teknek

An ITW Company

Contact Cleaning & Static Control

How to eliminate defects & safeguard against in-field failures

teknek ACADEMY est.2008

Introduction

Contact Cleaning is a very powerful defect elimination tool for many advanced manufacturing processes, especially in the PCB and PCBA sectors. Teknek invented the technique over 35 years ago and whilst at first glance the various solutions offered today may appear similar, they are not.

Specifically designed for high performance cleaning

At the core of the Contact Cleaning process is an engineered elastomeric roller and a reverse wound adhesive roll. Whilst Teknek elastomers and adhesive products are designed and made specifically for high performance cleaning, the same can't be said of others. However, for the user it is confusing, not least because other suppliers focus on making their products look visually like Teknek but fail to match Teknek's performance.

Static control: Beware of misleading claims

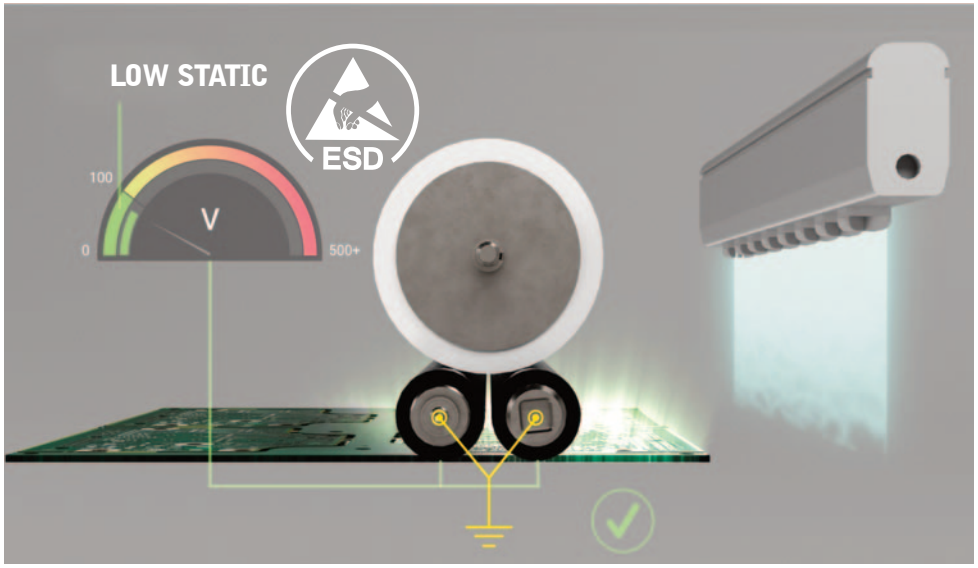
Many may remark – 'all blue rollers are the same', and all suppliers claim they work the same. And yes, whilst they look similar, they are anything but the same. As with many things in the world, fake products are everywhere, they look similar but use alternative materials, are often unsafe, and almost never have data to support their performance claims. Many competitor products promise the user good performance and claim to meet Industry Standards. Static control is one such area where misleading claims are made. Static control is an essential part of many processes to avoid detectable defects. While failures due to ESD are well understood, increasingly producers are also looking to reduce EOS events which are responsible for in field failures.

COMPANYWIDE STATIC CONTROL PROGRAMS

For good static control performance, industry standards must be adhered to. Organisations such as IPC and ANSI/ESD publish standards which provide the basis for a comprehensive static control program.

Perhaps the most widely adopted standard in this regard is ANSI/ESD S20.20-2021. (IEC 61340-5-1.) The most recent versions of this standard have sections specifically related to Automated Handling Equipment (AHE), namely ANSI/ESD SP10.1-2016 which applies to most modern PCB and PCBA production processes. Contact Cleaning technology is also covered by this section.

A defect removal process such as Contact Cleaning, typically applied before solder paste, is required to remove all unwanted contamination in PCBA. Equipment specified by leading Tier 1 suppliers also needs to be free of reverse contamination risks– i.e. chemical transfer from the cleaning roller, or adhesive transfer from the adhesive roll. In addition, the cleaning process must not create any static events.



ANSI/ESD SP10.1-2016

This equipment standard is clear and simple and includes:

- All insulative materials within 15cm (6 inches) of a device's critical path must be shielded, coated, plated, or otherwise rendered static safe.
- All dissipative and conductive materials within 15cm (6 inches) of static sensitive devices should be grounded.
- Where possible, all machine components that contact device leads should be static dissipative and grounded to prevent CDM (charged device model) type damage.
- Where possible, all machine components separated from the chassis by bearings of any kind (solid, rolling, radial linear, etc.) should be grounded in a manner that will provide a constant ground path (1 megohm or less) regardless of rotary or transitional rate. This may include but is not limited to: flexible ground conductors (i.e. braided cables), metal brushes, graphite commutators, beryllium copper commutators, conductive greases, etc.

Measurements of continuity on these assemblies when idle or powered down may not take into account intermittent connections of moving parts.

For those that make automatic handling equipment [AHE] products these simple demands require careful design and appropriate material selection.

There is considerable confusion in the area of material selection, with many suppliers of AHE interchanging the terms 'Antistatic' and 'Static Dissipating' and to that end it is vital to understand the difference between them.

As we explore this area, one thing is clear: "Antistatic" does not meet ANSI/ESD s20.20, only "Static dissipating" rollers in conjunction with dissipative adhesive and good machine grounding is compliant.

ESD MATERIALS

Materials for protection and prevention of electrostatic discharge can be categorised into three distinct groups; separated by their ranges of electrical conductivity.

Conductive

Resistivity generally between 10^3 and 10^5 ohms per square. However fast dissipation of charges resulting from this level of resistivity can result causing ESD events.

ANSI/ESD s20.20 requires automatic handling equipment to comply with SP10.1 and as such cleaning rollers and adhesive rolls should be static dissipating.

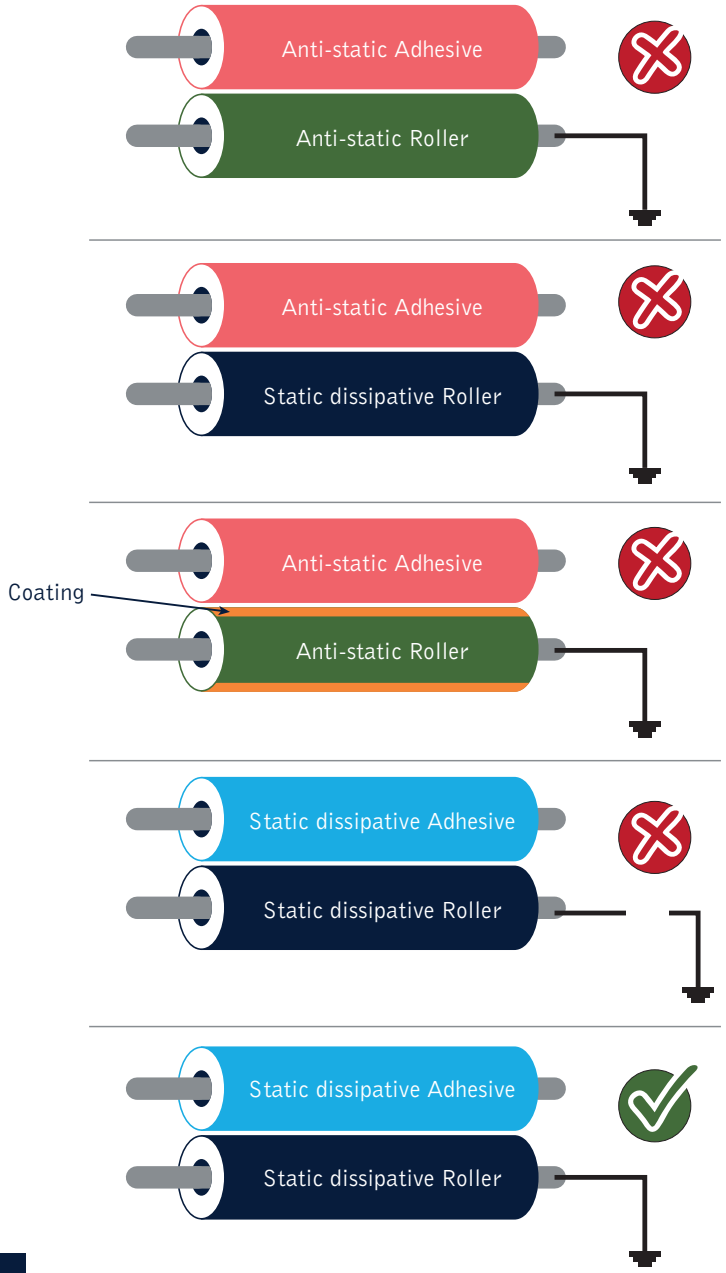
Anti-Static

Resistivity generally between 10^{10} and 10^{12} ohms per square. The generation of electrostatic charges are suppressed.

Static Dissipative

Resistivity generally between 10^6 and 10^9 ohms per square. Static dissipative materials have an electrical resistance between insulated and conductive materials. There can be electron flow across or through the dissipative material, but it is controlled by the surface resistivity or volume resistivity of the material.

Why static control is important when considering the use of contact cleaning is illustrated in the simple checklist to the right.



Range of conductivity to electrical charges

Metals		Shielding Composites			Carbon Powders & Fibers			Conductive Composites			Static Dissipative Composites				Anti-Static Composites			Insulative Base Polymers			
10^{-5}	10^{-4}	10^{-3}	10^{-2}	10^{-1}	1	10^{1}	10^{2}	10^{3}	10^{4}	10^{5}	10^{6}	10^{7}	10^{8}	10^{9}	10^{10}	10^{11}	10^{12}	10^{13}	10^{14}	10^{15}	10^{16}

CLEANING ROLLERS

When designing a high-performance contact cleaning machine, great care and attention must be paid to the properties of the cleaning rollers and adhesives.

Cleaning rollers touch the item to be cleaned, for example the panel in PCB, or the PCB in PCBA. It is therefore the cleaning roller that is the key component requiring examination.

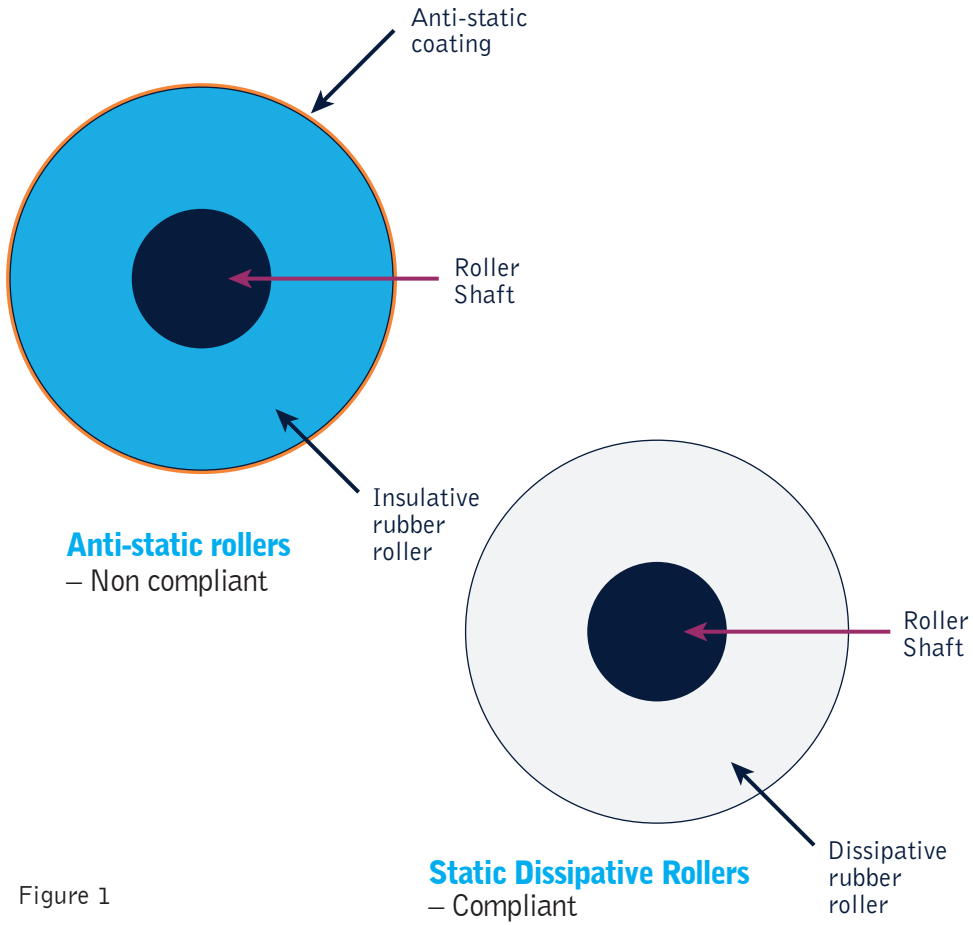


Figure 1

Anti-static rollers – Non compliant

An antistatic agent is a compound used for treatment of materials or their surfaces in order to reduce or eliminate buildup of static electricity. Standard insulative rollers can be coated with an antistatic agent. The compounds are dispersed in a solvent such that once coated onto the roller, the solvent evaporates and a very thin antistatic layer is formed as a 'skin' on the roller. See Figure 1 below. The antistatic layer is measured in Microns (μm).

The resultant coated roller is not able to dissipate static charge. Moreover, the layer is very thin and fragile and is worn away quickly (typically within weeks) resulting in a standard insulative roller.

Rollers such as these will give low static readings when using a field meter, however, once the coating is worn away meter readings will be high.

Moreover, as the cleaning roller runs in contact with the adhesive roll static charge readings will inevitably be high on the adhesive roll and increase once the coating is removed.

Static Dissipative Rollers – Compliant

Rollers which meet the strict guidelines of a company-wide static control program look very similar to both insulative and anti-static rollers. Indeed, simply by looking at these rollers it is hard to tell the difference.

However, the elastomer can dissipate static charge. In the case of Teknek NTcleen and GNTcleen rollers the entire elastomer layer has electrostatic properties such that when the roller is grounded static charge flows through the roller elastomer to the shaft and onto ground.

The ability to have the roller grounded is essential to comply with ANSI/ESD s20.20.

GROUNDING

Whatever roller used, even one which is dissipative, unless the system is well grounded, static charge cannot be dissipated.

Any charge which is present on the customers material before cleaning, or which is created during the cleaning process, or created by the rollers in contact with the adhesive rollers, will increase until a rapid discharge occurs, unless it can be dissipated by grounding.

An insulative silicone roller with an anti-static coating has no pathway to ground so cannot dissipate static charge and therefore does not meet the standard. Some users may gain comfort from the fact they measure low levels of static on the cleaning roller when it is in use, this in itself does not prevent ESD and EOS events.

Moreover, most contact cleaning machines use an adhesive roll which has a film as its base material. Even running against a coated anti-static roller, tribocharging occurs at the roller/adhesive interface. The adhesive roll acts as capacitor and can build charges upwards of 20kV. The proximity of a board to this elevated charge can induce a significant electric field which leads to static events. The adhesive, as well as the cleaning roller, must be static dissipative and grounded.

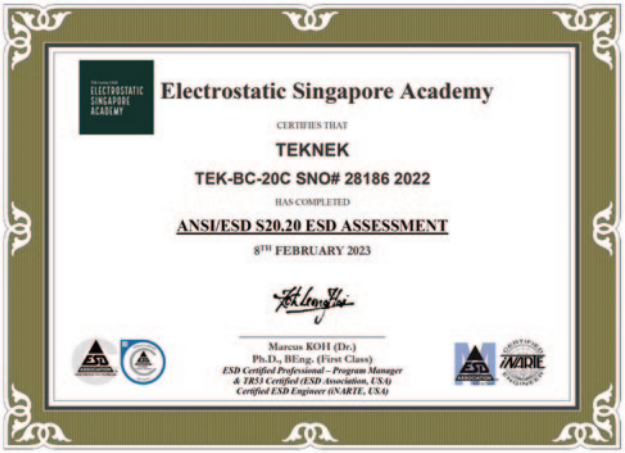
Key data is required, for example.

Cleaning rollers

- Surface resistivity of $1x10^6$ to $1x10^9$.
- Grounding to ANSI/ESD s6.1 <1MOhm Z

Adhesive Rollers

- Surface resistivity of $1x10^6$ to $1x10^9$
- Non film base material to prevent charge accumulation.
- Grounding to ANSI/ESD s6.1


Electrostatic Singapore Academy

CERTIFIES THAT

TEKNEK

TEK-BC-20C SNO# 28186 2022

HAS COMPLETED

ANSI/ESD S20.20 ESD ASSESSMENT

8TH FEBRUARY 2023

Marcus KOH (Dr.)
Ph.D., BEng. (First Class)
ESD Certified Professional - Program Manager
& TR53 Certified (ESD Association, USA)
Certified ESD Engineer (iNARTE, USA)

3RD PARTY APPROVAL

The easiest way to assess Automatic Handling Equipment when considering static performance is to request a Test Certificate from an approved test facility. Teknek machines are evaluated against ANSI/ESD s20.20 by the iNarte Approved Test house at the Electrostatic Singapore Academy.

THE LOW STATIC CLEANING SYSTEMS

STATIC DISSIPATIVE CLEANING ROLLERS

ntcleen

Dissipative textured formula for low static cleaning as part of a Teknek system. Best for cleaning thin materials in static sensitive processes. Complies with ANSI/ESD s20.20.

TEXTURED FINISH

gntcleen

Dissipative elastomer formula for low static board cleaning as part of a Teknek system. The future of particle removal. Complies with ANSI/ESD s20.20.

SMOOTH FINISH

CONCLUSION

Contact cleaning is an effective defect reduction process for the PCB and PCBA sectors. However, it is vital that the equipment used forms part of an approved company-wide static control program.

Equipment such as contact cleaners are required to comply with specific regulations such as those prescribed by ANSI SP10.1

Gaining 3rd party approval requires careful equipment design and a deep understanding of the materials and their interactions during the cleaning process.

Alternative approaches by some makers of equipment attempt to confuse users and fails to provide adequate data or independent testing to prove compliance.

A basic understanding of the differences between various ESD materials allows the manufacturer of cleaning equipment and the user make a safer product selection.

GLOSSARY

ESD

ESD stands for "electrostatic discharge". ESD is the release of static electricity when two objects come into contact. In more technical terms, electrostatic discharge "is a sudden and momentary flow of electric current between two electrically charged objects caused by contact, an electrical short or dielectric breakdown".

EOS

EOS - "Electrical overstress" is a term used to describe an event whereby an electronic component is exposed to an environment above its absolute maximum electrical rated values as specified in its data sheet. In other words, EOS is experienced by an electronic component when that component is operated - deliberately or accidentally - above its absolute maximum electrical rated values. EOS can be a single event, repeated events, or continuous in nature.

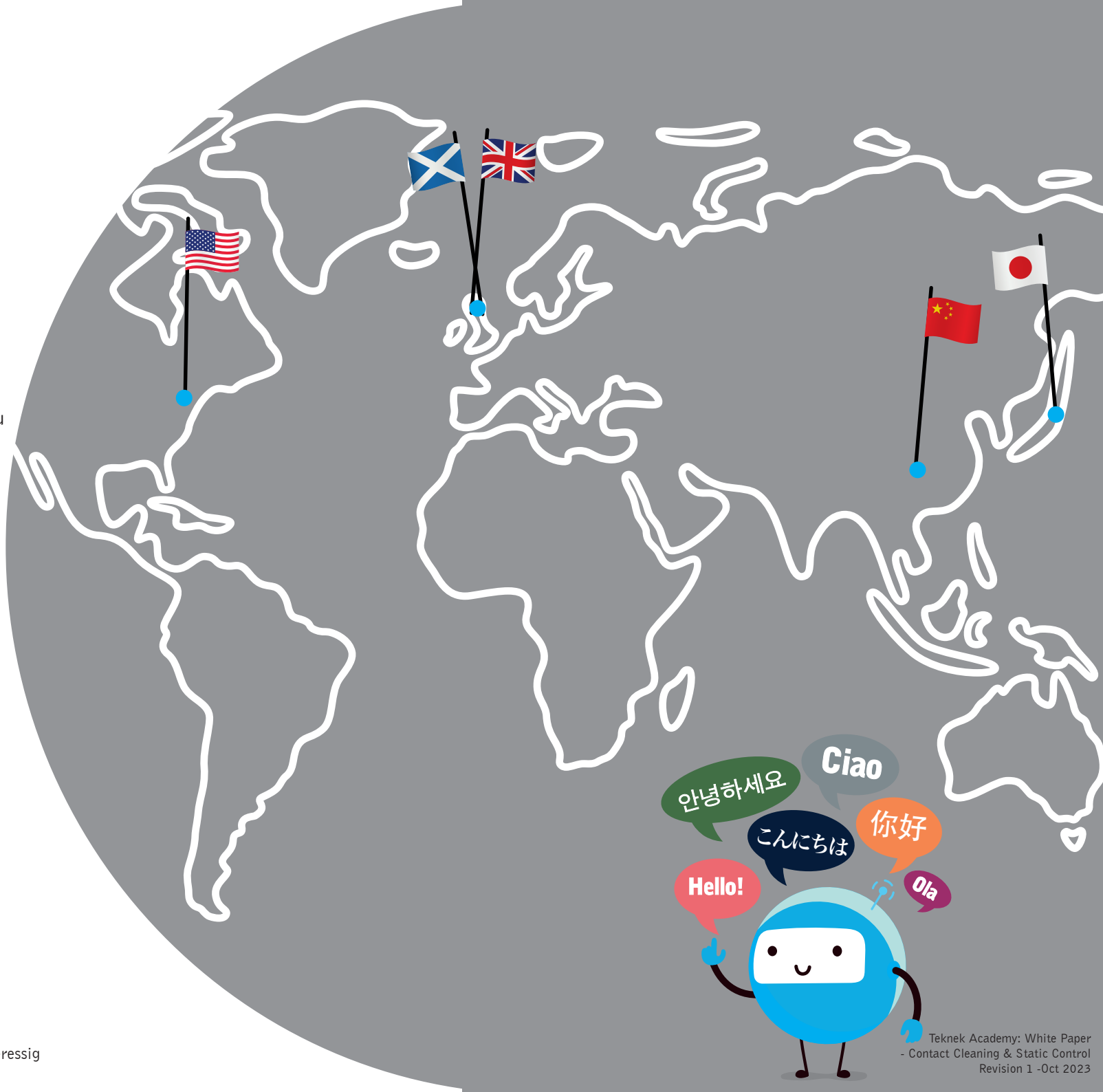
Teknek Head Office
River Drive
Inchinnan Business Park
Renfrewshire, PA4 9RT
Scotland, UK
T: + 44 (0)141 568 8100
E: teknek@teknek.com

Teknek (BRUX Japan)
1-3-1-6F Hakataekiminami Hakata-ku
Fukuoka-city 812-0016
Japan
T: +81 (0)92 473 6455
E: teknekjapan@brux.jp

Teknek China Ltd
Unit E, 4/F,
Winfield Industrial Building,
Tuen Mun, N.T,
Hong Kong
T: +852 2468 3160
E: hk@teknek.com

Teknek (Simco-Ion)
2257 North Penn Road
Hatfield,
PA 19440
USA
T: +1 125 822 6401
E: ussales@teknek.com

teknek.com



*Courtesy of AutoMoto TV **Courtesy of Saueressig