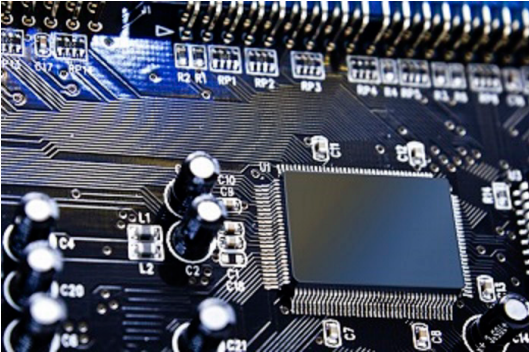


# AQUANOX<sup>®</sup> A4727

*Next Generation Aqueous Assembly Cleaner*

Aquanox A4727 is designed to address the critical challenges facing high reliability assembly operations. Meet your high-performance cleaning requirements with advanced inhibition technology that is effectively buffered for a stable pH throughout its long bath life, enhancing compatibility with your devices and cleaning equipment. Environmentally responsible A4727 can be used at low concentrations to effectively remove even the toughest soils on complex, dense assemblies while rinsing easily and completely.



- **Exceptional Cleaning of ALL Widely Used Solder Materials**
- **Excellent Material Compatibility**
- **Brilliant Solder Joints**
- **Superior & Complete Rinsing**
- **Low VOC**
- **Verified multi-year development cycle**

*The information contained herein is based on available data from reliable sources and is accurate to the best of KYZEN Corporation's knowledge at the time of this publication. KYZEN makes no warranty, expressed or implied, of merchantability or fitness for a particular purpose, course of performance or usage of trade. The user is solely responsible for determining the suitability and completeness of such information for their particular application and for adopting appropriate safety precautions. Physical properties listed within are typical values based on samples tested and should not be construed as guaranteed analysis of any specific lot or as specifications for the product. Other factors may involve additional safety or performance considerations—refer to the KYZEN product Safety Data Sheet (SDS) for complete safety information. This data is not to be taken as a warranty or representation for which KYZEN assumes legal or financial responsibility.*

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## Appendix

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## PRODUCT DESCRIPTION

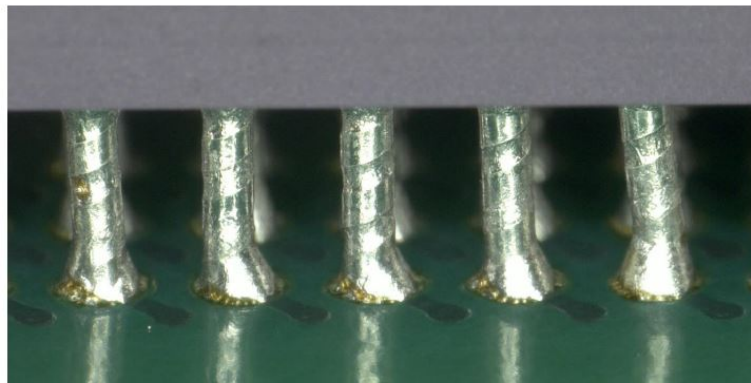
Aquanox A4727 is a highly dispersive cleaning agent engineered to remove lead-free no-clean flux residues and is effective on all solder pastes in production today. Aquanox A4727 is commonly used to clean rosin and no-clean flux residue types but will also clean water soluble soils.

Aquanox A4727 is a low foam cleaning agent that is commonly monitored based on the solvent / water ratio. Wash time is a function of the soil, component geometry and Z-axis gap. Lower Z-axis gaps under components typically require longer wash times.

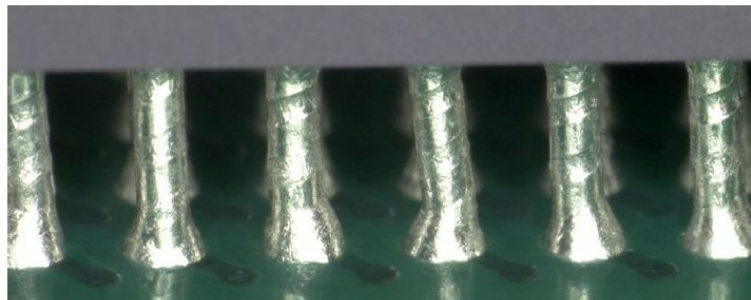
Aquanox A4727 solvency make-up is engineered with a mixture of oxygenated alcohol-ether compounds, which are partially soluble in water. The solvents were selected on their ability to dissolve rosin and resin structures. The solvents provide a unique hydrophobic (rosin/resin loving) and hydrophilic (water loving) balance. Aquanox A4727 is formulated with high dispersive, moderate polarity, and moderate hydrogen bonding forces.

The high level of solvency within the Aquanox A4727 concentrate provides high dispersive values at the dilution concentration ranges. The solvent micro-droplets at operating wash temperatures ranging from 52-68°C / 125-155°F provide high affinity for non-polar resin and rosin structures.

Aquanox A4727 contains low levels of a polar organic reactive solvent with one side of the molecule inducing the ion-dipole on non-polar resins and the other portion of the molecule providing dispersive forces. These unique properties provide affinity for both ionic and non-ionic solutes. Functional additives are added to reduce interactions on metallic alloys, anodized aluminum, and conversion coatings.



*Before 50X*



*After 50X*

## CHEMICAL AND PHYSICAL PROPERTIES

This KYZEN product is environmentally responsible and operator safe, when handled in accordance with good industrial hygiene and safety practices. *Table 1* summarizes important chemical and physical properties of this product.

| <i>Table 1: Typical Chemical and Physical Properties</i> |                               |             |              |                   |
|--|-------------------------------|-------------|--------------|-------------------|
| Parameter  | 100% Concentrate              | 5% Dilution | 10% Dilution | Special Values    |
| Clarity  | Clear                         |             |              |                   |
| Color  | Light straw, darkens with age |             |              |                   |
| Odor   | Mild                          |             |              |                   |
| Flash Point, °C / °F (TCC)                               | 99°C / 210°F                  |             |              |                   |
| Boiling Point, °C / °F                                   | 139°C / 282°F                 |             |              |                   |
| Volatile Organic Compound (VOC)<br>Autocalculated        | 823.6 gm/L                    |             |              | 150 <sup>1</sup>  |
| Surface Tension  |                               |             | 31 - 33      |                   |
| Chemical Oxygen Demand, (COD),<br>mg/L (ppm)             |                               |             |              | 24.2 <sup>1</sup> |
| pH   | 8.3 – 8.9                     | 9.5 – 10.0  |              | 9.7 <sup>2</sup>  |
| Specific Gravity, @20°C                                  | 0.98                          |             |              |                   |
| Weight/gallon  | 8.2 lbs/gal                   |             |              |                   |
| Refractive Index, ° BRIX                                 | 60 – 64                       |             |              |                   |
| MEQ to pH 8.3  | 0.10 – 1.10                   |             |              |                   |
| MEQ to pH 4.0  | 0.30 – 1.30                   |             |              |                   |
| Alkalinity Ratio   | 1 : 2.00                      |             |              |                   |
| Non-volatile Residue (NVR) %                             | 11.7                          | 0.6         | 1.2          |                   |

<sup>1</sup> Measured at 0.01% dilution.

<sup>2</sup> Measured at 10 g/L dilution.

## PRODUCT USE DIRECTIONS

In general, wash concentration, wash temperature, spray impingement energy, wash time and rinsing are five key elements of process optimization.

KYZEN recommends the following process parameters for applications using Aquanox® A4727.

Aquanox A4727 is designed for use in spray-in-air cleaning machines. Wash concentration, wash temperature, spray impingement energy and wash time are four key factors to successful cleaning.

1. **Wash Concentration:** For lead-free no-clean (NC) and rosin based flux residues, a concentration range from 10-18% is the recommendation. A recommended concentration range for organic acid (OA / WS) flux residues is 1% - 8%. If the residues are reflowed above the recommended peak temperatures, a higher concentration level may be needed.
2. **Wash Temperature:** For most lead-free no-clean, rosin, and organic acid flux residues, a wash temperature range of 55-60°C / 130-140°F is sufficient. The defoaming properties of Aquanox A4727 are best when operating at 51-60°C / 125-140°F wash temperatures.
3. **Spray Impingement:** Spray energy is needed to move the cleaning agent under Z-axis components (low stand-off). Fluid dynamics improve cleaning and shorten cycle time. Spray pressures in the range of 50-100 psi using tight fan and coherent spray jets work well.
4. **Wash Time:** Determining the optimum wash time is a function of the residue properties, component density and geometry, Z-axis gap height and cleaning equipment. Planarized (conveyor) inline cleaning machine designs provide high fluid flow and energy. Conveyor belt speeds in the range of 0.5-2.0 FPM work well. Single chamber aqueous batch spray-in-air designs provide high flow at lower pressures. A wash time in the range of 7-15 minutes is adequate for most applications.

A final rinse using DI water established from IPC-J-STD and IPC-CH-65B guidelines is recommended.

Aquanox A4727 works best when the cleaning agent is added to the wash tank using a dosing injection system such as the KYZEN Chemtroller. When the wash tank calls for water make-up, the dosing systems add Aquanox A4727 at the desired concentration levels. Alternatively, KYZEN's PCS Type II (process control system) automatically controls both cleaning agent and water make-up to the wash tank. Maintaining the concentration within the lower and upper set points reduces variability. KYZEN recommends that the wash concentration be monitored using KYZEN's Chem Control Type II split monitoring method (see section on Bath Maintenance Methods).

*Appropriate bath maintenance methods specific to this product are detailed in latter sections of this supplement.*

## COMPATIBILITY INFORMATION- SUBSTRATES AND EQUIPMENT

All chemicals have the potential to adversely affect substrates and process equipment. As such, the effects of short-term exposure for substrates common to parts and assemblies and the effects of long-term exposure for materials of equipment construction must be considered. *Tables 2, 3 and 4* summarize known compatibility recommendations regarding the use of this product with specific substrates. These compatibility recommendations are based on internet research of A4727's major formulation materials and internal KYZEN testing on the product as a whole of commonly available materials. Elastomers and plastics can vary greatly in quality. Metals, elastomers and plastics can vary greatly in quality. For the most accurate results on long-term exposure of your materials, it is advised to perform additional testing.

**Table 2: Plastics and Elastomers**

| Brand Name               | Generic Description                    | A4727 |
|--------------------------|--|-------|
| Delrin™                  | Acetal                                 | A     |
| Acrylic                  | Acrylic                                | D     |
| Nylon 6/6                | Polyamide                              | A     |
| Lexan™                   | Polycarbonate resin                    | D     |
| ABS Plastic              | Acrylonitrile butadiene styrene        | D     |
| PEEK                     | Polyetherether Ketone                  | E     |
| PVC                      | Polyvinyl Co-polymer                   | C     |
| Natural Rubber           | Black rubber                           | C     |
| NORYL®                   | PPO™ resin and polystyrene             | E     |
| Neoprene                 | Polychloroprene                        | C     |
| PPS (Ryton®)             | Polyphenylene sulfide                  | E     |
| PTFE (Teflon™)           | Polytetrafluoroethylene                | A     |
| Kalrez® 4079             | ASTM D395B: FFKM (FFPM)                | A     |
| Kynar™                   | Polyvinyl fluoride                     | E     |
| Aflas                    | Tetrafluoroethylene and Propylene      | E     |
| Tefzel™                  | Ethylene/tetrafluoroethylene copolymer | E     |
| Polypropylene            | Polypropylene                          | A     |
| Hypalon®                 | Chlorosulfonated Polyethylene (CSPE)   | E     |
| Chemraz®                 | Perfluoroelastomer (FFKM)              | E     |
| Alathon™                 | High density polyethylene              | A     |
| Viton A or B             | Fluoroelastomer                        | D     |
| Low density polyethylene | Polyethylene                           | A     |
| Ultem™                   | Polyether imide                        | E     |
| Silicone Rubber          | Silicone Rubber                        | A     |
| CPVC                     | Chlorinated Polyvinyl Chloride         | D     |
| Buna-S                   | Styrene Butadiene                      | E     |
| Buna-N                   | Styrene Nitrile Copolymer              | D     |
| Kel-F® / Neoflon®        | PolyChloroTriFluoEthylene (PCTFE)      | E     |
| EPDM                     | Ethylene Propylene Diene Monomers      | C     |

# COMPATIBILITY INFORMATION- SUBSTRATES AND EQUIPMENT

**Table 3: Metals and Alloys**

| Substrate                      | A4727          |
|--------------------------------|----------------|
| 2024 Aluminum- Bare            | A <sup>3</sup> |
| 2024 Aluminum- Alclad          | A <sup>3</sup> |
| 2024 Aluminum- Anodized        | A <sup>3</sup> |
| Black Anodized Aluminum        | A <sup>3</sup> |
| 3003, 6061 and 7075 Aluminum   | A <sup>3</sup> |
| 7075 Aluminum- Alclad          | A <sup>3</sup> |
| Silver                         | A              |
| Gold                           | A              |
| Copper                         | A              |
| Zinc                           | E              |
| 1018 Steel                     | A              |
| 304 and 316 Stainless Steel    | A              |
| Titanium                       | A              |
| Steel, Galvanized              | A              |
| Tin-Lead Based Alloys          | A <sup>3</sup> |
| Tin-Copper Based Alloys        | A              |
| Tin-Silver-Copper Based Alloys | A              |
| Bismuth-Tin Based Alloys       | A              |

**Ratings - Chemical Effect**

A - Excellent  
 B - Good: Minor Effect, slight corrosion, or discoloration.  
 C - Fair: Moderate Effect, not recommended for continuous use. Softening or loss of strength, and swelling may occur.  
 D - Severe Effect: Not recommended for any use.  
 E – Test / Information not available.

**Explanation of Footnotes**

1-Satisfactory to 72°F (22°C)  
 2-Satisfactory to 120°F (48°C)  
 3-Repeated wash exposure beyond a typical process cycle time can lead to discoloration or etching of the surface. KYZEN Booster 20 is recommended to dose sump side to minimize any reaction.

**Table 4: Equipment**

**When considering long-term exposure for materials of equipment construction, the following materials are generally compatible with chemistries used for inline and batch cleaning systems:  
 (listed in order of resilience)**

| Type                         | Compatibility   |
|------------------------------|---|
| EXHAUST                      | Stainless Steel, Polypropylene  |
| PUMP SEALS, O-RINGS, GASKETS | Preferred: Teflon, Kalrez® 4079. Acceptable/Non-wetted areas: EPDM (EPR)<br>Note: VITON is not recommended. |
| PLUMBING LINES               | Stainless steel or Polypropylene (machine piping). PVC (drain piping)<br>Note: CPVC is not recommended.     |
| CURTAINS                     | Polypropylene or Reinforced Silicone (red)  |
| WINDOW / DOOR SEALS          | Silicone Rubber   |
| RTV                          | Dow Corning 732 or similar high grade   |

## BATH MAINTENANCE AND MONITORING

When a KYZEN bath solution is properly maintained, prolonged bath life can be expected. The results of a bath life study conducted with this product confirm the extended bath life experienced by many KYZEN users. Expended process baths can be a significant and expensive waste stream for facilities. Numerous factors can degrade bath performance, including depletion or imbalance of bath chemistries and buildup of contaminants from drag-in or other sources. Process bath life can be extended through simple process control and contaminant reduction techniques, resulting in significant waste reductions and cost savings.

**KYZEN recommends KYZEN TYPE II METHOD to monitor bath concentration.**

**KYZEN recommends NON-VOLATILE RESIDUE (NVR) to monitor bath life.**

There are two NVR methods available; The legacy, oven dry testing method as shown in the Application Note on Page 13 or the newest test method that uses the Mettler-Toledo HE53 Analyzer described on Page 14.

Contact KYZEN Technical Support if you have any questions on wash bath monitoring or bath life testing.

### NOTES AND COMMENTS

- **Recommended procedures for bath life maintenance and monitoring are appended to this supplement.**
- KYZEN Chem Control Kit Type II / PN# FF16910
- KYZEN's **Bath Profile Kit** / PN# F00206 can help determine NVR and physical properties trends by analyzing six (6) wash bath samples collected over a determined time frame. Please contact your KYZEN Representative for more information.
- A Single Sample Wash Bath Analysis / PN# F00212 is also available to test physical properties and NVR.
- The Mettler-Toledo HE53 Moisture Balance Analyzer and its supporting items can be purchased direct from KYZEN.
  - HE53 Moisture Analyzer / PN# 116070
  - Aluminum Sample Pans / PN# 116071
  - Fiber Pads for Liquid samples / PN# 116072



### **SHELF-LIFE**

Retain samples are taken from every product batch and kept for a minimum of five years. Additionally, randomly selected retain samples of key products are maintained indefinitely. KYZEN determined the shelf life of our aqueous and non-aqueous products by closely monitoring the quality of product samples stored in these retain samples over time. The results of this study provided valuable information on the stability of our products over time.

**With few exceptions\*, KYZEN products are acceptable for use up to FIVE (5) years, when packaged in sealed containers of five gallons or greater.**

Conversely, it is more difficult to predict the long-term integrity of a product in containers holding less than five gallons, as well as unsealed containers of any size. Smaller product containers and unsealed containers are more susceptible to contamination and evaporation, which preclude extended expiration dates. Capping opened containers when not in use can minimize contamination and evaporation. Exceptions to shelf-life are clearly documented on product-specific Certificates of Compliance.

### **PRODUCT COLOR**

For all KYZEN products, *color does not indicate product quality*; therefore, color is not used as a quality control parameter or specification for final product evaluation. KYZEN products are made from a blend of raw materials, some of which are organic solvents derived from agricultural materials. After 20 years of collecting data on KYZEN products containing these raw materials, studies have shown that these materials can contribute to color variances in concentrated and diluted product, as well as slight color variations over time. These same studies confirm that while *color changes may occur, product quality is unaffected*. To assure product quality, KYZEN evaluates each lot of these raw materials to verify integrity before blending.

### **STORAGE**

Store this product in the original container at temperatures between 5-30°C / 41-86°F indoors, or out of direct sunlight. Most products have a freezing point much lower than water and a very high boiling point; therefore, most KYZEN products do not require any special handling to address temperature changes. KYZEN conducts freeze/thaw studies on all products to determine if product quality is affected by such factors and completes further testing if necessary. Following best practices always use the oldest inventory first and keep your stock rotating. *Exceptions to storage temperature requirements are clearly documented on product-specific Certificates of Compliance.*

### **HANDLING**

This product is environmentally responsible and operator safe, when handled in accordance with good industrial hygiene and safety practices. Refer to the Safety Data Sheet (SDS) regarding safe handling practices with this product. It is always a good practice to wear safety glasses or goggles and nitrile gloves whenever handling Aquanox.

## ENVIRONMENTAL CONSIDERATIONS

KYZEN products are generally compatible with common primary and secondary waste treatment processes; however, the addition of soils removed during the cleaning process can significantly escalate environmental concerns. These environmental considerations vary widely depending on the cleaning machine and the operating parameters of your particular cleaning process. As such, the selection of the cleaning agent must incorporate the inherent impact on air emissions, water discharges and waste generation from your facility. Each of these three environmental mediums may require a permit depending on the usage rate and existence of other air emissions, water discharges and waste generation at your facility.

### ***What are KYZEN's responsibilities for proper disposal?***

- The *United States OSHA Hazard Communication Standard* requires suppliers to provide a GHS compliant Safety Data Sheet (SDS) for all products.
- KYZEN is responsible for providing known information on toxicity testing, health hazards, waste disposal, safe work practices, protective equipment, material reactivity and flammability, etc.
- Note: All information needed to properly classify a product for disposal, wastewater treatment or discharge into a wastewater stream can be found in the product SDS, specifically in Sections Three (3), Nine (9), Twelve (12) and Thirteen (13). Therefore, KYZEN does not disclose proprietary, non-hazardous product constituents for this purpose.

### ***What are the end user's responsibilities for proper disposal?***

- It is the user's responsibility to seek guidance and rule interpretation from appropriate authorities before applying for any required permits. This is usually accomplished by providing a copy of the product SDS, supplied by KYZEN, to local authorities. Because local regulations are often more stringent than federal regulations, it is imperative for the user to consult with local regulatory agencies before starting a waste water discharge, or introducing new chemicals or chemical processes to an existing permitted waste water discharge stream.
- The three regulatory agencies that a user must review are federal (national), state (regional), and local. Each company must meet the minimum federal standards. The state regulations may be the same or even more restrictive than the federal. Finally, the local community's regulations will be at least as restrictive as state regulations.
- The discharge of any wastewater stream, both by total flow and by chemical make-up must conform to national, regional and local regulations in all nations. Such regulations vary from very strict limits with little derogation to relatively flexible conditions. Many nations, particularly in Europe, have very strict legal requirements dictated on a national scale, covering many aspects of waste water quality. Other nations have less comprehensive regulations, covering only the more important considerations. Local authorities may offer derogations to national legislation if the local treatment plant is able to handle the otherwise out-of-tolerance waste.

### **The end user is ultimately responsible for compliance with all applicable regulations.**

KYZEN is the industry leading provider of environmentally friendly cleaning chemistries and processes and contributes this knowledge and experience to a number of industry publications. For more detailed information on environmental considerations, please reference Section Nine (9) of the *IPC-CH-65B Guidelines for Cleaning of Printed Boards and Assemblies, July 2011*.

**Your KYZEN Representative is available to assist you  
throughout your cleaning process.**

**KYZEN Technical Support**

**1-800-845-5524**

**[www.KYZEN.com](http://www.KYZEN.com)**

*Materials furnished under all KYZEN orders are manufactured in accordance with KYZEN Corporation specifications. KYZEN maintains documentation of conformance to these specifications, which is available for review upon request. All raw materials used in KYZEN products are obtained from suppliers on KYZEN's Approved Vendor List (AVL), pursuant to ISO certified standard operating procedures for raw material quality control.*

## KYZEN TYPE II TEST KIT PROCEDURE

Aquanox® A4727

USE PERSONAL PROTECTION EQUIPMENT (PPE) | WASH SOLUTION IS HOT | TYPE II REAGENT POWDER MAY IRRITATE SKIN, EYES AND/OR NOSE | AVOID DIRECT CONTACT



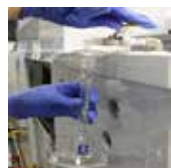
**STEP 1:** Add one scoop of KYZEN Type II Reagent to a clean KYZEN Flask.



**STEP 2:** Allow wash pump/process mixer to run for five (5) minutes for routine measurement. A new bath may need to run for up to sixty (60) minutes.



**STEP 3:** From the sample port, pull a 500mL sample to purge the sample line. Repeat if necessary to completely purge the sample line.

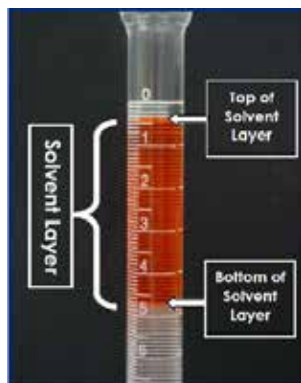


**STEP 4:** Immediately fill the KYZEN Flask with bath solution directly from the sample port. *Do not fill the KYZEN Flask above the "0" line.* Cork the flask with a standard taper size 13 stopper. Holding the stopper in place, rotate the flask 3 to 4 times to dissolve reagent powder.



**STEP 5:** Immediately remove stopper. Wait five (5) to ten (10) minutes for the sample to separate (split) in the flask. Sample is complete when large bubbles completely rise to the surface.

- Some small bubbles may cling to the glass or the solution may have a pink tint.
- Total volume may decrease as the solution cools in the flask, but will not affect split calculation.



**STEP 6:** View the flask at eye-level and determine the volume of the top and bottom of the solvent layer in milliliters (mL). Subtract the top reading from the bottom reading to determine the total volume of the solvent layer.

**EXAMPLE CALCULATION**

$$\begin{aligned} \text{Bottom Reading} &= 4.7\text{mL} \\ \text{Top Reading} &= \underline{0.5\text{mL}} \\ \text{Total Split Volume} &= 4.2\text{ mL} \end{aligned}$$

**CONVERSION CHART**

**= 17.6%** Bath Concentration **ON REVERSE SIDE**

## CONCENTRATION CHART

Use the calculated split volume (mL) to determine concentration (%).

| mL split | Concentration(%) | mL split | Concentration(%) | mL split | Concentration(%) |
|----------|------------------|----------|------------------|----------|------------------|
| 0.5      | 5.0              | 2.9      | 13.8             | 5.3      | 20.4             |
| 0.6      | 5.4              | 3.0      | 14.1             | 5.4      | 20.6             |
| 0.7      | 5.8              | 3.1      | 14.4             | 5.5      | 20.9             |
| 0.8      | 6.3              | 3.2      | 14.7             | 5.6      | 21.1             |
| 0.9      | 6.7              | 3.3      | 15.0             | 5.7      | 21.4             |
| 1.0      | 7.1              | 3.4      | 15.3             | 5.8      | 21.6             |
| 1.1      | 7.5              | 3.5      | 15.6             | 5.9      | 21.8             |
| 1.2      | 7.9              | 3.6      | 15.9             | 6.0      | 22.1             |
| 1.3      | 8.3              | 3.7      | 16.2             | 6.1      | 22.3             |
| 1.4      | 8.7              | 3.8      | 16.5             | 6.2      | 22.5             |
| 1.5      | 9.1              | 3.9      | 16.7             | 6.3      | 22.8             |
| 1.6      | 9.5              | 4.0      | 17.0             | 6.4      | 23.0             |
| 1.7      | 9.8              | 4.1      | 17.3             | 6.5      | 23.2             |
| 1.8      | 10.2             | 4.2      | 17.6             | 6.6      | 23.4             |
| 1.9      | 10.5             | 4.3      | 17.8             | 6.7      | 23.7             |
| 2.0      | 10.9             | 4.4      | 18.1             | 6.8      | 23.9             |
| 2.1      | 11.2             | 4.5      | 18.4             | 6.9      | 24.1             |
| 2.2      | 11.6             | 4.6      | 18.6             | 7.0      | 24.3             |
| 2.3      | 11.9             | 4.7      | 18.9             | 7.1      | 24.6             |
| 2.4      | 12.2             | 4.8      | 19.1             | 7.2      | 24.8             |
| 2.5      | 12.6             | 4.9      | 19.4             | 7.3      | 25.0             |
| 2.6      | 12.9             | 5.0      | 19.6             | 7.4      | 25.2             |
| 2.7      | 13.2             | 5.1      | 19.9             | 7.5      | 25.4             |
| 2.8      | 13.5             | 5.2      | 20.1             | 7.6      | 25.6             |

## ADDITIONAL INFORMATION

- Reference the KYZEN Type II Reagent SDS for complete safety and performance considerations.
- A well-mixed bath solution is required for accurate measurement.
- If no sample port is available, pull solution from spray nozzles. Contact your KYZEN Representative to purchase a Sample Port Kit.
- Failure to clean and dry the KYZEN Flask before use can decrease the accuracy of results.
- Using extra powder will not cause the solution to split more quickly and excessive amounts of powder may cause inaccurate measurements.
- Do not shake flask after separation has occurred. This will cause a long delay for the solution to split again.
- The initial calibration of the KYZEN Flask is certified by the flask manufacturer and does NOT require further calibration. Please contact your KYZEN Representative should you require a Certificate of Compliance to further validate calibration certification.

## Non-Volatile Residue (NVR) Procedure

KYZEN recommends Non-Volatile Residue (NVR) testing for soil contaminant as a tool for bath life monitoring of certain KYZEN products. A sample of a used wash bath is placed into an aluminum weighing dish and dried at 105°C / 221°F for a minimum of four hours. The residue that remains in the dish is allowed to cool in a desiccator and is re-weighed. The weight of the bath residue is then compared to the residue of a virgin sample of the cleaning product at the same concentration and dried in the same manner.

### APPARATUS

Forced Air Oven set at 105°C / 221°F  
Aluminum weighing dish  
(See Tip Number 1 'Tips for Successful Use' at the end of the procedure)  
Analytical Balance  
Desiccator

### REAGENTS AND MATERIALS

Transfer pipettes  
Virgin sample of the product to be tested

### HAZARDS AND PRECAUTIONS

For specific safety information, reference the Material Safety Data Sheet for the product you are testing.

### STATISTICAL CONTROL

Samples should be analyzed in triplicate. The average of the three analyses is reported.

### CALCULATIONS

$$\%NVR = [(c-a)/b] \times 100$$

a = Initial weight of the aluminum dish, b = Initial weight of the sample, c = Weight of weighing dish and residue after heating

$$\% NVR \text{ resulting from soil contamination} = \%NVR \text{ of sample} - \% NVR \text{ of virgin sample}$$

### PREPARATION

- A. Set the forced air oven to 105°C / 221°F for a minimum of two hours to allow the temperature to stabilize.
- B. Place the aluminum weighing dishes to be used into the forced air oven at 105°C / 221°F for a minimum of one hour to dry.
- C. Place the dried weighing dishes into a desiccator and allow to cool.

### PROCEDURE

- A. Place a cool weighing dish on the analytical balance. Record the weight (*this is weight 'a'*).
- B. Tare the balance and add approximately 10 grams of sample to the weighing dish<sup>2</sup>. Record the weight of the sample to the nearest 0.0001g (*weight 'b'*).
- C. Place the dish in the oven at 105°C / 221°F for a minimum of four hours<sup>3</sup>. Remove the dish to a desiccator and allow to cool.
- D. Weigh the cooled dish on the analytical balance and record the weight to the nearest 0.0001g (*weight 'c'*).
- E. Repeat Procedure steps A through D a total of three times for both the sample and the virgin product.

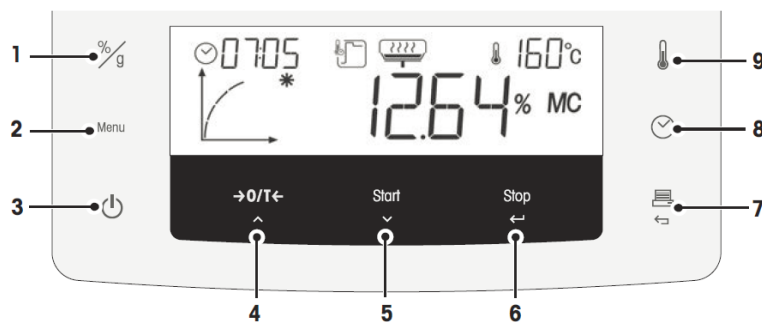
### TIPS FOR SUCCESSFUL USE

1. A beaker or ceramic dish can be used in place of the aluminum pan; however, these must be compatible with the cleaning product and able to withstand the required oven temperatures.
2. The amount of sample used for testing is not critical, but must be weighed accurately.
3. A dirtier bath will require longer than 4 hours to completely dry. To ensure that your sample is completely dry, return the sample to the oven for 30 minutes after taking the first weight. Cool in the desiccator and reweigh. Continue this until there is less than 5% change in the weight.

## NVR Measurement by HE53 Moisture Analyzer Method KYZEN® AQUEOUS PRODUCTS

**This Application Note provides instructions on how to use the Mettler Toledo HE53 Moisture Analyzer to measure the Non-Volatile Residue (NVR) of KYZEN® Aqueous Products.**

1. Follow instructions in Section 4 of the *HE53 Operating Instructions* to appropriately setup the moisture analyzer and prepare for measurement.
2. Program the moisture analyzer to the settings below to begin the measurement procedure.



- a. Press Menu [2]. Use the Up [4] and Down [5] arrows to select **PROG** and press Stop [6]. Again, using either of the arrows, select **RAPID** and press Stop [6]. This selects the RAPID DRYING MODE.
  - b. Press Thermometer [9]. Adjust temperature, using arrows, to **120°C** and press Stop [6].
  - c. Press Clock [8]. Use arrows to select **TIMED** and press Stop [6]. Use arrows to adjust to **1 hour** then press Stop [6].
  - d. Press %/g [1]. Use arrows to select **%DC** and press Stop [6]. The results will be displayed in % DRY CONTENT.
3. Place the empty sample pan in the sample pan handler and place the sample pan handler in the draft shield. Ensure that the tongue of the sample pan handler lies in the slot of the draft shield.
  4. Place the provided Glass Fiber Pad in the sample pan. *Note: the pads are designed for single use and a new pad should be used for each test in ensure accuracy of the test.*
  5. Close the heating module and press O/T [4] to tare.
  6. Open the heating module cover and add approximately 2 grams of sample directly to the Glass Fiber Pad in the sample pan.
  7. Close the heating module and press Start [5]. **The %NVR results will display on the screen when finished.**

*Condensation may collect and pool in the chamber- this is normal. Follow instructions in Section 9.1 of the HE53 Operating Instructions to clean and thoroughly dry equipment between each use.*