Y

For more information, please contact:
International Test Solutions | 1595 Meadow Wood Lane | Reno, NV 89502 (USA)
www.inttest.net | mail: sales@inttest.net | Phone: +1 775-284-9220

10/03/19

TEST CONTACTOR CLEAN (TCC)®
PRODUCT DESCRIPTION: H-TYPE AND H+ TYPE

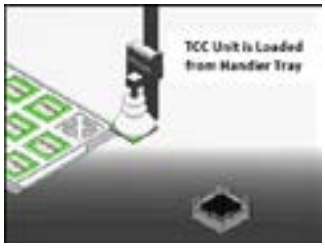
TEST CONTACTOR CLEAN (TCC)®
TCC PD-SCD002

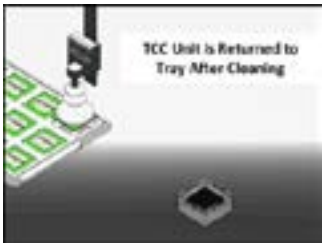
GENERAL

Test Contact Clean (TCC) cleaning unit are "turn-key" cleaning surrogates fabricated to match device package geometries. As the cleaning units are regularly cycled through a handler, they effectively maintain stable socket performance by removing debris and contaminants with minimal downtime.

For efficient on-line cleaning, the handler stores the cleaning devices and the user defines cleaning recipes based upon the test process requirements. Handler software tracks cleaning material usage and is wholly compatibility with yield management software. On-line Cleaning using TCC cleaning devices dramatically reduces mis-contacts and substantially improves First Pass Yields to maximize OEE.

HOW DOES IT WORK?





TCC UNITS ARE ENGINEERED TO BE TURN-KEY

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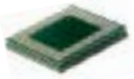
- FR4 and metallic substrates for elevated temperature requirements as high as 200C.
- Polishing efficiency for pin cleaning and tacky surface for debris collection.

Device Package Type

Quad-Flat-No-Lead

Package-on-Package



Quad-Flat-Package

Bumped Array Package

Cleaning Unit Design

Leadless TCC Unit

POP TCC Unit

Leaded TCC Unit

BGA TCC Unit

Units Perform Under Demanding Test Conditions

		H type	H+ type
Performance	Debris Collection	Y	Y
	Abrasion	Medium	High
	Polishing	Medium	High
Thermal Performance	-45C to 155C	Y	Y
Contactor Type	Spring Pin (spear, crown)	Y	Y
	Sliding / Wiping	Y	Y
Package Type	Non-Leaded (QFN, etc.)	Y	Y
	Ball Grid Array (BGA, etc.)	Y	Y
	POP Package	Y	Y
	Leaded (QFP, SOIC, etc.)	Y	Y
Handler Type	Low Volume Manual	Y	Y
	High Volume Manufacturing	Y	Y

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10/03/19

PROBE LAP®
PRODUCT DESCRIPTION

PROBE LAP®
PCC PD-PL001

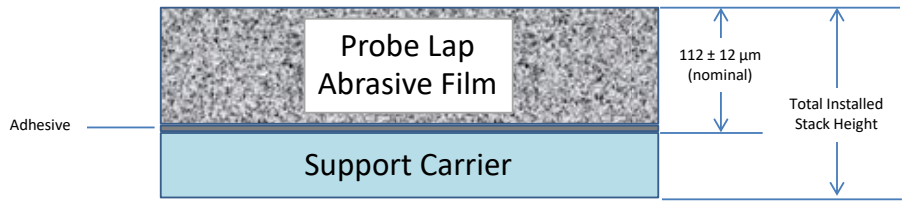
GENERAL

Probe Lap® is used as a direct replacement for on-line lapping film applications. It is built using aluminum-oxide or silicon-carbide abrasive particles. The sheets can be mounted on various substrates and abrasion plates used for on-line and off-line probe cleaning.

Standard Probe Lap® cleaning wafers and cleaning sheets have an operating temperature range -50C to 125C. With additional processing, tempered Probe Lap® high temperature capable cleaning wafers and cleaning sheets can be used at test temperatures up to -50C to 150C. Ultra-Temp Probe Lap sheets and wafers have a maximum operating temperature of 200C.

Material	Material Designation	Material Color	Nominal Abrasive	Operating Temperature				
				-50C	25C	125C	150C	200C
Probe Lap (Standard)	PL-xAH (AlO)	Yellow	0.5 µm	O	O	O		
		Purple	1 µm					
		Green	3 µm					
	PL-xSH (SiC)	Light Gray	1 µm					
		Dark Gray	3 µm					
Probe Lap (High Temp)	PL-xAT (AlO)	Yellow	0.5 µm	O	O	O	O	
		Purple	1 µm					
		Green	3 µm					
	PL-xST (SiC)	Light Gray	1 µm					
		Dark Gray	3 µm					
Probe Lap (Ultra Temp)	PL-xAHT (AlO)	Brown	1 µm	O	O	O	O	O
			3 µm					
	PL-xSHT (SiC)	Gray	1 µm					
			3 µm					

CROSS SECTION



	Cleaning Material Configuration			
	Sheet	200mm Wafer	300mm Wafer	Custom Install
Support Carrier		725 ± 20µm (SEMI Standard)	775 ± 20µm (SEMI Standard)	Contact ITS
Total Installed Stack Height	112 ± 12 µm	837 ± 32µm	887 ± 32 µm	Contact ITS

For more information, please contact:
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07/25/19

ASSEMBLY CLEAN®
PRODUCT DESCRIPTION

ASSEMBLY CLEAN®
PCC PD-AC001

GENERAL

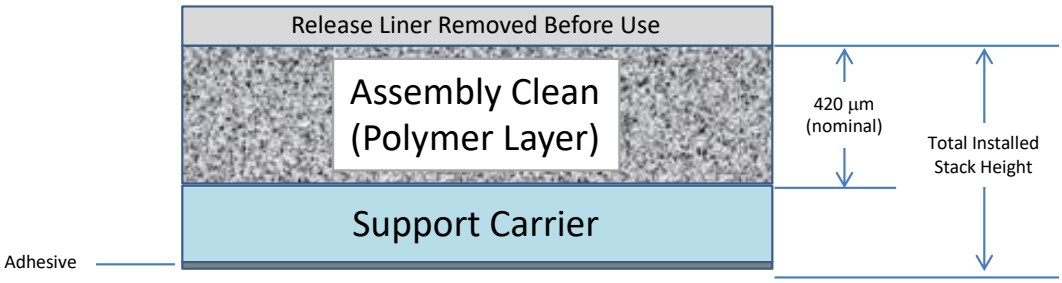
Assembly Clean® is designed to remove loose debris, which is generated during the assembly process and stuck to the pick and place hardware. It is not designed to remove embedded or bonded debris. The removal of embedded or bonded debris requires abrasive products such as Probe Polish®.

Regular use of Assembly Clean® in assembly equipment such as die attach extends the time between when abrasive cleaning may be required. The collet and other pick and place fixture cleaning frequency and number of cleaning insertions varies according to the specific environment.

The cleaning motion with Assembly Clean® is only in the Z direction. No lateral forces are applied to the fixture. The forces exerted on the fixture when cleaning with Assembly Clean® are far less than the forces as during normal operations.

The Assembly Clean® polymer collects and traps the debris generated during cleaning. Reuse of the cleaning pad will cause the trapped debris to be pushed deeper into the polymer. Visually check the pad from time to time to ensure that it does not become over- loaded with debris, which reduce the cleaning performance of the material. To achieve maximum cleaning efficiency, offset each touchdown location approximately 2X the probe diameter in the XY directions, such that probe tip always touches the clean surface of the cleaning material.

CROSS SECTION



	Cleaning Material Configuration			
	Sheet	200mm Wafer	300mm Wafer	Custom Install
Polymer Layer Thickness	420 µm (nominal)	420 µm (nominal)	420 µm (nominal)	Contact ITS
Support Carrier	145 µm (PET nominal)	725 ± 20µm (SEMI Standard)	775 ± 20µm (SEMI Standard)	Contact ITS
Total Installed Stack Height	565 ± 20µm	1145 ± 40µm	1195± 40 µm	Contact ITS

For more information, please contact:
International Test Solutions | 1595 Meadow Wood Lane | Reno, NV 89502 (USA)
www.inttest.net | mail: sales@inttest.net | Phone: +1 775-284-9220

07/25/19

PROBE CLEAN®
PRODUCT DESCRIPTION

PROBE CLEAN®
PCC PD-PC001

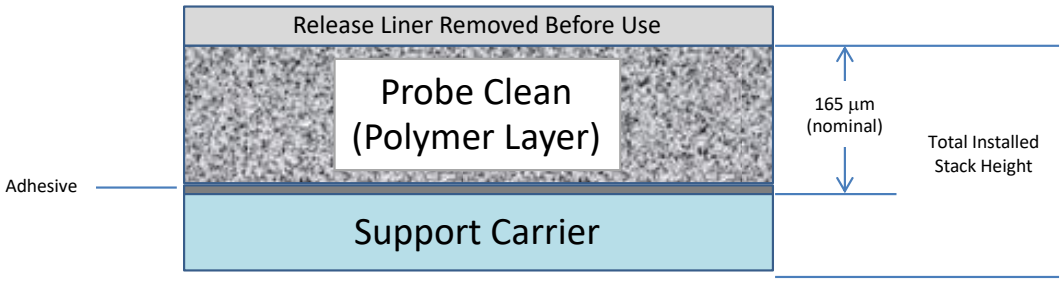
Probe Clean® is designed to remove loose debris, which is generated during probing. It is not designed to remove embedded or bonded debris. The removal of embedded or bonded debris requires abrasive products such as Probe Polish® and/or Probe Lap®.

Regular use of Probe Clean® in the prober during wafer level test extends the time between when abrasive cleaning may be required. Probe card cleaning frequency and number of cleaning insertions varies according to the specific testing environment.

The cleaning motion with Probe Clean® is only in the Z direction. No lateral forces are applied to the probes. The forces exerted on the probe when cleaning with Probe Clean® are far less than the forces as during normal testing operations.

The Probe Clean® polymer collects and traps the debris generated during cleaning. Reuse of the cleaning pad will cause the trapped debris to be pushed deeper into the polymer. Visually check the pad from time to time to ensure that it does not become over- loaded with debris, which reduce the cleaning performance of the material. To achieve maximum cleaning efficiency, offset each touchdown location approximately 2X the probe diameter in the XY directions, such that probe tip always touches the clean surface of the cleaning material.

CROSS SECTION



	Cleaning Material Configuration			
	Sheet	200mm Wafer	300mm Wafer	Custom Install
Polymer Layer Thickness	165 µm (nominal)	165 µm (nominal)	165 µm (nominal)	165 µm (nominal)
Support Carrier	143 µm (PET nominal)	725 ± 20µm (SEMI Standard)	775 ± 20µm (SEMI Standard)	Contact ITS
Total Installed Stack Height	308 ± 20µm	890 ± 30µm	940 ± 30 µm	Contact ITS

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08/21/19

PROBE CLEAN®
INSTALLATION AND SETTINGS

PROBE CLEAN®
PCC PD-PC002

INSTALLATION

1. Install the Probe Clean® onto the cleaning stage of into the prober; or place the cleaning wafer into the appropriate wafer tray.

2. For detailed step-by-step installation instructions refer to ITS Document PCC-TB-PP003 "Overview of Practices for Installing the Cleaning Materials onto a Polish Plates".

3. Use the pull-tab or a piece of transparent tape to touch the edge of the protective cover. Peel the front protective cover from the sample.

USE EXTRA CARE NOT TO TOUCH THE WORKING SURFACE WITH THE SCOTCH TAPE.

RECOMMENDED CLEANING SETTINGS

Parameter	Probe Clean
Cleaning Method:	Z-Only Up and Down
Cleaning Touchdowns:	10 to 25 at T = 25C[1] 25 to 50 at T > 25C
Cleaning Overdrive:	50 to 80um from last touch[2]
Cleaning Frequency:	50 to 250 at T = 25C[3] 50 to 200 at T > 25C
Index between Cleaning Touchdowns:	Minimum of 50um[4] Approximately 2X Tip size in X and Y
Up/Down Touchdowns in Same Location:	1

NOTES:
1. Depends on the device electrical requirements, to be optimized by Customer
2. Cleaning overtravel can be performed at same setting as the probing overtravel
3. Cleaning frequency that is needed to maintain stable yield or contact resistance (as defined by the customer process). At the beginning of the probe card life we recommend usage of LOWEST frequency prescribed.
4. The "shift between touchdowns" indicated the minimum distance between consecutive touchdowns such that the probe tip always touches the clean surface of the cleaning material.

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08/21/19

PROBE POLISH®
PRODUCT DESCRIPTION

PROBE POLISH®
PCC PD-PP001

GENERAL

Probe Polish® is designed to remove embedded and bonded debris from probe shaped tips and collect any loose debris that was generated during probing. The abrasive material in the polymer will remove the accumulation of embedded or bonded debris but is not so aggressive that it will alter the probe material or probe contact area.

Frequent use of the Probe Polish®, will reduce the number of touchdowns required to remove the embedded or bonded debris Probe card cleaning frequency and number of cleaning insertions varies according to the specific testing environment.

The cleaning motion with Probe Polish® is only in the Z direction. No lateral forces are applied to the probes. The forces exerted on the probe when cleaning with Probe Polish® are less than the forces as during normal testing operations.

The Probe Polish® polymer layer collects and traps the debris generated during cleaning. Reuse of the cleaning pad will cause the trapped debris to be pushed deeper into the polymer. This allows reuse of the same location several times. Visually check the pad from time to time to ensure that it does not become over- loaded with debris, which will reduce the cleaning efficiency of the material. To achieve maximum cleaning efficiency, offset each touchdown location approximately 2X the probe diameter in the XY directions, such that probe tip always touches the clean surface of the cleaning material.

CROSS SECTION

	Cleaning Material Configuration			
	Sheet	200mm Wafer	300mm Wafer	Custom Install
Polymer Layer Thickness	231 µm (nominal)	231 µm (nominal)	231 µm (nominal)	231 µm (nominal)
Support Carrier	143 µm (PET nominal)	725 ± 20µm (SEMI Standard)	775 ± 20µm (SEMI Standard)	Contact ITS
Total Installed Stack Height	374 ± 20µm	956 ± 30µm	1006 ± 30 µm	Contact ITS

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08/21/19

PROBE FORM®
PRODUCT DESCRIPTION

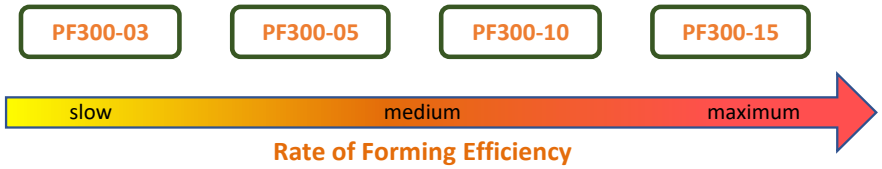
PROBE FORM®
PCC PD-PF001

GENERAL

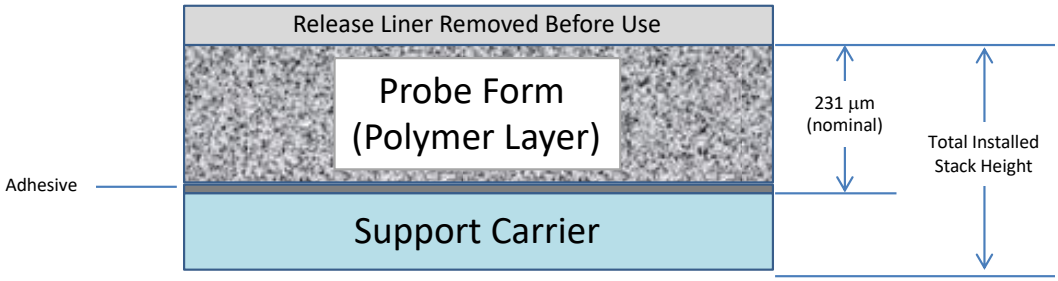
Probe Form® and Probe Form®-A were developed to provide cost effective methods of uniformly "forming" and "reforming" probe tip geometries. Probe Form® and Probe Form®-A use highly crosslinked, non-corrosive silicone-based polymers specifically designed to remove probe material.

The primary forming action with Probe Form® is created by insertions in the Z direction only. Minimal lateral forces are applied to the probes during forming. Forces exerted on the probe with Probe Form® will be significantly less than the forces as during normal testing operations.

During forming, the probe tips should be inspected and measured frequently to determine the material removal and rate of shaping. It is possible to attain tip changes in less than 1000 touchdowns; however, the overall shaping rate will depend on the tip shape, tip size, and probe material. The total number of insertions will vary according to customer requirements. To achieve maximum forming efficiency, offset each touchdown location approximately 2X the probe diameter in the XY directions.



CROSS SECTION



	Cleaning Material Configuration			
	Sheet	200mm Wafer	300mm Wafer	Custom Install
Polymer Layer Thickness	231 µm (nominal)	231 µm (nominal)	231 µm (nominal)	231 µm (nominal)
Support Carrier	143 µm (PET nominal)	725 ± 20µm (SEMI Standard)	775 ± 20µm (SEMI Standard)	Contact ITS
Total Installed Stack Height	374 ± 20µm	956 ± 30µm	1006 ± 30 µm	Contact ITS

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07/25/19

PROBE VERTICAL®
PRODUCT DESCRIPTION

PROBE VERTICAL®
PCC PD-PV001

GENERAL

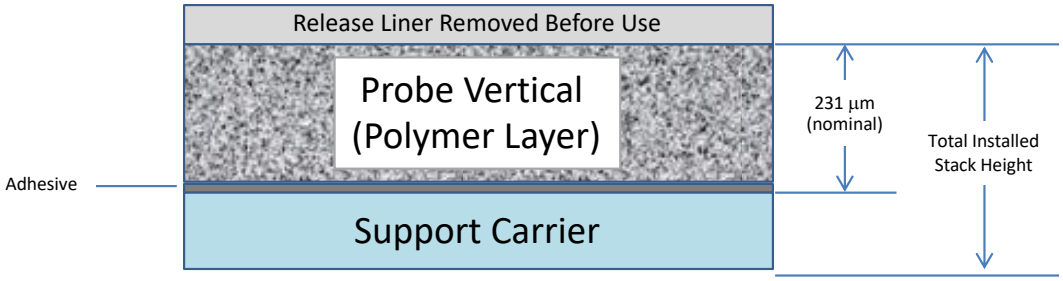
Probe Vertical® is designed to remove embedded and bonded debris from pointed probe tips and collect any loose debris that was generated during probing. The abrasive material in the polymer will remove the accumulation of embedded or bonded debris but is not so aggressive that it will alter the probe material or probe contact area.

Frequent use of the Probe Vertical®, will reduce the number of touchdowns required to remove the embedded or bonded debris probe card cleaning frequency and number of cleaning insertions varies according to the specific testing environment.

The cleaning motion with Probe Vertical® is only in the Z direction. No lateral forces are applied to the probes. The forces exerted on the probe when cleaning with Probe Vertical® are less than the forces as during normal testing operations.

The Probe Vertical® polymer layer collects and traps the debris generated during cleaning. Reuse of the cleaning pad will cause the trapped debris to be pushed deeper into the polymer. This allows reuse of the same location several times. Visually check the pad from time to time to ensure that it does not become overloaded with debris, which will reduce the cleaning efficiency of the material. To achieve maximum cleaning efficiency, offset each touchdown location approximately 2X the probe diameter in the XY directions, such that probe tip always touches the clean surface of the cleaning material.

CROSS SECTION



	Cleaning Material Configuration			
	Sheet	200mm Wafer	300mm Wafer	Custom Install
Polymer Layer Thickness	231 µm (nominal)	231 µm (nominal)	231 µm (nominal)	231 µm (nominal)
Support Carrier	143 µm (PET nominal)	725 ± 20µm (SEMI Standard)	775 ± 20µm (SEMI Standard)	Contact ITS
Total Installed Stack Height	374 ± 20µm	956 ± 30µm	1006 ± 30 µm	Contact ITS

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08/21/19

PROBE REFRESH®
PRODUCT DESCRIPTION

PROBE REFRESH®
PCC PD-PR001

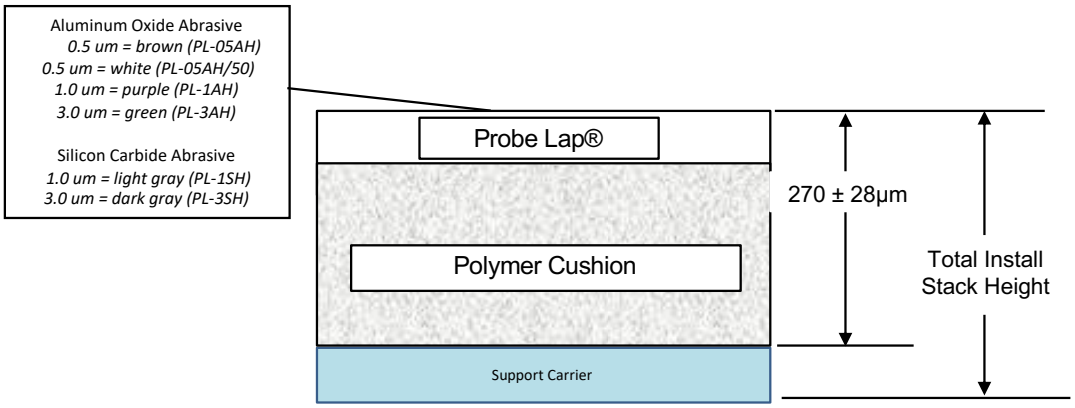
GENERAL

Probe Refresh® is precision lapping film with a cushioned under layer. The lapping film is built using aluminum-oxide or silicon-carbide abrasive grit. The cushion under layer is a high quality compliant polymer Probe Refresh® can be mounted on various substrates and abrasion plates used for on-line and off-line probe cleaning. Probe Refresh® is used as a direct replacement for on-line lapping film applications. Probe Refresh® has an operating temperature range -50C to 125C. With additional processing, tempered Probe Refresh® high temperature capable cleaning wafers and cleaning sheets can be used at test temperatures up to -50C to 150C.

Frequent use of Probe Refresh®, will reduce the cleaning frequency and number of touchdowns required to remove bonded or embedded debris. Cleaning frequency and cleaning touchdowns will vary according to the specific testing environment.

Advanced and fine pitch probe card technologies cannot withstand high frictional loading or deformation against abrasive films, such as the top layer of Probe Refresh®. For these advanced probe technologies, International Test Solutions recommends a non-destructive, low impact cleaning technique such as Probe Polish® to collect debris, clean the contact surface, and maintain the tip shape.

CROSS SECTION



	Cleaning Material Configuration			
	Sheet	200mm Wafer	300mm Wafer	Custom Install
Polymer Layer Thickness	270 µm (nominal)	270 µm (nominal)	270 µm (nominal)	270 µm (nominal)
Support Carrier	150 µm (PET nominal)	725 ± 20µm (SEMI Standard)	775 ± 20µm (SEMI Standard)	Contact ITS
Total Installed Stack Height	420 ± 30µm	995 ± 50µm	1045 ± 50 µm	Contact ITS

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02/20/20

LC4K (low-chlorine, abrasive foam)
PRODUCT DESCRIPTION

LC4K (low-chlorine, abrasive foam)
PCC PD-LC4K01

GENERAL

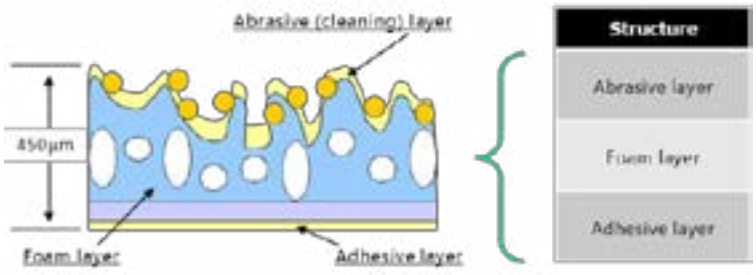
The presence of chlorine ions and chloride contamination on a bond pad surface can act as a catalyst for the copper (Cu) corrosion process and dramatically weaken the copper-aluminum (Cu-Al) intermetallic compounds (IMC). Reduced bond integrity can create long-term reliability issues for packaged devices.

LC4K (low-chlorine, abrasive foam) cleaning sheets were developed with chlorine levels of <100 ppm versus >800ppm of the WA4000-SWE (yellow). The LC4K cleaning material has the same surface morphology / cross-section structure and matched material properties that define cleaning efficiency (i.e., hardness and wear rate). As with WA4000-SWE, the maximum operating temperature of the LC4K material is T = 80C.

To reduce the risk of chlorine contamination the LC4K (Low-Cl) material can be used as a direct replacement for the chlorinated WA4000-SWE for probe card cleaning applications

Material Property	LC4K (Low-Cl)	WA4000
Color	Orange-Yellow	Yellow
Abrasive	#4000, Alumina	#4000, Alumina
Installed Thickness	~450um	~450um
Chlorine Content	< 100ppm	> 800ppm
Operating Temperature	0C to 80C	0C to 80C

CROSS SECTION



	Cleaning Material Configuration			
	Sheet	200mm Wafer	300mm Wafer	Custom Install
LC4K Layer Thickness	450 µm (nominal)	450 µm (nominal)	450 µm (nominal)	450 µm (nominal)
Support Carrier		725 ± 20µm (SEMI Standard)	775 ± 20µm (SEMI Standard)	Contact ITS
Total Installed Stack Height	450 ± 100µm[1]	1175 ± 120µm[1]	1225 ± 120 µm[1]	Contact ITS

1. Due to inherent lot-to-lot height variations associated with the abrasively coated foam, a certificate of inspection is provided with each material lot and should be used as the starting prober overtravel.

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02/26/20

LC6K (low-chlorine, abrasive foam)
PRODUCT DESCRIPTION

LC6K (low-chlorine, abrasive foam)
PCC PD-LC6K01

GENERAL

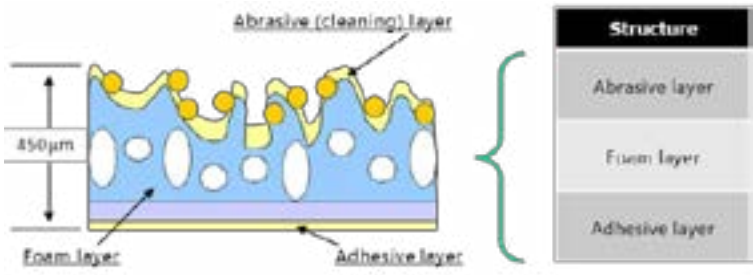
The presence of chlorine ions and chloride contamination on a bond pad surface can act as a catalyst for the copper (Cu) corrosion process and dramatically weaken the copper-aluminum (Cu-Al) intermetallic compounds (IMC). Reduced bond integrity can create long-term reliability issues for packaged devices.

LC6K (low-chlorine, abrasive foam) cleaning sheets were developed with chlorine levels of <100 ppm versus >1800ppm of the WA6000-SWE (green). The LC6K cleaning material has the same surface morphology / cross-section structure and matched material properties that define cleaning efficiency (i.e., hardness and wear rate). As with WA600-SWE, the maximum operating temperature of the LC6K material is T = 80C.

To reduce the risk of chlorine contamination the LC6K (Low-Cl) material can be used as a direct replacement for the chlorinated WA6000-SWE for probe card cleaning applications

Material Property	LC6K (Low-Cl)	WA6000 (Green)
Color	White / Blue	Green
Abrasive	#6000, Alumina	#6000, Alumina
Installed Thickness	~450um	~450um
Chlorine Content	< 100ppm	>1800ppm
Operating Temperature	OC to 80C	OC to 80C

CROSS SECTION



	Cleaning Material Configuration			
	Sheet	200mm Wafer	300mm Wafer	Custom Install
LC6K Layer Thickness	450 µm (nominal)	450 µm (nominal)	450 µm (nominal)	450 µm (nominal)
Support Carrier		725 ± 20µm (SEMI Standard)	775 ± 20µm (SEMI Standard)	Contact ITS
Total Installed Stack Height	450 ± 100µm[1]	1175 ± 120µm[1]	1225 ± 120 µm[1]	Contact ITS

1. Due to inherent lot-to-lot height variations associated with the abrasively coated foam, a certificate of inspection is provided with each material lot and should be used as the starting prober overtravel.

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02/26/20

LC8K (low-chlorine, abrasive foam)
PRODUCT DESCRIPTION

LC8K (low-chlorine, abrasive foam)
PCC PD-LC8K01

GENERAL

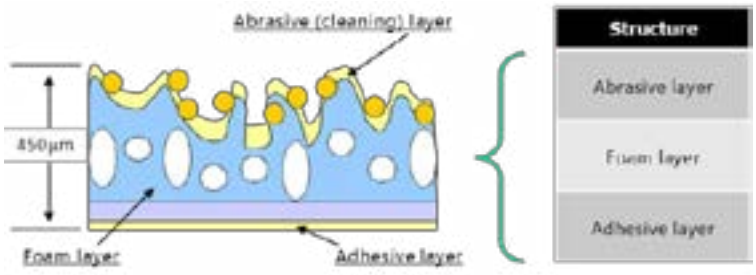
The presence of chlorine ions and chloride contamination on a bond pad surface can act as a catalyst for the copper (Cu) corrosion process and dramatically weaken the copper-aluminum (Cu-Al) intermetallic compounds (IMC). Reduced bond integrity can create long-term reliability issues for packaged devices.

LC8K (low-chlorine, abrasive foam) cleaning sheets were developed with chlorine levels of <100 ppm versus >800ppm of the WA8000-SWE (pink). The LC8K cleaning material has the same surface morphology / cross-section structure and matched material properties that define cleaning efficiency (i.e., hardness and wear rate). As with WA8000-SWE, the maximum operating temperature of the LC8K material is T = 80C.

To reduce the risk of chlorine contamination the LC8K (Low-Cl) material can be used as a direct replacement for the chlorinated WA8000-SWE for probe card cleaning applications

Material Property	LC8K (Low-Cl)	WA8000
Color	Brown	Pink
Abrasive	#8000, Alumina	#8000, Alumina
Installed Thickness	~450um	~450um
Chlorine Content	< 100ppm	> 800ppm
Operating Temperature	0C to 80C	0C to 80C

CROSS SECTION



	Cleaning Material Configuration			
	Sheet	200mm Wafer	300mm Wafer	Custom Install
LC8K Layer Thickness	450 µm (nominal)	450 µm (nominal)	450 µm (nominal)	450 µm (nominal)
Support Carrier		725 ± 20µm (SEMI Standard)	775 ± 20µm (SEMI Standard)	Contact ITS
Total Installed Stack Height	450 ± 100µm[1]	1175 ± 120µm[1]	1225 ± 120 µm[1]	Contact ITS

1. Due to inherent lot-to-lot height variations associated with the abrasively coated foam, a certificate of inspection is provided with each material lot and should be used as the starting prober overtravel.

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02/26/20

LC10K (low-chlorine, abrasive foam)
PRODUCT DESCRIPTION

LC10K (low-chlorine, abrasive foam)
PCC PD-LC10K01

GENERAL

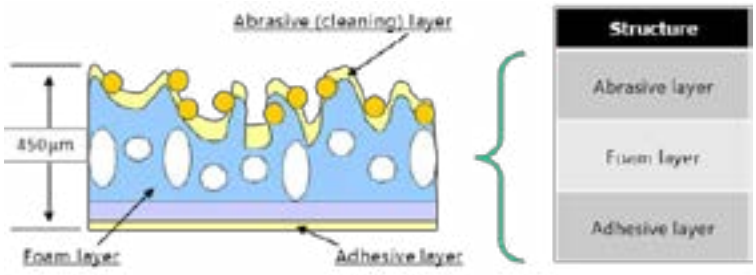
The presence of chlorine ions and chloride contamination on a bond pad surface can act as a catalyst for the copper (Cu) corrosion process and dramatically weaken the copper-aluminum (Cu-Al) intermetallic compounds (IMC). Reduced bond integrity can create long-term reliability issues for packaged devices.

LC10K (low-chlorine, abrasive foam) cleaning sheets were developed with chlorine levels of <100 ppm versus >800ppm of the SI10000-SWE (orange). The LC10K cleaning material has the same surface morphology / cross-section structure and matched material properties that define cleaning efficiency (i.e., hardness and wear rate). As with SI10000-SWE, the maximum operating temperature of the LC10K material is T = 80C.

To reduce the risk of chlorine contamination the LC10K (Low-Cl) material can be used as a direct replacement for the chlorinated SI10000-SWE for probe card cleaning applications

Material Property	LC10K (Low-Cl)	SI10000
Color	Green	Orange
Abrasive	#10000, Silicon-Oxide	#10000, Silicon-Oxide
Installed Thickness	~450um	~450um
Chlorine Content	< 100ppm	> 800ppm
Operating Temperature	0C to 80C	0C to 80C

CROSS SECTION



	Cleaning Material Configuration			
	Sheet	200mm Wafer	300mm Wafer	Custom Install
LC10K Layer Thickness	450 µm (nominal)	450 µm (nominal)	450 µm (nominal)	450 µm (nominal)
Support Carrier		725 ± 20µm (SEMI Standard)	775 ± 20µm (SEMI Standard)	Contact ITS
Total Installed Stack Height	450 ± 100µm[1]	1175 ± 120µm[1]	1225 ± 120 µm[1]	Contact ITS

1. Due to inherent lot-to-lot height variations associated with the abrasively coated foam, a certificate of inspection is provided with each material lot and should be used as the starting prober overtravel.

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02/26/20

AO3K Fiber Film
PRODUCT DESCRIPTION

AO3K (FIBER FILM)

PCC-PD-AO3K-FiberFilm

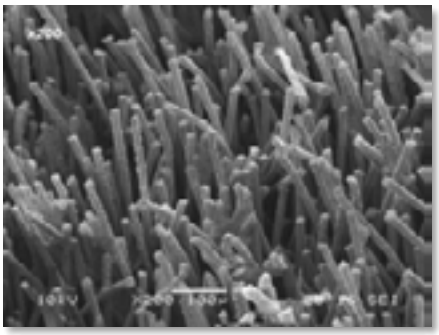
GENERAL

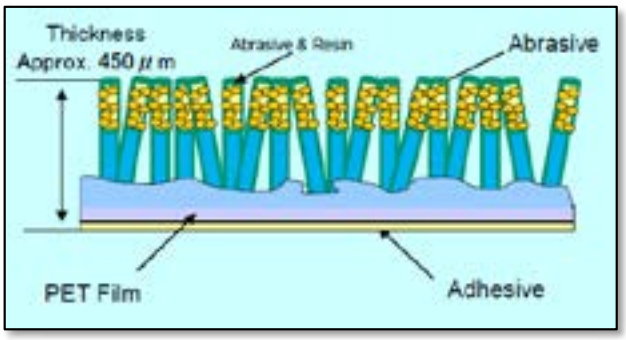
AO3K (fiber film) sheets are typically used for chemical mechanical polish (CMP) and optical connector polishing at ambient temperatures. These sheets are an abrasive pad constructed with 3mm to 5mm long fibers that have been embedded into a poromeric foam layer. The tiny fibers are coated with aluminum oxide abrasive particles and a resin binder.

AO3K cleaning films have been used in various off-line polishing steps to remove lightly adherent particles from the probe tips. During usage, the flexible and compliant tiny fibers move around the surface of a workpiece to create a less aggressive abrasive action.

Material Property	AO3K – Fiber Film
Color	Brown
Abrasive	#3000, Alumina
Installed Thickness	450 ± 100µm
Maximum Operating Temperature	0C < T < 80C

SURFACE AND CROSS SECTION





	Cleaning Material Configuration			
	Sheet	200mm Wafer	300mm Wafer	Custom Install
AO3K Layer Thickness	450 µm (nominal)	450 µm (nominal)	450 µm (nominal)	450 µm (nominal)
Support Carrier		725 ± 20µm (SEMI Standard)	775 ± 20µm (SEMI Standard)	Contact ITS
Total Installed Stack Height	450 ± 100µm[1]	1175 ± 120µm[1]	1225 ± 120 µm[1]	Contact ITS

1. Due to the compressibility and variable heights of the fibers, the nominal material thickness should be used as the starting prober overtravel.

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02/26/20

ITS Cleaning Materials Compliance
Restriction of Hazardous Substances (RoHS)

RoHS (EU-2015/863/E) Compliance
Restricted or Prohibited Hazardous Substances

Restriction of Hazardous Substances (RoHS) Compliance

Regarding the DIRECTIVE (EU) 2015/863 of 31 March 2015 amending Annex II to 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS Directive), International Test Solutions routinely polls all of our qualified raw material suppliers for their use of these substances.

Based on the information provided by our qualified suppliers, our current cleaning products formulations, and past analytical testing results, International Test Solutions does not expect that the following restricted substances would be present in any of our Probe Card Cleaning Materials and Substrates, Test Contactor Cleaning Materials and Substrates, or Chuck Cleaning Wafer Materials and Substrates at or above the specified limits: Cadmium (Cd): 0.01%; Mercury: 0.1% (Hg); Lead (Pb): 0.1%; Hexavalent chromium (Cr6+): 0.1%; Polybrominated biphenyls (PBB): 0.1 %; Polybrominated diphenyl ethers (PBDE): 0.1 %; Bis(2-Ethylhexyl) phthalate (DEHP): 0.1%; Benzyl butyl phthalate (BBP): 0.1%; Dibutyl phthalate (DBP): 0.1%; or Diisobutyl phthalate (DIBP): 0.1%. Trace amounts may be present as contaminants but are expected to be well below the maximum thresholds as established by the RoHS directive(s).

Furthermore, International Test Solutions does not intentionally add any Cadmium (Cd), Mercury (Hg), Lead (Pb), Hexavalent chromium (Cr6+), Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE), Bis(2-Ethylhexyl) phthalate (DEHP), Benzyl butyl phthalate (BBP), Dibutyl phthalate (DBP), or Diisobutyl phthalate (DIBP) during formulation or production of any the Probe Card Cleaning Materials or Substrates, Test Contactor Cleaning Materials or Substrates, or Chuck Cleaning Wafer Materials or Substrates.

These declarations are based on our knowledge of the components used in the manufacturing process and information provided by our qualified suppliers. Please know that International Test Solutions does periodically analyze our existing finished products - Probe Card Cleaning Materials, Test Contactor Cleaning Materials, or Chuck Cleaning Wafer Materials - for the substances restricted by this regulation.

It is the responsibility of our customers to determine that their use of our product(s) is safe, lawful, and technically suitable in their intended applications.

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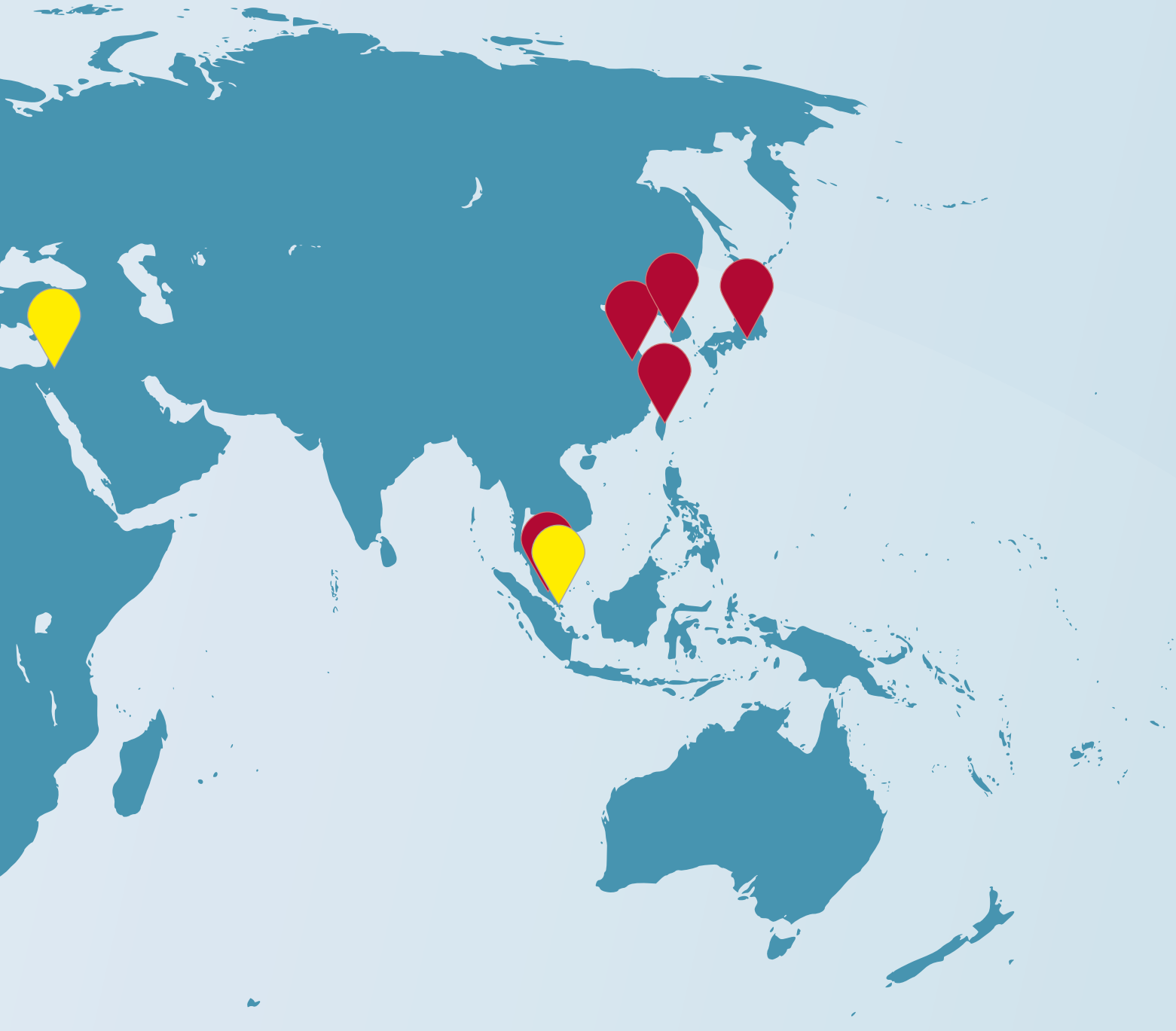
08/27/19

CONTACT ITS

ITS Headquarters

ITS Sales Office



ITS Representative Sales Office

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