



WHAT IS
SCIENCE
WITHOUT
CARE?

TECHNICAL REPORT

Prepared For:

Henkel Loctite GC 50

Because we want you to achieve the highest levels of performance, we connect care with leading science to continuously improve, problem solve and create the most effective cleaning solutions to suit your specific needs.

KYZEN is an ISO 9001:2015 certified company.

Scope: This document reports *Best Fit Cleaning Agent* process parameters for removing Henkel Loctite GC 50 paste flux residue. Solubility testing was used to evaluate the effectiveness of KYZEN’s Electronic Assembly cleaning agents for removing the flux residue set.

Objective: To characterize the cleaning and solubility properties of Henkel Loctite GC 50 paste flux residue.

Henkel Loctite GC 50 no clean solder paste is designed for the jet print system.

Process Cleaning Rate

The process cleaning rate theorem holds that the rate at which a solvent or cleaning agent dissolves a residue (static rate) plus mechanical energy (dynamic rate) equals the process cleaning rate. To determine the static cleaning rate (rate at which the cleaning agent dissolves the residue in the absence of mechanical energy).

The Hansen Solubility Parameter provides insight into the KYZEN material sets that dissolve the residue. The “Phase 2” test exposes the processed flux residue on test coupons to different KYZEN cleaning agents in an effort to match up the right cleaning agent to the soil matrix. This testing provides insight into the technology base options for cleaning the specific residue set. The test coupons are graded (Figure 1) based on each KYZEN solutions’ ability to dissolve the flux residue.

This testing provides insight into the technology base options for cleaning the specific flux residue set.

Procedure: Phase 2 - Matching the Cleaning Agent to the Flux Residue

The objective of Phase 2 testing is to develop the static cleaning rate. Static cleaning rates measure the cleaning agent’s affinity to dissolve the soil in the absence of mechanical forces. High static cleaning rates indicate a strong match for the soil in question.

Wash concentration of the Aquanox materials was set at 10, 15 and 20% and testing temperature was 40°C and 60°C.

The semi – aqueous materials are processed as neat (100%) solutions. Testing temperature was 40°C and 60°C.

Time is fixed at 10 minutes.

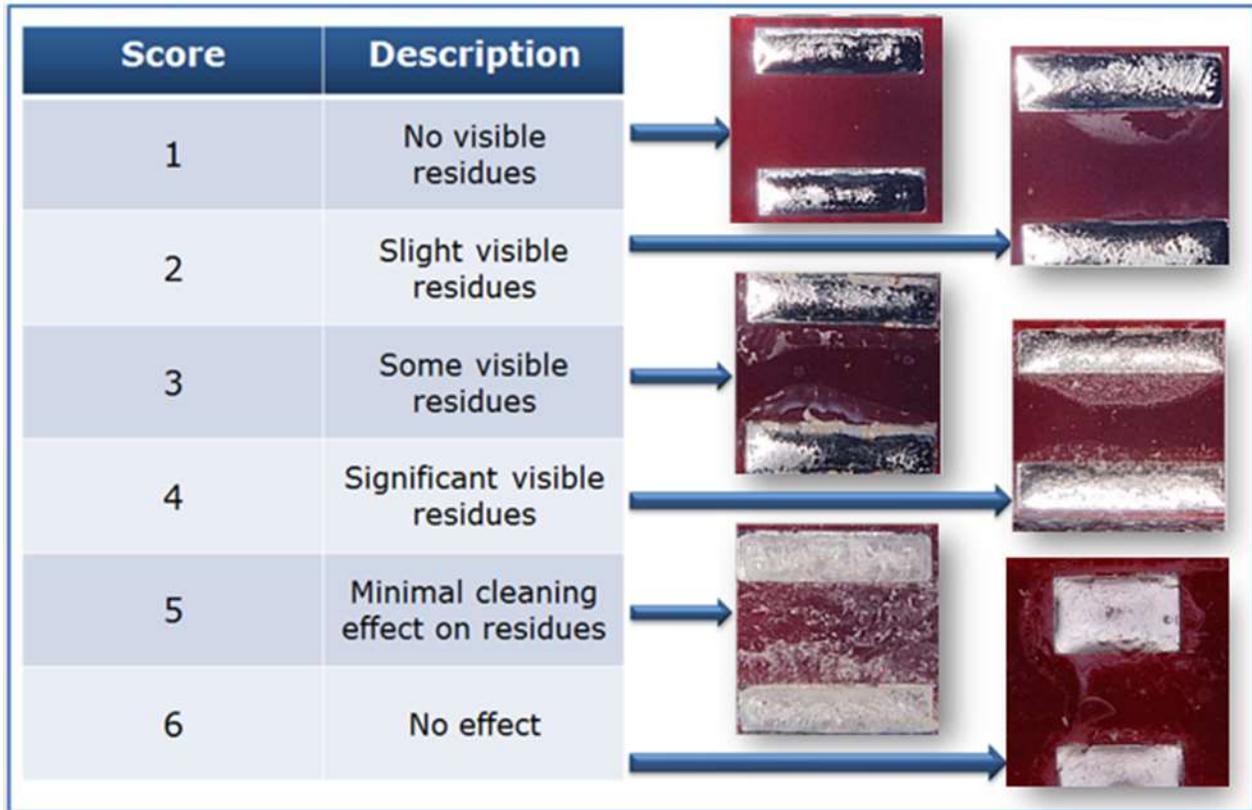
The test vials are slowly rotated at specific temperatures in a LabRoller to assure that the cleaning agent is well mixed during the test. After the 10-minute exposure the coupons are rinsed and dried, observed at 10-30x and the test scores logged into Minitab software. Minitab will generate a Main Effects Plot as shown on Pages 3 and 5.



The broken horizontal line is the average mean for the products tested.

Figure 1 illustrates the grading scale template used to score the test coupons.

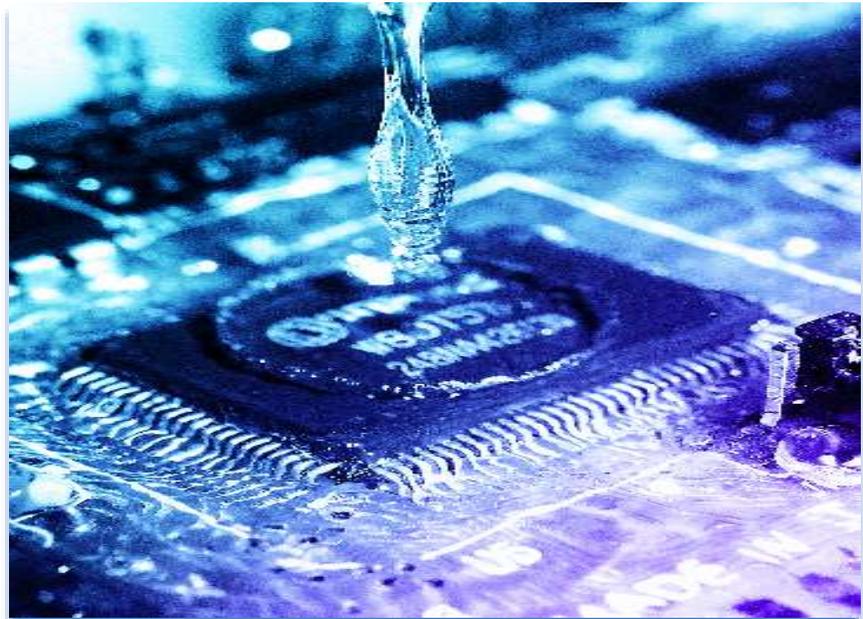
Figure 1: Grading Scale 1-6



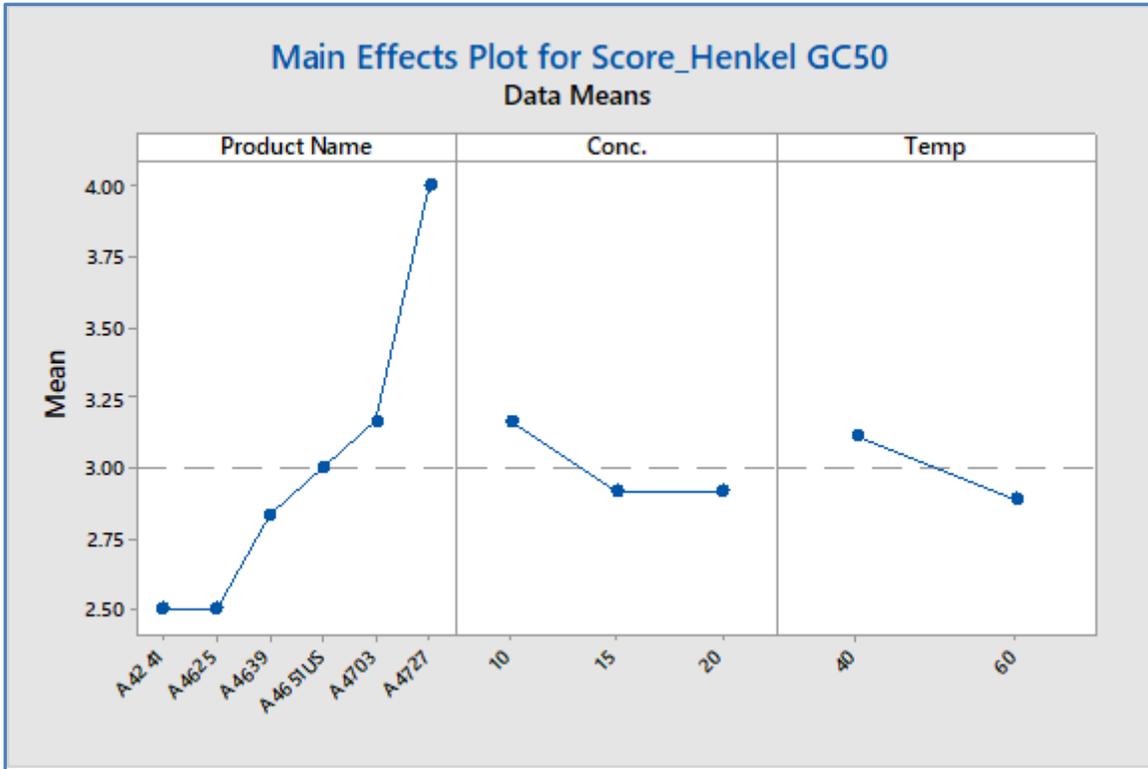
Data Findings:

The response scores were placed into Minitab statistical software package. The main effects plot provides insight into the cleaning agents that best match up with the Henkel Loctite GC 50 flux residue. The cleaning agents tested were grouped into the following product categories:

1. Aqueous Defluxing
2. Semi-Aqueous Defluxing



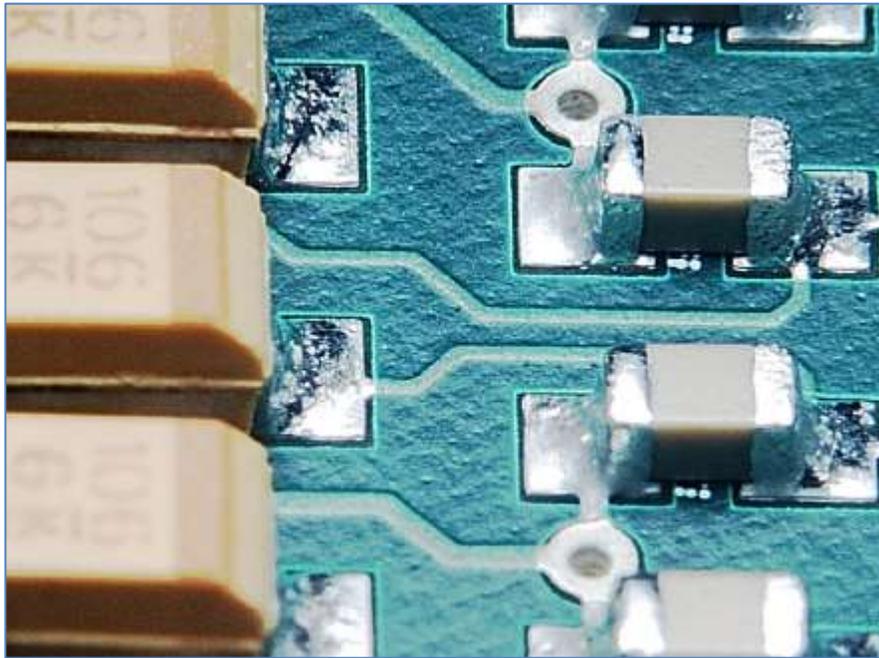
AQUEOUS CLEANING AGENTS



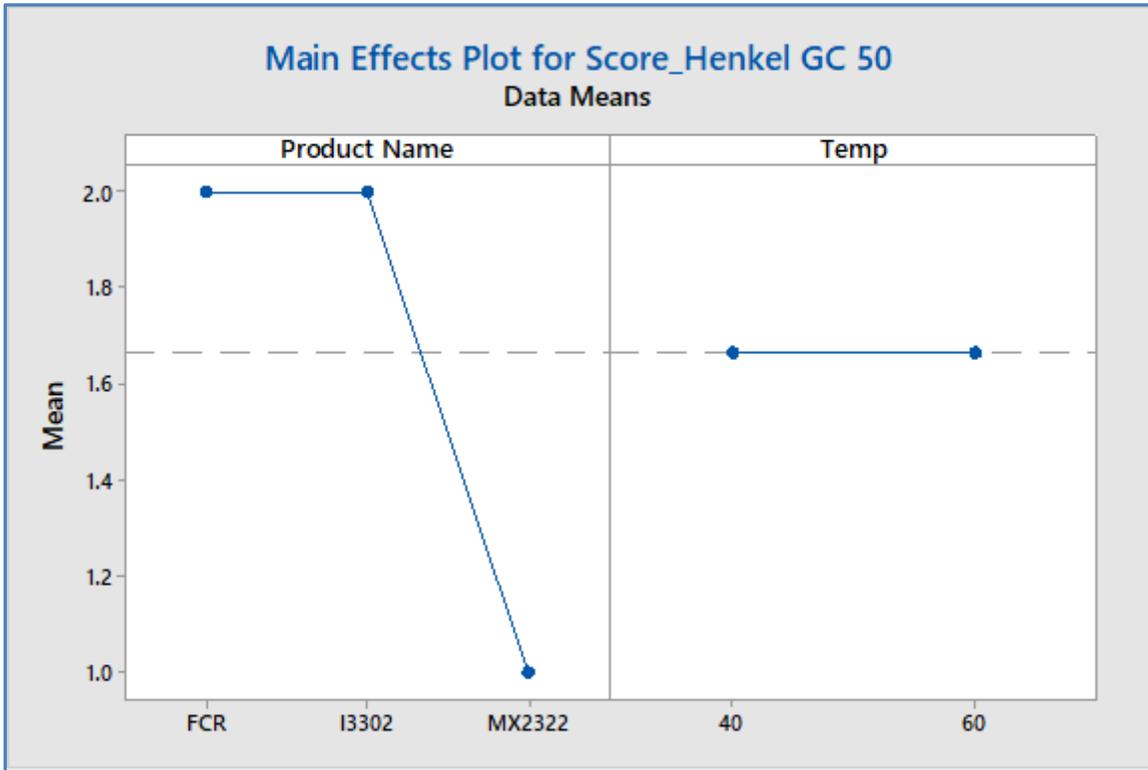
1. Aquanox A4241 is an engineered aqueous cleaning agent designed to remove all flux residues with spray in air cleaning equipment. The static testing indicates that Aquanox A4241 is most effective at removing Henkel Loctite GC 50 flux residue.
2. Aquanox A4625 is an engineered aqueous cleaning agent designed to remove all flux residues with spray in air cleaning equipment. The static testing indicates that Aquanox A4625 is most effective at removing Henkel Loctite GC 50 flux residue.
3. Aquanox A4639 is a next generation single chamber batch cleaning solution that provides exceptional cleaning results and protection of metallic surfaces with minimal monitoring and no sump-side additives. The static testing indicates that Aquanox A4639 is most effective at removing Henkel Loctite GC 50 flux residue.
4. Aquanox A4651US is a low pH aqueous cleaning solution designed exclusively for use in ultrasonic immersion cleaning systems. The static testing indicates that Aquanox A4651US is most effective at removing Henkel Loctite GC 50 flux residue.
5. Aquanox A4703 is a pH neutral range engineered aqueous cleaning agent designed to remove reflowed & wave solder flux residues with spray in air cleaning equipment. The static testing indicates that Aquanox A4703 is effective at removing Henkel Loctite GC 50 flux residue.
6. Aquanox A4727 is designed for reliable production and assembly operations. Environmentally responsible, Aquanox A4727 can be used at low concentrations to effectively remove even the toughest soils and rinse easily and completely. The static testing indicates that Aquanox A4727 is marginally effective at removing Henkel Loctite GC 50 flux residue.

Aqueous Cleaning Recommendations – Henkel Loctite GC 50

Cleaning Agent	Soil	Wash Conc.	Wash Temp.	Cleaning Tool
Aquanox A4241	Solder Paste flux residue	20-25%	60°C	Batch & Inline SIA
Aquanox A4625	Solder Paste flux residue	12-15%	60°C	Batch & Inline SIA
Aquanox A4639	Solder Paste flux residue	15-17%	60°C	Batch SIA
Aquanox A4703	Solder Paste flux residue	15-20%	60°C	Batch & Inline SIA
Aquanox A4727	Solder Paste flux residue	15-20%	60°C	Batch & Inline SIA
Aquanox A4651US	Solder Paste flux residue	20-25%%	60°C	Ultrasonic Immersion

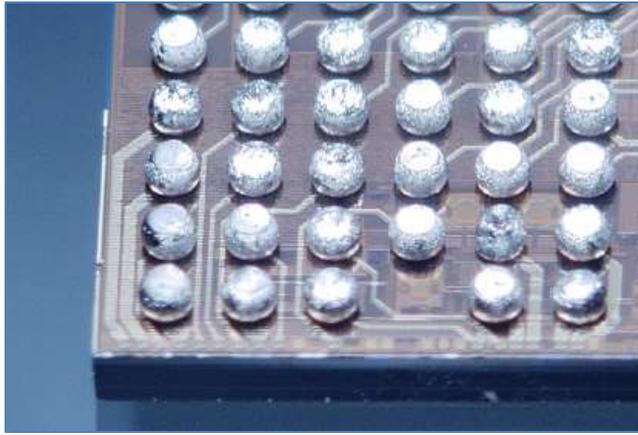


SEMI-AQUEOUS & SOLVENT CLEANING AGENTS



1. Ionox FCR is a high strength concentrated cleaner containing a blend of organic solvents and inhibitors. It is multi-metal safe and can be used in immersion agitation, ultrasonic or centrifugal systems. As a legacy cleaning solution Ionox FCR is effective for the removal of virtually all types of pastes and fluxes including rosin, low residue/no-clean and organic acid flux. The static testing indicates that Ionox FCR is effective at removing Henkel Loctite GC 50 flux residue.
2. Ionox I3302 is a semi-aqueous cleaning agent designed as a broad spectrum high strength solvent for SMT assemblies, semiconductor, flip-chip and wafer level packaging. The static testing indicates that Ionox I3302 is effective at removing Henkel Loctite GC 50 flux residue.
3. MICRONOX MX2322 is a semiconductor grade engineered semi aqueous solvent and designed to clean all types of paste fluxes common in wafer bumping, wafer level packaging, die attach, flip-chip and SiP that contain copper pillar. The static testing indicates that Micronox MX2322 is most effective at removing Henkel Loctite GC 50 flux residue.

Semi-Aqueous & Solvent Cleaning Recommendations - Henkel Loctite GC 50				
Cleaning Agent	Soil	Wash Conc.	Wash Temp.	Cleaning Tool
Ionox FCR	Solder Paste flux residue	100%	60°C	Spray Under Immersion, Ultrasonic & Direct Energy Wet Bench Processes
Ionox I3302	Solder Paste flux residue	100%	60°C	Spray Under Immersion, Ultrasonic & Direct Energy Wet Bench Processes
Micronox MX2322	Solder Paste flux residue	100%	60°C	Spray Under Immersion, Ultrasonic & Direct Energy Wet Bench Processes



Phase 3: Dynamic Cleaning Energy

The third important cleaning parameter is represented by the energy used to deliver the cleaning agent to the soil. Fluid dynamics increase the cleaning rate using fluid flow and pressure.

Aqueous cleaning processes are dramatically improved with dynamic cleaning energy and temperature. One benefit when formulating aqueous cleaning agents is the ability to engineer a material set that matches up to the residue. The concentration range for these products is typically 10% to 20% for No-clean and rosin fluxes and 3-10% for water soluble fluxes.

Applying spray in air impingement energy and elevated wash temperatures opens the process window for excellent cleaning results. The data in this report characterized both the flux residue and cleaning agents.

Semi-aqueous cleaning agents drive more with the static rate than with the dynamic rate. The solvency of semi-aqueous cleaning agents with the flux soil is a critical parameter for predicting cleaning performance. This statement also applies to vapor degreasing solvents.

The Ideal Cleaning Condition is dependent on many factors and does not solely rest on the cleaning agent. It is important to review the variables present as outlined in below Figure 2.

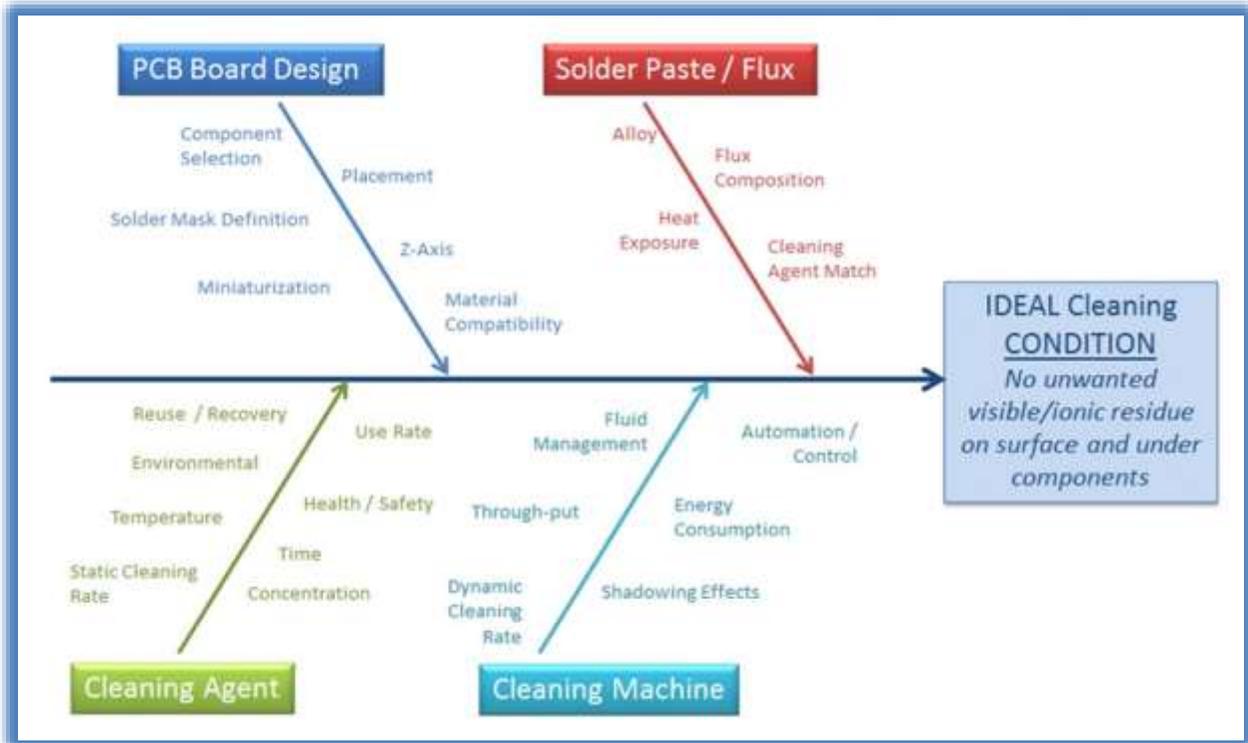


Figure 2

Inferences and Recommendations from the Data

Static material property testing confirms that solder flux residues are different in composition and their ability to be cleaned must be closely matched to the cleaning agent. The data in this report characterized both the flux residue and cleaning agents. This data is important when designing your cleaning process.

Achieving proper cleanliness levels has become more challenging due to;

- Highly dense component placements
- Component configurations
- Low clearance with a lot of flux underneath
- Flux residues that form a hard clear shell require longer wash times to dissolve in the cleaning agent, thus requiring increased wash bath exposure time to effectively clean these residues.

The data finds that Henkel Loctite GC 50 paste flux has shown to be easily cleaned when exposed to KYZEN cleaning solutions. However, most importantly a carefully defined wash process must be in place to effectively clean this flux formula.

As the report details, KYZEN engineers a wide range of cleaning agents designed to match up with client needs. Contact your local KYZEN representative for the best recommendation and product samples for testing.

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STATEMENT OF TESTING INTEGRITY

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