#### **THIRD EDITION**

# PRECISION AQUEOUS CLEANING OF: VINYL RECORDS



**By: Neil Antin** 

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## **JANUARY 2022**

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### FOREWORD

This book is provided as an effort to "give back" to the communities in which I spent my career and life as an engineer with the U.S. Navy engaged in precision cleaning techniques and as an audio enthusiast who has witnessed increasing interest in effective cleaning methods for vinyl records. It is provided for those intrepid souls who receive enjoyment from the audible and physical experience that is uniquely part of listening to music reproduced by a vinyl record.

Some seven years ago, after a 20-year hiatus, I returned to the unique experience and challenge of listening to vinyl records. My initial reentry was less than stellar, but by combining my background, perseverance and an appetite for knowledge an effective, simple, economical, and safe vinyl record manual cleaning process has been developed. This third edition of the paper continues to document the journey, and is offered with no expectations other than an opportunity to share knowledge. However, it is my continued observation that to effectively clean a vinyl record, a precision cleaning process is required and what lies within the grooves of a vinyl record may just now be fully realized.

In this third edition, I have again taken into account the feedback received from readers who had posed questions and comments on the various audio forums about the second edition of March 2021. I continue to benefit significantly from that in shaping this revised third edition to better meet reader needs. Additionally, the book continues to expands upon many of those general discussions to delineate the many details with a deeper understanding of the 'why'. The following summarizes the changes made in this third edition with most changes highlighted yellow throughout the book for ease of use.

- Chapter I has one change regarding the Shibata stylus ability to bridge groove damage.
- Chapters II to V add an acid-wash and optional acid-soak using Alconox<sup>™</sup> Citranox<sup>™</sup>. In Chapter II, for the EU/UK, recommendation for an alternate to Alconox<sup>™</sup> Liquinox<sup>™</sup> is now clear, fragrance-free laundry detergent and substitutes for Australia (AU) added. Chapter IV adds why an acid is being used, and a discussion on physical damage to records that cannot be corrected by cleaning. Chapter V, reference to VinylStack<sup>™</sup> is mostly deleted since it is no longer available. Alternates such the Groovemaster<sup>™</sup> record label protector are available and illustrated, and the generic term "record label protector" is used.
- Chapter VI adds a detailed triboelectric charge affinity table, corrects the error in the second edition regarding corona; deleting electrons and replacing with ions; introduces using a simple Teflon rod for lint and some static removal, and addresses the effects of diamond wear on particle generation.
- Chapter VII adds details on reverse osmosis/deionized water systems for home use and addresses the different availability of DIW in the USA and EU/UK.
- Chapter VIII updates ILFORD<sup>™</sup>-ILFOTOL<sup>™</sup> data; expands the graphs of isopropanol to include ethanol; and adds discussion of alcohol evaporation from water, alcohol specifications, enzymes; details for acids and Alconox<sup>™</sup> Citranox<sup>™</sup>, and cleaning tenacious spots.

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#### FOREWORD (Cont'd)

- Chapter IX adds Polysorbate 20 nonionic surfactant and updates data for substituting ILFORD<sup>™</sup>-ILFOTOL<sup>™</sup> as the final cleaner.
- Chapter X-material compatibility and Chapter XI-cleanliness verification have been updated to address Alconox<sup>™</sup> Citranox<sup>™</sup> and the acid-clean step.
- Chapter XII-cleaning process has had been revised to address the acid-clean step.
- Chapter XIII-vacuum record cleaning machines (RCM) has had only a minor revision to include two examples of those that use a separate wet/dry vacuum cleaner.
- Chapter XIV-ultrasonic cleaning machines (UCM) has been significantly revised adding new information on standing waves, water height, record spacing, degas, and additional details for pump-filtration systems including radiators for cooling, pressure-gauges, and a detailed parts list for three different cost options.
- References are identified in each instance and the full citations are hyperlinked for download in the **APPENDIX C RECORD OF CHANGES** at the end of this paper. Hyperlinks are provided only to secure (https://) sites.

Some of the contents of this paper, which has grown from a monograph to what amounts to a handbook on record cleaning, may be considered too detailed or excessive. No apologies are made; the devil is in the details and documenting those details provides others with the opportunity to explore. One reaction from a lot of readers was "At last, a highly detailed and comprehensive document on record cleaning!" Many readers were lacking good information on the processes and the rationale for using one chemical over another, and their trial-and-error attempts to improve results were not guided by a sufficient understanding of either the chemistry or the process. For those who found the prior editions to be overwhelming in their detail, there continues to be a number of "off-ramps" which enable you to take advantage of certain processes described herein or improve some aspect of your cleaning regimen without entirely changing what you do (Cleaning a vinyl record is similar to the overall audio upgrade journey in this respect—you can make changes incrementally with certain elements remaining constant to have some control over results). At its simplest there is a core approach outlined in Chapters II to VI which provides anyone with just reasonable skill and cost, the opportunity for clean, mostly extraneous noise-free, high fidelity vinyl record play achieved easily and safely; record pressing quality notwithstanding. And once cleanliness is achieved, using reasonable care and appropriate practices, easily maintained.

All cleaning procedures specified herein are presented as only "a" way to clean a record. No claim is made there is only one way to approach the process. All methods/procedures specified here present opportunity for experimenting with different cleaning agents, different cleaning brushes, different drying cloths, and different cleaning equipment. Future revisions will continue to take into account the community feedback from forums such as Audiogon™, Audiokarma®, The Steve Hoffman Forum™, The VinylPress™, VPI™, VinylEngine® and What's Best Forum™ to name just a few. If you

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#### FOREWORD (Cont'd)

proceed down this path, the information provided by this book can guide you to informed decisions that adheres to the three axioms when cleaning:

- ✓ Do No Harm to Yourself or Others; and
- ✓ Do No Harm to the Item Being Cleaned the Record; and
- ✓ Do No Harm to the Environment

<u>Wishful Thinking</u>: Everyone wants the silver bullet – the single cleaning solution. There was only one safe, nonflammable, cheap, superior solvent ever manufactured that could degrease and remove fine particulate in one step with a boiling point low enough to dry quickly leaving essentially no residue, and compatible with just about all materials - 1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113), often known as Freon® PCA (precision cleaning agent). Unfortunately, chloro-fluorocarbon CFC-113 had this "small" problem with damaging the ozone layer, and by the Montreal Protocol of 1986, all manufacture stopped 1996. In its place were created the many equivalent aqueous cleaning processes now in-use. As a note of caution, non-flammable, high performance chlorinated hydrocarbon solvents such as perchloroethylene that are still manufactured; and easily purchased, are not CFCs but are highly toxic and known to cause cancer among other unpleasant effects.

<u>Author Bio</u>: Mr. Antin volunteered his time to prepare this document and is a retired Naval Sea Systems Command (NAVSEA) Technical Warrant who from the late 1980's for 20-years was the NAVSEA technical authority for *MIL-STD-1330 Precision Cleaning and Testing of Shipboard Oxygen, Helium, Helium-Oxygen, Nitrogen, And Hydrogen Systems* and *MIL-STD-1622 Standard Practice for Cleaning of Shipboard Compressed Air Systems*. During the early 1990's he led the NAVSEA effort to mostly eliminate chlorofluorocarbon (CFC) solvents from these military standards. His efforts were successful and are documented in *MIL-STD-1330D* and *MIL-STD-1622B*, and acknowledged with an EPA Ozone Protection Award 1995, two US Patents US 5427729 and 5520837, and NAVSEA Engineer of the Year 1997. The procedures and discussion detailed herein follow many of the fundamentals and practices that were developed for *MIL-STD-1330D* and *MIL-STD-1622B*. After his turn at precision cleaning, Mr. Antin professionally moved on to other unrelated projects before retiring in 2019 after 44-years of combined U.S. Navy experience as a Sailor, Defense Contractor and Civil Servant.

<u>Acknowledgement</u>: Extend my thanks to Bill Hart of The Vinyl Press<sup>™</sup> <u>https://thevinylpress.com/</u>, who has graciously offered his expertise as an Editor and host of this book on his site for distribution. Neither myself nor Bill Hart will receive any financial benefit from this book, and we have agreed that should any financial benefit result, the proceeds will be donated. Additionally, I wish to thank all those who shared their experience and knowledge; each of you in many ways stimulated my thinking and either helped me better understand the nature of the problem or how to better describe a solution to the challenges presented.

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#### **CHAPTER I. VINYL RECORD CLEANING CHALLENGES:**

The *ARSC Guide to Audio Preservation, 2015* (5) commissioned for and sponsored by the National Recording Preservation Board of the Library of Congress, states: *"Vinyl discs are the most stable physical sound recording format developed to date; they can last 100 years in a controlled environment."* With the recent resurgence of vinyl records, history may prove that the durability of the simple vinyl record exceeds 100 years, and let us not forget that the National Aeronautics and Space Agency (NASA) Voyager space probe carries a gold record with simple directions for playback.

- I.1 However, the challenge of cleaning a simple vinyl record is well known as detailed in the technical paper *THE WEAR AND CARE OF RECORDS AND STYLI, by Harold D. Weiler, 1954* (34) with excerpts as follows:
- 1.1.1 "Completely removing dust and grit from a record is not a simple problem. A number of factors must be considered. Firstly, the cleaner must not contain any gummy substance that will remain in the engraved depressions in the record groove. Secondly, the cleaner must completely penetrate these same depressions and remove any dust or grit they may contain. Thirdly, the cleaner must not affect the record material itself in any manner."
- 1.1.2 "Record dust/dirt when examined under a microscope consists of grease, stylus particles, abrasive material, and solids which resemble wool fibers covered with a soft waxy substance. An analysis of the "dust" removed from a number of stylus tips, which had been used on dirty records, showed that it consisted of approximately; 12% jagged silica particles, 35% diamond dust, 40% miscellaneous particles, including soot, grit and particles worn from the record groove itself. The remaining 13% consisted of fibers and lint."
- 1.1.3 "Complete removal of dust and grit from the record grooves resulted in increases of up to 60% in the useful life of both records and styli." "Careful handling, storage and cleaning of one's record collection is more than repaid in better reproduction and greatly increased record and stylus life."
- I.2 The paper Record Contamination: Causes and Cure by Percy Wilson, Journal of The Audio Engineering Society April 1965, Volume 13, Number 2 (61) echoes Harold D. Weiler (34) when it discusses three types of contaminants "...discrete particles such as soot, dust, grit, textile fluff, tobacco ash and cosmetic powders: fluids which, after evaporation, leave behind crusty deposits, such as household sprays and saliva deposits; and condensates formed from fumes, such as tobacco smoke, cooking vapors and automobile exhaust fumes."
- I.3 Expanding upon the discussion written THE WEAR AND CARE OF RECORDS AND STYLI by Harold D. Weiler 1954 (34) and Record Contamination: Causes and Cure by Percy Wilson, 1965 (61), the challenge posed by cleaning vinyl records is to remove a variety of organic and inorganic contaminates from a circular disc whose nominal dimension is 12-inches diameter,

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manufactured from various proprietary formulas of a polyvinyl chloride-acetate/polyvinyl chloride (PVCa/PVC) blend (see **CHAPTER X. DISCUSSION OF MATERIAL COMPATIBILITY**: for further details), that is grooved with sidewall ridges as follows:

- I.3.1 V-shaped groove with 'nominal' dimensions of 56 microns (0.0022") wide at the top, a radius of 6 microns (0.00025") at the bottom, and a 'nominal' depth of 28 microns (0.0011"). Actual groove width and depth will vary based on the frequency and amplitude of the audio signal. Consecutive groove spirals are nominally 200 to 250 grooves per inch equal to a groove separation of 125 to 100 microns (0.005"). Larger separations are used to reproduce high output low frequency sound.
- I.3.2 The groove is cut (often referred to as modulations) so that the stylus can move side-to-side (laterally) or up-and-down (vertically) to produce the audio signal. Groove sidewall ridges are used to reproduce right and left high frequency information for stereo. Figure 1 illustrates record grooves using a scanning electron microscope (SEM) at 142X magnification with some details of the side-wall ridges. The side wall ridges are closely space to produce high frequency signals; 10 microns for a 33.333 rpm record to produce 20 kHz. The distance from the peak of the side wall ridge to its valley is the lateral amplitude and these can be less than 1-micron.



Figure 1 - Record Groove Under SEM at 142 Magnification (Image courtesy of University of Rochester: URnano)

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I.3.3 **Figure 2** is a close-up (324X magnification) of **Figure 1**. However, while **Figure 2** shows smooth groove side-wall ridges, SEM photos at 1000X show much more ragged details of the sidewall ridges that can be seen here <u>SEM of grooves in LP record - Stock Image - H100/0098 - Science Photo Library</u>.



Figure 2 - Record Groove Under SEM at 324X Magnification (Image courtesy of University of Rochester: URnano)

I.4 Except for the grooves per inch and the low frequency groove modulations all other dimensions are invisible to the naked eye under bright white light that is limited to about 50 microns (*source MIL-STD-1330D (51) & MIL-STD-1622B (52)*). Ultraviolet (UV) blacklight at 365 nano-meters (nm) can detect particles that fluoresce that are about 25 microns, but the groove bottom and groove sidewall ridges will not be individually detectable. Also, based on the groove dimensions, particles of interest can be very small – less than 10 microns and per Figure 3, common in any residential environment. While individual particles of less than 1 micron 'may' be of little consequence (see CHAPTER XI. DISCUSSION OF CLEANLINESS CRITERIA: for a detailed analysis), groups of these small particles can conglomerate into larger masses. Consequently, the cleaning process has to be able to remove invisible contaminants. Obviously, "looks clean" to the naked eye is basically meaningless other than to note significant defects resulting from the pressing process, handling or abuse and to see some of the more obvious manifestations of contamination, *e.g.*, fingerprints or large dust particles. To effectively clean a record, we must approach the task with a level of precision that is not

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readily apparent to the naked eye. This calls for more precision in method and the selection and application of chemistry as well as the removal of the cleaning agents, once they have performed their function.



Cleaning a vinyl record falls under the category of "Precision Cleaning".

- I.5 To effectively remove particulate, the item must first be degreased. Organic contaminates (i.e., oil/greases/tobacco-tar) and anything similar can cover over and trap particulate. Failure to remove large particulate in the groove will result in audible pops, clicks and other annoying sounds. However, of equal importance is that since the groove sidewall ridges are not deep, contamination can fill-in the ridge spaces and effectively attenuate and or distort high frequency sounds. But concentrated cleaners can often leave enough non-volatile-residue (NVR) behind requiring a final clean to remove the residue left from the "precleaner".
- I.6 Record wear is influenced by the stylus shape, vertical tracking force and the record material.
   Figure 4 (circa 1968) shows groove wear caused by two different styluses after 50 plays obtained from *Record -Groove Wear*, *J G. Woodward, HiFi Stereo Review Magazine, October 1968 (37)*: Photo A shows the wear produced by a 0.7 -mil spherical stylus tracking at 5

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grams. Photo C is a  $0.2 \ge 0.7$  -mil elliptical at 1.5 grams. The wear shown in **Figure 4** is permanent plastic deformation, but very little material has actually been removed.



Figure 4 – Record Wear Spherical vs Elliptical Stylus – 50 Plays (Image Groove Wear, J G. Woodward, HiFi Stereo Review Magazine, October 1968, Page 88 "scan courtesy of <u>www.worldhistory.com</u>")

I.7 Figure 5 (circa 1976) shows record wear of a long-wearing record material developed by RCA<sup>™</sup> for the Shibata stylus and quadrasonic sound; from *RCA Engineer Magazine, 1976, Issue 02-03, Development of Compound for Quadradiscs, by G.A. Bogantz S.K. Khanna (71).* Photo A is a Shibata stylus at 1.5 gram after 100 plays, showing little or no wear. Photo B shows a Conical stylus at 4.5 grams after 100 plays, showing clean trenching. But RCA<sup>™</sup> also showed significant wear with material from another vendor after just 25 plays with a Shibata stylus at 1.5 grams and just 10 plays with a Conical stylus at 4.5 grams after 10 plays.



Figure 5 – Record Wear Shibata vs Conical Stylus – 100 Plays (Image Development of Compound for Quadradiscs, G.A. Bogantz & S.K. Khanna, RCA 1976 "scan courtesy of <u>www.worldhistory.com</u>")

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- I.8 One item to note is that highly contoured/profiled styluses such as Shibata can bridge the trench made by the conical or elliptical stylus allowing full fidelity playback. Otherwise, the record wear in Figure 4 and Figure 5 can be accelerated by the cleaning method. Solvents and some aggressive concentrated aqueous cleaners can soften by swelling the leading edge of the side-wall ridges that could cause loss of high frequency fidelity as the stylus permanently smears the leading edge with accelerations over 1,000 g's and pressures equivalent to 20,000 pounds per square inch (psi) and greater that are influenced by the stylus shape and proportional to the vertical tracking force (VTF) (*source: Disc Phonograph Records by Dr. A. M. Max, RCA Engineer Magazine 1966-08-09 (1)*). Alternately, solvents and aggressive concentrated aqueous cleaners "may" extract components of the vinyl record leading to hardening of the leading edge of the side-wall ridges that could similarly cause loss of high frequency fidelity caused by premature record wear by the stylus. See CHAPTER X. DISCUSSION OF MATERIAL COMPATIBILITY: for detailed discussion of cleaning agent material compatibility.
- 1.9 Verifying cleanliness is a further challenge. When is a record clean? Currently other than use of a SEM, there is no practical quantitative method to verify record cleanliness. Visual techniques such as white light and UV-blacklight have detection limits that will not be sufficient to verify that the record is actually clean. Very thin, transparent soil films associated with mineral-based oils and greases can be difficult to detected below 100 milligrams per square foot (mg/ft<sup>2</sup>), and this type of contamination generally does not fluoresce under UV-blacklight. Other common industry cleanliness verification techniques such as solvent wash and measure of effluent non-volatile residue (NVR) and particle count are not practical for many reasons; cost, compatibility of available solvents with the vinyl record, skill and the very difficult geometry illustrated Figure 1 and Figure 2 just to name a few. Performing cleanliness verification with the assistance of an ultrasonic (UT) tank is possible, but is at best qualitative (see CHAPTER XIV. DISCUSSION OF ULTRASONIC CLEANING MACHINES:). In the absence of a practical quantitative cleanliness verification method, the subjective after cleaning play-test how does the record sound prevails.

#### \*CONCLUSION\*

The 'precision cleaning process' must be robust enough to provide a large margin for error.

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## CHAPTER II. PROCESS SUMMARY AND LIST OF MATERIALS:

The manual precision aqueous vinyl record cleaning procedure detailed by this document began with the cleaning process used by the *United States Library of Congress* (42) to clean delicate lacquer records. That procedure was then modified following the fundamentals developed for *MIL-STD-1330D Precision Cleaning and Testing of Shipboard Oxygen, Helium, Helium-Oxygen, Nitrogen, And Hydrogen Systems* (51) and *MIL-STD-1622B Standard Practice for Cleaning of Shipboard Compressed Air Systems* (52). The resulting cleaning procedure is a multi-step process that uses readily available materials, is very economical, is safe (when used correctly) and is summarized in **Figure 6**.



Figure 6 - Precision Aqueous Vinyl Record Cleaning Process Summary

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- II.1 SAFETY: Safety is emphasized throughout. Being courageous or cavalier with safety when handling concentrated chemicals can lead to injury. It is very easy to get chemical on a gloved hand and then not thinking rub your eye(s) for any number of reasons. Most residential homes do not have an eye-wash station, and eye injury can occur. All highly concentrated cleaning agents such as Alconox™ Liquinox™, Alconox™ Citranox™ and Dow™ Tergitol™ 15-S-9 should be handled with appropriate personal protective equipment (PPE) such as gloves and eye protection and be protected from accidental ingestion by children and pets. In the event of accidental ingestion, contact the Poison Control Center® hotline 1-800-222-2222.
- II.1.1. Some concentrated (and not so concentrated) chemicals and cleaners can have chronic (long-term) exposure concerns, obviously the worst being cancer. But others can attack the central nervous system, respiratory or any number of organs over a prolonged exposure, and this can be much worse for young children and reproductive females. No such product is recommended here. But, if substituting cleaning agent(s), readers are advised to consult the Safety Data Sheet (SDS) for appropriate safety precautions. NOTE: Most SDS today are prepared in accordance with the *United Nations, Global Harmonized System of Classification and Labeling of Chemicals (GHS) (79).* Whereas previous material safety data sheets (MSDS) would often list all/many ingredients, under the GHS, only hazardous chemicals are listed.
- II.1.2. All aqueous cleaning agents recommended by this document once diluted as specified herein, are not flammable, have no reported acute or chronic toxicity hazard, and are often safer than common household, concentrated detergents or bathroom cleaners.
- II.2 The manual cleaning procedure in CHAPTER III. CLEANING SOLUTION PREPARATION: and CHAPTER V. MANUAL CLEANING PROCESS: are formatted with specific steps. All steps are further separated by a dotted line. All Cautions are generally placed after the step but before the applicable image. Information notes generally are placed after the applicable step. All Figures follow (placed after) the applicable step.
- II.3 Table I is a list of all materials used or otherwise referenced in this paper for the manual precision aqueous cleaning of vinyl records detailed CHAPTER III. CLEANING SOLUTION PREPARATION:, CHAPTER IV. RECORD INSPECTION: and CHAPTER V. MANUAL CLEANING PROCESS:, indicating applicable sources and estimated cost as of the version date of this document.
- II.4 AU/EU/UK Material Substitution: Some materials such as Alconox<sup>™</sup> Liquinox<sup>™</sup>, Alconox<sup>™</sup> Citranox<sup>™</sup>, Dow<sup>™</sup> Tergitol<sup>™</sup> 15-S-9, and the Record Doctor brush are either difficult to obtain or not sold in Europe (EU) or United Kingdom (UK) or Australia (AU). Substitutes are

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available and are listed Table II for the EU/UK and Table III for the AUfor the EU/UK and **Table III** for the AU.

Item	Source	Estimated Cost
Groovemaster™ record label protector (or	- The Clear Choice For Cleaner	
equivalent)	Sound <sup>®</sup> (groovmaster.com)	<mark>٦47.00</mark>
Dow™ Tergitol™ 15-S-9 nonionic surfactant 1	https://www.talasonline.com	\$22.00
nint (16 ounces)	nttps://www.talasoninte.com,	<i>722.00</i>
Alconox™ Liquinox™ 1-Ot	Alconox™ Amazon™ & Others	\$28.00
Alconox™ Citranox™ 1-Ot	Amazon™ & Others	\$28.00
Record Doctor™ Clean Sweep Record Brush, or	Audio Advisor™. Amazon™ &	\$20.00 & up
Statis $\mathbb{M}$ Record Brush (w/50 micron bristle), or	Others	φ20100 α up
OSAGE <sup>™</sup> Nvlon Record Cleaning Brush		
335-0090 - The Super PVA White PVA Sponge	Super Cool Products™	\$10.00
Block in plastic storage case The Super PVA	PVA Clean Room Sponges.	
Sponge Products (super-cool-products.com)	Wipes, and Mops (super-cool-	
	products.com)	
Kinetronics™ Tiger anti-static microfiber cloth,	Amazon™ & Others	\$15.00
10-inch x 18-Inch Cloth		
Four (4) clean white translucent HDPE spray	Amazon™ & Others	\$10.00
bottles about 16 ounces (or 32 ounces) each		
such as Pinnacle Mercantile Plastic Spray Bottles		
Leak Proof Technology Empty 16 oz Value Pack		
of 2 Made in USA: Amazon.com: Industrial &		
<u>Scientific</u>		
One (1) gallon distilled <mark>(readily available USA)</mark> or	Local Drug/Grocery store or	\$1.00 & up
demineralized water (readily available EU/UK).	produce your own (see Chapter	
	VII).	
Powder-free disposable nitrile gloves, box of 50	Local Grocery, Hardware or	\$15.00 & up
(or 100), or reusable nitrile glove(s)	Drug Store, or Amazon™	
Safety Glasses or Goggles	Local or Online Hardware Store	\$2.00 & up
	or Amazon™	
Disposable Low-Density Polyethylene (LDPE)	Amazon™	\$5.00 & up
Pipettes 3-mL and/or 5-mL capacity to mix		
concentrated cleaners. Bags of 50 or 100.		400.00.0
Anti-static, Lint-Free, Archival Quality Record	Audio Advisor™, Music Direct™,	\$20.00 & up
Sleeve	Elusive Disc™, Sleeve City™ &	(for quantity 50)
	Others	¢25.00
Uptional: UV Blacklight 365nm, 10W, Alonefire	Amazon'	\$25.00
Ivide SV003 (or equivalent)	Amazan <sup>IM</sup> & Othara	620.00
optional: Nalgene <sup>rm</sup> 500 mL wide mouth wash	Amazon ····· & Uthers	\$20.00
solution		
Ontional: OXOM Good Grins Dich Pack (or	Container Store™ & others	¢20.00
		şz0.00

Та	ble I
Manual Record Cleani	ng Process Material List

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EU/UK Manual Record Cleaning	Process Material Substitution List	
Item	Source	Estimated Cost
Loricraft™ 12" LP Record Nylon Cleaning Brush	Loricraft 12" LP Record Nylon Cleaning Brush - SCOTT NANGLE AUDIO (snvinyl.co.uk)	£18.00
Stasis™ Record Cleaning Brush w/50-micron bristles (same as Record Doctor™)	Amazon™ UK and <u>Amplifiers</u> , <u>Headphones</u> , <u>Cables - Analogue</u> Seduction	£25.00
BASF™ Dehypon® LS 54 nonionic surfactant 1-L (substitute for Tergitol™ 15-S-9)	<u>Dehypon – Conservation Resources</u> (UK) Ltd (conservation- resources.co.uk)	£22.00
ILFORD-ILFOTOL <sup>™</sup> wetting agent/nonionic surfactant, 1-L (substitute for Tergitol <sup>™</sup> 15-S-9)	Amazon™ UK & eBay™ UK	£23.00
Polysorbate 20 (Tween™ 20) nonionic surfactant, 500-ml (substitute for Tergitol™ 15- S-9)	Amazon™ UK search "Polysorbate 20"	£8.00
Alconox™ Liquinox™ 1-Qt	Alconox Liquinox 1232-1 Critical Cleaning Liquid Detergent; 1 QT Bottle from Cole-Parmer United Kingdom (coleparmer.co.uk) or	£28.00 (w/VAT)
	Liquinox   Sigma-Aldrich (sigmaaldrich.com)	
<ul> <li>Alconox<sup>™</sup> Liquinox<sup>™</sup> may not be easily purchased in the EU/UK. The sites listed above may have significant delivery time delays. At the time of this Third Edition, no direct equivalent has been found.</li> <li>The product Vinyl Clear<sup>™</sup> is clear (so no dye), appears to be formulated for records and is concentrated. It is available as a <u>Record Machine Cleaning Fluid Concentrate - 250ml by:</u> <u>Amazon.co.uk: Electronics</u>. The vendor site <u>FAQs - Vinyl Clear</u> talks about dust which implies the cleaner if not rinsed (or subject to final clean) can leave a residue in the form of a dry powder. So long as using only for pre-clean, this should not be experienced.</li> <li>A cheaper alternative could be a liquid, machine clothes detergent that is not colored (no dyes), unscented (no fragrance) and contains no anti-bacterial agents. These will also have enzymes that can be beneficial for the removal of certain types of soils – see <b>paragraph</b> VIII.9; but diluted-down into a spray bottle can work as a pre-cleaner – see <b>CHAPTER III. CLEANING SOLUTION PREPARATION:</b>.</li> <li>Use of dish detergents should be avoided since they contain many ingredients that have nothing to do with cleaning such as thickeners and other ingredients intended to be safer for hand washing, and can be very difficult to fully rinse.</li> </ul>		
Alconox'™ Citranox'™ 1-Qt	Alconox Citranox 1801-1 Liquid Acid Cleaner and Detergent; 1 gal. Bottle from Cole-Parmer United Kingdom	±51.00 (w/VAT)
Alconox <sup>™</sup> Citranox <sup>™</sup> is not easily purchased in the EU/UK. The site listed above can have significant delivery time delays. At the time of this 3rd Edition, no direct equivalent has been found other than Distilled White Vinegar (5% acidity) plus some nonionic surfactant to act as a wetting agent – see <b>CHAPTER III. CLEANING SOLUTION PREPARATION:</b> .		

## Table II

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Table III
AU Manual Record Cleaning Process Material Substitution List

Item	Source	Estimated
		Cost
Stasis <sup>™</sup> Record Cleaning Brush w/50-micron	еВау	£30.00
bristles (same as Record Doctor™)		
Osage™ Record Cleaning Brush	<b>Record Cleaning Brushes and</b>	\$55.00
	Cloths - GrooveWorks Aust Pty Ltd	
Polysorbate 20 (Tween™ 20) nonionic surfactant	Amazon AU, or search Polysorbate	\$16.00
(substitute for Dow™ Tergitol™ 15-S-9), 500-ml	20 "Australia"	
ILFORD-ILFOTOL <sup>™</sup> wetting agent/nonionic	Search: ILFORD-ILFOTOL	£45.00
surfactant (substitute for Dow™ Tergitol™ 15-S-	"Australia"	
9), 1-L		
The Super Cool PVA sponge block was previously	Search: Slurpex Sponge	\$16.00
marketed as Slurpex in Europe, and Australia. It	"Australia"	
is the same as the SuperCool product except it is		
a yellow color.		

Alconox<sup>™</sup> Liquinox<sup>™</sup> is not for purchase in the AU. At the time of this 3rd Edition, no direct equivalent has been found.

- A cheap alternative could be a quality-brand, liquid, machine clothes detergent that is not colored (no dyes), un-scented (no fragrance) and contains no anti-bacterial agents. These will also have enzymes that can be beneficial for the removal of certain types of soils – see paragraph VIII.9; but diluted-down into a spray (or wash) bottle can work as a pre-cleaner – see CHAPTER III. CLEANING SOLUTION PREPARATION:.
- Use of dish detergents should be avoided since they contain many ingredients that have nothing to do with cleaning such as thickeners and other ingredients intended to be safer for hand washing, and can be very difficult to fully rinse.

Alconox<sup>™</sup> Citranox<sup>™</sup> is not easily purchased in the AU. At the time of this 3rd Edition, no direct equivalent has been found other than Distilled White Vinegar (5% acidity) plus some nonionic surfactant to act as a wetting agent – see **CHAPTER III. CLEANING SOLUTION PREPARATION:**.

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### **CHAPTER III. CLEANING SOLUTION PREPARATION:**

**III.Step 1.** Assemble all cleaning agents, distilled water, spray bottles, measuring devices, and personal protective equipment (nitrile gloves and safety glasses). It is recommended to clean (wipe down) the local area to minimize cross contamination.



Reuse of household cleaner plastic spray bottles for DIW, NID, CLEANER and ACID spray bottles is possible with appropriate cleaning, but at the user's own risk of contaminating the distilled water, Alconox<sup>™</sup>, or Tergitol<sup>™</sup> cleaning agents. The recommended spray bottle material is white translucent high-density polyethylene (HDPE).



Figure 7 – Preparing Cleaning Process Solutions

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**III.Step 2.** <u>Prepare the DIW Spray Bottle</u>: For first time use, fill one spray bottle with tapwater about 1/4-full, install sprayer, shake vigorously, check for foam, exercise sprayer and then dump to sink to pre-clean/rinse spray bottle. If there was foam noting that tap-water does not foam, repeat the tap-water rinse until there is no evidence of foam. Then, final-clean spray bottle by filling about 1/4-full with distilled water, exercise sprayer and then dump to sink. Then, fill spray bottle full with distilled water and label the spray bottle "DIW".

**III.Step 3**. Pre-Clean the NID & CLEANER Spray (or Wash) Bottles: For first time use, clean/rinse by filling the bottles with tap-water about 1/4-full, install sprayer (or cap for wash bottle) and shake vigorously, check for foam, exercise sprayer (wash-bottle) a few times and then dump to sink. If there was stable foam more than about 1/4-inch noting that tap-water does not foam, repeat tap-water rinse until there is no evidence of a high stable foam (bubbles over and above the liquid surface); a small number of bubbles on the surface is inconsequential.

**III.Step 4**. **Prepare the CLEANER**, ACID & NID Spray (or Wash) Bottles: Don nitrile gloves and eye protection. Add distilled water to spray (or wash) bottle and fill about 1/2 to 3/4 full.



Store concentrated Alconox<sup>™</sup> Liquinox<sup>™</sup> cleaner, Alconox<sup>™</sup> Citranox<sup>™</sup> acid and Dow<sup>™</sup> Tergitol<sup>™</sup> 15-S-9 surfactant away from children and pets. Dispose of any unused concentrated product in accordance with the safety data sheet (SDS) available on the internet – search "Alconox<sup>™</sup> Liquinox<sup>™</sup> SDS", "Alconox<sup>™</sup> Citranox<sup>™</sup> SDS" or "Dow<sup>™</sup> Tergitol<sup>™</sup> 15-S-9 SDS". Store labeled diluted solutions same as any general household spray cleaners.



Wear eye protection when handling the concentrated  $Alconox^{TM}$  Liquinox<sup>TM</sup> cleaner, Alconox<sup>TM</sup> Citranox<sup>TM</sup> acid or Dow<sup>TM</sup> Tergitol<sup>TM</sup> 15-S-9 (or equivalent) surfactant. In the concentrated state,  $Alconox^{TM}$  Liquinox<sup>TM</sup>,  $Alconox^{TM}$  Citranox<sup>TM</sup> and Dow<sup>TM</sup> Tergitol<sup>TM</sup> 15-S-9 are classified as a severe eye irritant. The concentrated  $Alconox^{TM}$  Liquinox<sup>TM</sup> cleaner, Alconox<sup>TM</sup> Citranox<sup>TM</sup> acid and Dow<sup>TM</sup> Tergitol<sup>TM</sup> 15-S-9 have the consistency of a light-weight oil and while unlikely to splash, small amounts on your gloves could be a risk if you rub your eyes.

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Wear nitrile gloves to protect hands from cleaner exposure and prevent cross contamination. Unlike standard dish detergent, concentrated and diluted solutions of Alconox<sup>™</sup> Liquinox<sup>™</sup>, Alconox<sup>™</sup> Citranox<sup>™</sup> and Dow<sup>™</sup> Tergitol<sup>™</sup> 15-S-9 (or equivalent) contain no additives to protect the skin.

- III.Step 4.1 <u>Alconox<sup>™</sup> Liquinox<sup>™</sup></u>: Measuring with a disposable pipette, add about 5 mL of the Alconox<sup>™</sup> Liquinox<sup>™</sup> to 16 ounces (470-500 mL), or about 10 mL to 32 ounces (0.95 to 1.0 liters) to obtain about a 1.0% solution. Install sprayer (or wash bottle cap) and gently shake to mix. Then top off to full with distilled water, and label bottle "CLEANER". This solution will produce a lot of foam when agitated. NOTE: Alconox<sup>™</sup> Liquinox<sup>™</sup> is about 50% active ingredients so that the 1% solution is actually 0.5% concentrate.
- III.Step 4.2 <u>Alconox<sup>™</sup> Citranox<sup>™</sup></u>: Measuring with a disposable pipette, add about 7.5 mL of the Alconox<sup>™</sup> Citranox<sup>™</sup> to 16 ounces (470-500 mL), or about 15 mL to 32 ounces (0.95 to 1.0 liters) to obtain about a 1.5% solution. Install sprayer (or wash bottle cap) and gently shake to mix. Then top off to full with distilled water, and label bottle "ACID". This solution will produce foam when agitated. NOTE: Alconox<sup>™</sup> Citranox<sup>™</sup> is about 65% active ingredients so that the 1.5% solution is actually about 1.0% concentrate.
- III.Step 4.3 <u>Dow<sup>™</sup> Tergitol<sup>™</sup> 15-S-9</u>: Measuring with a disposable pipette, add about 0.5 mL of the nonionic surfactant to 16 ounces (470-500 mL) or about 1 mL to 32 ounces (0.95 to 1.0 liters) to obtain about a 0.1% solution. Install sprayer (or wash bottle cap) and gently shake to mix. Then top off to full with distilled water, and label bottle "NID" (nonionic detergent). The low concentration of this NID solution will produce foam when agitated.





Use of other water-based record cleaner(s) is **at the user's own risk.** Alconox<sup>TM</sup> Liquinox<sup>TM</sup>, Alconox<sup>TM</sup> Citranox<sup>TM</sup> and Dow<sup>TM</sup> Tergitol<sup>TM</sup> 15-S-9 (or equivalents) are being recommended based on the detailed SDS, known ingredient(s), detailed use data, and human and environmental safety when diluted.

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General rule of thumb is that 15-18 drops equal one 1 mL, but this can vary to as high as 25-drops/mL. Disposable LDPE 3-mL or 5-mL graduated pipettes are very convenient and inexpensive.



Using too much Alconox<sup>™</sup> Liquinox<sup>™</sup>, Alconox<sup>™</sup> Citranox<sup>™</sup> or Dow<sup>™</sup> Tergitol<sup>™</sup> 15-S-9 (or equivalent) to prepare the CLEANER, ACID or NID solution is worse than using too little. Too high a concentration will not significantly increase the detergency or the acidity. It will increase the time, effort and quantity of water required to rinse.



All solution concentrations since they are liquid are indicated as only % and are intended as percent by volume (sometimes noted as v/v%). Since most of the cleaners used have a specific density close to 1.0 same as (water), the v/v% is very close to weight % (wt%). Any small differences are inconsequential for their intent as cleaning agents.

.....

III.AU/EU/UK. <u>Prepare the NID Spray (or Wash) Bottles</u>: Don nitrile gloves and eye protection. Add distilled water to spray (or wash) bottle and fill about 1/2 to 3/4 full.

- a) For Polysorbate 20 (Tween<sup>™</sup> 20): All prior **CAUTIONS** for handling and preparing Dow<sup>™</sup> Tergitol<sup>™</sup> apply. Note that this surfactant is viscous but using a disposable pipette and flushing the pipette with the DIW-surfactant solution should obtain the appropriate in-use concentration.
- b) For BASF<sup>™</sup> Dehypon® LS 54 All prior CAUTIONS for handling Dow<sup>™</sup> Tergitol<sup>™</sup> apply. Measuring with a disposable pipette, add about 0.2 mL of the BASF<sup>™</sup> Dehypon® LS 54 nonionic surfactant to 500 mL or about 0.4 mL to 1.0 liter to obtain about a 0.04% solution. Install sprayer (or wash bottle cap) and gently shake to mix. Then top off to full with distilled water, and label bottle "NID" (nonionic detergent). The low concentration of this NID solution may produce some foam when agitated.



For use of the IFORD-ILFOTOL which is diluted and of variable formulation as a final cleaner (NID), see paragraph IX.5. Additionally with Triton  $\mathbb{M}$  X-100 now banned in the EU/UK (see paragraph IX.4.3), its use is not listed. For those that may still have Triton  $\mathbb{M}$  X-100 see CHAPTER IX. DISCUSSION OF THE FINAL CLEANERS: for directions of use as a final cleaner.

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The enzymes in clothes/laundry detergents can be irritating to some individuals. Per *Guidance for the Risk Assessment of Enzyme-Containing Consumer Products (1), "*Almost all enzymes used in consumer products are proteins which are foreign to the human immune system and can act as allergens through a Type 1 hypersensitivity mechanism following exposure, typically by inhalation.". If while handling or using any breathing irritation is experienced stop use immediately and seek medical attention if symptoms continue.

III.AU/EU/UK Prepare the CLEANER Spray (or Wash) Bottles: If using Vinyl Clear™ mix in accordance with manufacturer directions. If using a clothes/laundry detergent add distilled water to spray (or wash) bottle and fill 1/2 to 3/4 full. Add about 10 mL of the detergent to 500 mL or about 20 mL to 1.0 liter to obtain about a 0.5% active solution. Install sprayer (or wash bottle cap) and gently shake to mix. Then top off to full with distilled water, and label bottle "CLEANER". This CLEANER solution should produce foam when agitated. NOTE: Most machine clothes/laundry detergents are about 50% active so the dilution formula is as follows for a 0.5%/L solution: (1000 mL) x (0.005)/(0.5) = 10 mL/L.

IV.AU/EU/UK Prepare the ACID Spray (or Wash) Bottles: If using Distilled White Vinegar (5% acidity) add to spray (or wash) bottle and fill 1/2 to 3/4 full. Add about 5drops/500 ml of concentrated NID. Install sprayer (or wash bottle cap) and gently shake to mix. Then top off to full with Distilled White Vinegar (5% acidity), and label bottle "ACID". This ACID solution with the NID should produce some foam when agitated.

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#### **CHAPTER IV. RECORD INSPECTION:**

- IV.1 Visually inspect the record to assess how dirty is the record. This document uses the following 'grades' to define the record condition as it applies to cleaning.
- IV.1.1 Exceptionally Dirty Records that have tightly adherent contamination on top of the record such as mildew or oily residue; i.e., resurrecting a flea-market find. These records should receive the pre-clean step twice with the Alconox<sup>™</sup> Liquinox<sup>™</sup> 1.0% CLEANER solution as specified CHAPTER V. MANUAL CLEANING PROCESS: before proceeding to the Alconox<sup>™</sup> Citranox<sup>™</sup> 1.5% ACID wash and using Dow<sup>™</sup> Tergitol<sup>™</sup> 15-S-9 0.1% NID final clean steps. For heavy hard water spots acid-soak using paragraph V.Step.17 may be required (see paragraphs IV.8 and VIII.12 for discussion). For mold see section VIII.11.3 for additional information. For tenacious spots not otherwise cleaned see section VIII.13.
- IV.1.2 Heavily Soiled Records that are neither exceptionally dirty nor generally clean. These records have visible soil that is in the groove(s). These records should receive the pre-clean step once with the Alconox<sup>™</sup> Liquinox<sup>™</sup> 1.0% CLEANER solution as specified CHAPTER V.
   MANUAL CLEANING PROCESS: before proceeding to the Alconox<sup>™</sup> Citranox<sup>™</sup> 1.5% ACID wash and using Dow<sup>™</sup> Tergitol<sup>™</sup> 15-S-9 0.1% NID final clean steps.
- IV.1.3 **Generally Clean** - Records that have visible particulate and/or some evidence of oily fingerprints, or have a strong static charge. These records should receive the pre-clean step once with the Alconox<sup>™</sup> Liquinox<sup>™</sup> 1.0% CLEANER and final clean step using Dow<sup>™</sup> Tergitol<sup>™</sup> 15-S-9 0.1% NID solution as specified CHAPTER V. MANUAL CLEANING PROCESS:. Final clean by itself has not proven adequate to effectively clean light weights greases and oils and similar organic contaminants. Final clean with the nonionic wet cleaning process will remove the static charge that is common on new records. Even though the record may play quiet, that does not mean that the record is completely clean and even new records should be subject to the pre-clean and final clean steps. The record pressing plants are essentially industrial facilities with high background levels of very fine airborne particulate from many sources including the humans handling/packaging the records. Even though the record may appear to be generally clean, invisible, tenacious, thin-film contamination may be deep in the groove or on the grooved side-walls. For used records and even new records, acid wash using Alconox<sup>™</sup> Citranox<sup>™</sup> 1.5% ACID as specified **CHAPTER V. MANUAL CLEANING PROCESS:** has proven beneficial; further details are addressed **paragraph** IV.8.
- IV.2 Inspection with the optional low-powered UV-blacklight (see Table I) can improve the inspection process. But, be careful of too much light. Industrial 100-watt UV blacklights can cause record damage, and some LED tactical flashlights produce enough white light to "washout" the surface leaving no contrast to be able to see small particles.

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Do not view a UV-Blacklight directly to avoid eye injury.



There should be no record damage using the UV light. The UV light exposure is just a few seconds, exposure is a single UVA wavelength 365 nano-meter vs the entire UV spectrum, and the 10-watt UV light source listed **CHAPTER II. PROCESS SUMMARY AND LIST OF MATERIALS:Table I** is not very powerful.

IV.3 Figure 8 shows examples of generally clean records under UV blacklight. With only white light, the records in Figure 8 appeared clean, but under UV blacklight showed a lot of particles.



Figure 8 - Two New Records Inspected UV Light - Generally Clean

- IV.4 Figure 9 shows an example of a heavily soiled record under UV blacklight. With only white light, the record in Figure 9 did not appear heavily soiled, but under UV blacklight showed a variety of contaminants with staining that was not removable. The record in Figure 9 was subsequently fully cleaned as specified CHAPTER V. MANUAL CLEANING PROCESS:, and although the staining was not removed, it played quiet with reasonable fidelity.
- IV.4.1 Note that some fingerprints may actually be etched into the surface of the record and this can be determined with jeweler's loupe, or equal type magnification. These fingerprints are not removable and unless deep into the groove can play without distortion. Some

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'defects' may be remnants of the pressing process and can include metal chards that are embedded; but the record may play fine.

IV.4.2 The staining in Figure 9 may be caused by using recycled (repressed) records whose label(s) were not completely removed per a conversation at VPI<sup>™</sup> Forum, General Audio, "UV Inspection of Records Results" thread of Tue Mar 10, 2020 2:12 pm (66). A person who worked at Columbia Records factory in 1972 and 1973 was in the department that supplied the record material to the presses. The person indicated that the equipment that removed the labels from returned or over-pressed records would frequently malfunction. Labels were then part of the recycled vinyl mixed with virgin material used for pressing records that were allowed to be pressed with recycled material.



Figure 9 - One Record Inspected UV Light - Heavily Soiled with Staining

IV.5 Figure 10 is the worst record observed with staining from using repressed vinyl. Given the amount of staining, if there is any virgin material there is not much. However, after cleaning, the record played quiet, but with for want of better words - a hardness or edge to the music that is likely the consequence of the repressed material not having the same properties as virgin material. In the article *Disc Phonograph Records by Dr. A. M. Max, RCA Engineer Magazine 1966-08-09 (1)* it's noted that the record material deforms slightly under the pressure of the stylus. The deformation is not permanent and recovers after play. But if repressed material has stiffer properties, not as much 'plastic' deformation will occur and playback response will be different. Ultimately, with all the mechanical variables involved, vinyl record playback is more a musical instrument and, in some ways, the stylus is to the record, what the bow is to the violin.

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Figure 10 – Record Inspected UV Light – with Major Staining

- IV.6 No similar extreme fluorescence has been seen with records manufactured from virgin material, but fluorescence has been seen on some recently pressed records. The cause is currently unknown. While older records can show the large wave-shape of Figure 9 and Figure 10, the newer records show only a few stains that are unlikely to be caused by recycled vinyl containing label pieces. These stains 'may' be from using repressed material (the excess that is trimmed after pressing) or wax-type lubricants used in the record formula that may not be uniform with some near the surface. The staining noted on the new records is not removable by the cleaning process specified CHAPTER V. MANUAL CLEANING PROCESS: and follow-on play has not removed it either. Additional details on record formulas are discussed CHAPTER X. DISCUSSION OF MATERIAL COMPATIBILITY:
- IV.7 Figure 11 is a well-known new record. Photo A is white light after the record had been cleaned with a well-known record brush and an optical cleaning solution that will only lightly wet the record; very similar to the Discwasher<sup>™</sup> process. Photo B photo is the record under UV light and its shows a lot of detritus/lint/particles remaining, and the record played as it looked, very noisy. Photo C is the record after cleaning as specified CHAPTER V. MANUAL

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**CLEANING PROCESS:** but without the acid cleaning step. The cleaning process removed a lot of detritus/lint/particles, but there are still particles that are deep in the grooves that are not being removed. This record plays as it looks – there is some ticks throughout. In comparison, the *Bill Evans* and *Liz Story* records in **Figure 41** show almost complete absence of any particulate under UV light and they play as the look – very quiet.



Figure 11 - One Record Inspected White & UV Light Before-After Cleaning

IV.8 What is the source of the very fine particles that are in the groove? After reading this post Record Cleaners - a confession | Page 2 | Audiokarma Home Audio Stereo Discussion Forums, it occurred to me that the particles can be mineral salts (such as calcium & magnesium carbonate) which fluoresce intensely. The source is not the record formula, it's from the natural aerosols that are in the air. Natural aerosols are (*ref: NASA*) "tiny solid and liquid particles suspended in the atmosphere. Some aerosols come from natural sources, such as dust, volcanic eruptions, and sea salts. Some aerosols are produced by humans, such as pollution from industries or automobiles, or smoke from fires." Depending on the pressing plant cleanliness, ventilation and handling, these natural background aerosol particles can be pressed-in or deposited on the record. Very small mineral salt particles are easily dissolved/removed with a weak acid; the same process applies when using distilled white vinegar to clean a coffee pot. The record in **Figure 11-C** was cleaned with 1.5% Alconox<sup>™</sup> Citranox<sup>™</sup> acid cleaner (**V.Step.6**) and the particles were removed and the record played much quieter.

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- IV.9 There are limitations with using UV blacklight. Animal and vegetable-based oils and greases such as an oily fingerprint, waxes and hard-water mineral residue will generally fluoresce. However, mineral-based oils and greases such as motor oil, and synthetic greases generally will not fluoresce. Many natural fibers (including the record label) and lint fluoresce, but synthetic fibers from microfiber cloths and the Kinetronics<sup>™</sup> Tiger anti-static microfiber cloth do not fluoresce.
- IV.10 Records that have been precision cleaned can still sound for want of a better term bad; clicks, pops, hiss, and distortion. There are any number of reasons such as following, but no amount of cleaning is going to fix these physical defects.
- IV.10.1 For new records: Poor recording.
- IV.10.2 For new records: Problems with the stamper. The stamper prepared during the plating process may have defects. It may have been prepared dirty so that the surface has the impressions of very fine/microscopic particulate. The stamper may have been overused and is now deteriorated and/or shedding metal particles that are embedded in the record.
- IV.10.3 For new records: deficiencies with the record formulation. As previously stated, repressed material may not have the same qualities as virgin material. The material blend can be out of tolerance leaving the record with an inconsistent surface. This may be the source of the common incorrect theory that new records need to have the 'mold release' removed. Evidence of oil-splotches is the result of poor record formulation see paragraph X.1.5.
- IV.10.4 For new records: deficiencies with the pressing. Incorrect pressing heat, pressure and time can leave un-filled areas. Incorrect pressing cooling and time can result in material pulled during separation leaving microscopic defects. Note: It is not uncommon for a clean new record to sound noisy for the first few plays. This is not uncommon. There are often microscopic burrs left from the pressing process, and the first few plays essentially 'burnish' the surface, removing the burrs.
- IV.10.5 For new and used records: Obvious deep scratches. Very light surface scratches are often of no consequence. For used records, many light surface scratches may indicate use of once popular automatic changers that could play a stack of many records.
- IV.10.6 For used records: Groove damage such as trenching from conical and elliptical stylus as shown Figure 4 and Figure 5. Groove damage can also be from an over-worn stylus. The article *The Finish Line for Your Phonograph Stylus..., by Mike Bodell, May 23, 2019* (47) addresses this in detail. In this case the stylus carves/chisels away the side-wall ridges. However, as previously addressed (paragraph I.8), Shibata and other advanced profile stylus can sometimes bridge the trench made by conical and elliptical stylus. However, damage caused by Shibata (or equivalent) is likely "terminal".

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#### **CHAPTER V. MANUAL CLEANING PROCESS:**



This **"manual cleaning** proce**ss"** uses tap-water for most rinsing and assumes the quality is close to USA EPA guidelines (or equivalent). The rationale for use is discussed **CHAPTER VII. DISCUSSION OF WATER QUALITY:** If not, substitute DIW for all rinse steps. This will incur greater cost and will lose the benefit of the force and volume of tap-water dropping from a faucet when rinsing. Paragraph VII.4 discusses some options to produce higher quality water. Otherwise **CHAPTER XIII. DISCUSSION OF VACUUM RECORD CLEANING MACHINES:** may be the better cleaning process.

V.Step.1 Assemble all equipment, material and solutions in a location that has access to a relatively large sink such as a residential kitchen. Figure 12 shows the Groovemaster<sup>™</sup> and VinylStack<sup>™</sup> record label protectors (*items not shown optional Nalgene wash bottle and dish rack*). If required, prepare cleaning solutions as specified CHAPTER III. CLEANING SOLUTION PREPARATION: Clean (wipe down) the local area to minimize cross contamination and obtain best cleaning results.



Figure 12 - Step 1: Assemble Cleaning Process Solutions and Materials

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The following steps show the VinylStack<sup>™</sup> record label protector (RLP) which is no longer available for purchase and/or the Groovemaster<sup>™</sup> RLP which is a direct substitute with the exception that it uses knobs on both sides instead of a handle on just one side. They both use O-rings to seal the RLP to the record. The Groovemaster<sup>™</sup> RLP has O-rings on either side, the large diameter for 12-inch long-play (LP) records the smaller for 7-inch 45 rpm records. There are cheaper knock-offs of the USA-Made Groovemaster<sup>™</sup> RLP; they are not the same. The Groovemaster<sup>™</sup> RLP they are not the same.

V.Step.2 <u>Assemble RLP</u>: Don nitrile gloves. Place Record Label Protector on flat surface, remove outer label protector, install record, assemble and tighten. After first tight, tighten about 1/4 to 1/3 additional turn to secure the label protector. If using the Groovemaster<sup>™</sup> (or similar type RLP with knobs or both sides), a block of foam (or other material) with hole cut-out for the round peaked knob with fixed male thread may ease assembly by allowing it to lay flat and stable as shown **Figure 14**.



Figure 13 - Step 2: VinyStack<sup>™</sup> RLP Assembly



Figure 14 - Step 2: Groovemaster™ RLP Assembly

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The Groovemaster<sup>™</sup> RLP can be modified for ease of use by replacing the triangle knob with a tapered handle (Plastic Tapered Handle, High-Temperature, with 1/4"-20 Size 3/8" Deep Thread, 2-5/8" Long | McMaster-Carr) and replacing the rubber washer with a neoprene coated washer (example: <u>18-8 Stainless Steel with Neoprene Rubber Sealing Washer, for 1/4" Screw</u> <u>Size, 0.275" ID, 1" OD | McMaster-Carr</u>) and these modifications are shown in **Figure 15**. Some may find the tapered handle easier to hold. The neoprene coated washer slides over the round knob fixed (1/4-20) thread much easier than the rubber washer making assembly and disassembly easier and faster.



Figure 15 - Step 2: Groovemaster™ RLP Modifications

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V.Step.3 <u>Pre-Rinse</u>: Move record to kitchen sink (or equivalent), and pre-rinse with steady stream of lukewarm to warm tap water (no need to use spray) to remove loose debris.



Using a plastic or rubber kitchen sink mat can protect the record should you drop the record into the sink. Placing the record against a hard surface and using physical force to 'deeply clean' is not recommended due to risk of record damage. Let the process chemistry and fluid agitation do the work. Additionally, using a plastic or rubber faucet protector can protect the record from the faucet.

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Figure 16 – Step 3: Pre-Rinse with Tap Water





Aerosol from the CLEANER spray bottle similar to any household spray cleaner may cause respiratory irritation during extended exposure such as sequentially cleaning more than a few records. Operating the sprayer partly or slowly (versus quick full-pumps) will reduce the amount of airborne aerosol. Operating a kitchen range hood will improve local ventilation. Otherwise, instead of a spray bottle use a Nalgene<sup>™</sup> wash bottle (see CHAPTER II. PROCESS SUMMARY AND LIST OF MATERIALS:Table I & Figure 7) to apply the CLEANER solution.



Per paragraph IV.1, for "exceptionally dirty" records such as those covered with large areas of mold or oily residue, recommend performing the pre-clean/rinse V.Step.4 & V.Step.5 twice. The process uses very little CLEANER and exceptionally dirty records may not be cleaned using only one application of the CLEANER.

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V.Step.4 Pre-Clean: Pre-clean with CLEANER (1% Alconox<sup>™</sup> Liquinox<sup>™</sup>). Using the CLEANER spray (or wash) bottle, liberally wet both sides of the record with the cleaning solution. The solution will wet the surface (not bead-up) almost instantly. Applying only a light pressure (the brush handle can scratch the record), use the Record Doctor<sup>™</sup> Clean Sweep Record Brush (or equivalent) in moderately short, fast, back and forth motions (such as two back-and-forth motions per second) that follow (are parallel to) the arc of the grooves, and clean the record both sides with the CLEANER solution. For those familiar with record cleaning machines (RCMs) – clean the record the equivalent of 3 to 5 rotations. The back-and-forth motion of the brush will perform the same as reverse rotation. Holding the record on an angle (about 45° to 60°) can assist with the cleaning process. The low surface tension of the CLEANER will keep it on the record. The CLEANER will develop foam as noted Figure 17 with most of the foam collecting in the brush.



Figure 17 - Step 4: Pre-Clean with CLEANER Solution & Brush

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When performing the pre-clean V.Step.4, ensure the record stays wet throughout the step to ensure a good rinse. Limit the exposure time to the pre-cleaner to not more than 15 minutes per side to mitigate any material compatibility risks with the vinyl record (material compatibility is discussed **CHAPTER X. DISCUSSION OF MATERIAL COMPATIBILITY:**).



The foam that is developed by the cleaning process is beneficial. It helps to lift debris and soil from the record groove. The Nylon brush adsorbing the foam assists with lifting the debris and soil from the record minimizing the risk of grinding debris and particles into record.

V.Step.5 <u>Pre-Clean Rinse</u>: Using lukewarm to warm tap water, flush the record with a steady stream (no need for spray) of water on both surfaces until the record is free of any cleaner. While rinsing, with very light pressure, use the Record Doctor<sup>™</sup> Clean Sweep Record Brush (or equivalent) in moderately slow long back-and-forth motions (i.e., similar to using a paint brush) that follow (are parallel to) the arc of the grooves to assist the water rinse and to flush the record brush of CLEANER. But, at the end, separately rinse the record both sides and the brush with only a steady stream (no need for spray) of water to ensure removal of CLEANER from both.



Water spray is not necessary. But, if water spray is used, wear eye protection to protect from cleaner back-splash.



If local tap-water is of insufficient quality and DIW is being substituted, recommend using a **Nalgene™ (or equivalent) wash/rinse bottle as indicated Table I** and shown **Figure 7**. This will obtain much better flow and rinsing than using a spray bottle.

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Figure 18 - Step 5: Pre-Cleaner Rinse with Tap Water & Brush





Aerosol from the ACID spray bottle similar to any household spray cleaner may cause respiratory irritation during extended exposure such as sequentially cleaning more than a few records. Operating the sprayer partly or slowly (versus quick full-pumps) will reduce the amount of airborne aerosol. Operating a kitchen range hood will improve local ventilation. Otherwise, instead of a spray bottle use a Nalgene<sup>™</sup> wash bottle (see CHAPTER II. PROCESS SUMMARY AND LIST OF MATERIALS:Table I & Figure 7) to apply the ACID solution.



Per paragraph IV.1, acid cleaning should be used for "exceptionally dirty" and "heavily soiled" records, and is recommended for "generally clean records". Acid cleaning with Alconox™ Citranox™ can remove very fine particulate that pre-cleaning with Alconox™ Liquinox™ may not – see paragraphs IV.8 and VIII.12 for further details. If acid-clean will not be performed, proceed to final clean V.Step.8. However, the small amount of ACID used and the few minutes of added time are recommended if there is any uncertainty to the record condition.

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V.Step.6 <u>Acid-Clean</u>: Acid-clean with ACID (1.5% Alconox<sup>™</sup> Citranox<sup>™</sup>). Similar to V.Step.4, using the ACID spray (or wash) bottle, liberally wet both sides of the record with the acid solution. The solution will wet the surface (not bead-up) almost instantly. Applying only a light pressure (the brush handle can scratch the record), use the Record Doctor<sup>™</sup> Clean Sweep Record Brush (or equivalent) in moderately short, back and forth motions (such as one back-and-forth motions per second) that follow (are parallel to) the arc of the grooves, and clean the record both sides with the ACID solution. For those familiar with record cleaning machines (RCMs) – clean the record the equivalent of 3 to 5 rotations. The back-and-forth motion of the brush will perform the same as reverse rotation. Holding the record on an angle (about 45° to 60°) can assist with the cleaning process. The low surface tension of the ACID will keep it on the record. The ACID will develop foam as shown Figure 19 with most of the foam collecting in the brush.



Figure 19 – Step 6: Acid Clean with Brush

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When performing the acid cleaning, ensure the record stays wet throughout the step to ensure a good rinse. Limit the exposure time to the acid to not more than 15 minutes per side to mitigate any material compatibility risks with the vinyl record (material compatibility is discussed **CHAPTER X. DISCUSSION OF MATERIAL COMPATIBILITY:**).



The foam that is developed by the acid cleaning process is beneficial. It helps to lift debris and soil from the record groove. The Nylon brush adsorbing the foam assists with lifting the debris and soil from the record minimizing the risk of grinding debris and particles into record. Note that Alconox™ Citranox™ will foam less than Alconox™ Liquinox™

V.Step.7 <u>Acid-Clean Rinse</u>: Same as V.Step.5, using lukewarm to warm tap water, flush the record with a steady stream (no need for spray) of water on both surfaces until the record is free of any cleaner. While rinsing, with very light pressure, use the Record Doctor<sup>™</sup> Clean Sweep Record Brush (or equivalent) in moderately slow long back-and-forth motions (i.e., similar to using a paint brush) that follow (are parallel to) the arc of the grooves to assist the water rinse and to flush the record brush of ACID. The ACID will not rinse as quickly as the CLEANER. But, at the end, separately rinse the record both sides and the brush with only a steady stream (no need for spray) of water to ensure removal of ACID from both.



Water spray is not necessary. But, if water spray is used, wear eye protection to protect from acid-cleaner back-splash.



If local tap-water is of insufficient quality and DIW is being substituted, recommend using a Nalgene<sup>™</sup> (or equivalent) wash/rinse bottle as indicated Table I and shown Figure 7. This will obtain much better flow and rinsing than using a spray bottle.

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Figure 20 – Step 7: Acid Rinse with Tap Water & Brush

V.Step.8 Final-Clean: Final clean with NID (0.1% Dow<sup>™</sup> Tergitol<sup>™</sup> 15-S-9). Using the NID spray (or wash) bottle, liberally wet both sides of the record with the cleaning solution. The NID solution will wet the surface (not bead-up) almost instantly. Applying only a light pressure (the brush handle can scratch the record), use the Record Doctor<sup>™</sup> Clean Sweep Record Brush (or equivalent) in moderately short, fast, back and forth motions (such as two back-and-forth motions per second) that follow (are parallel to) the arc of the grooves, and clean the record both sides with the NID solution. For those familiar with RCMs – clean the record the equivalent of 3 to 5 rotations. The back-and-forth motion of the brush will perform the same as reverse rotation. Clean the record the equivalent of 3-5 rotations. Holding the record on an angle (about 45° to 60°) can assist with the cleaning process. The low surface tension of the NID will keep it on the record. There will be some foam with the NID as noted.

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Aerosol from the NID spray bottle similar to any household spray cleaner may cause respiratory irritation during extended exposure such as sequentially cleaning more than a few records. Operating the sprayer partly or slowly (versus quick full-pumps) will reduce the amount of airborne aerosol. Operating a kitchen range hood will improve local ventilation. Otherwise, instead of a spray bottle use **a Nalgene™** wash/rinse bottle (see **Table I & Figure 7**) to apply the NID solutions.



Figure 21 – Step 8: Final Clean with NID Solution & Brush



When performing the final clean V.Step.8, limit the exposure time to the final cleaner to less than 15 minutes per side to mitigate any material compatibility risks with the vinyl record (material compatibility is discussed **CHAPTER X. DISCUSSION OF MATERIAL COMPATIBILITY:**).

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If a high stable foam develops, the record may not have been adequately rinsed following the pre-clean or acid clean steps, or an excessive quantity of the **Dow™ Tergitol™ 15**-S-9 was used to prepare the NID cleaning solution.

V.Step.9 Final Clean Rinse: Same as V.Step.5, using lukewarm to warm tap water, flush the record with a steady stream (no need for spray) of water on both surfaces until the record is free of any cleaner. While rinsing, with very light pressure, use the Record Doctor™ Clean Sweep Record Brush (or equivalent) in moderately slow, long back-and-forth motions (i.e., similar to using a paint brush) that follow (are parallel to) the arc of the grooves to assist the water rinse and to flush the record brush of cleaner. But, at the end, separately rinse the record both sides and the brush with only a steady stream (no need for spray) of tap-water to ensure NID is removed from both. Gently shake the record to remove bulk/large water drops.



Water spray is not necessary. But, if water spray is used, wear eye protection to protect from cleaner back-splash.



If local tap-water is of insufficient quality and DIW is being substituted, recommend using a **Nalgene™ (or equivalent) wash**/rinse bottle as indicated **Table I** and shown **Figure 7**. This will obtain much better flow and rinsing than using a spray bottle.

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Figure 22 – Step 9: 1<sup>st</sup> Final Rinse with Tap Water & Brush

V.Step.10 Final DIW Rinse: Using the DIW (distilled/demineralized water) spray bottle, liberally spray the record surface from top to bottom (both sides) to remove the tap water. The surface should readily bead-up evidence that all cleaner has been removed. This will leave only DIW that when dry will leave a clean, spot free surface. Gently shake the record to remove bulk drops.

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Figure 23 - Step 10: Final Spray Rinse with Distilled Water

V.Step.11 First Dry: Using the Super Cool<sup>™</sup> PVA Cleanroom Sponge, following the arc of the record grooves, lightly wipe the surface to remove most water. Excess pressure may produce a squeaking sound similar to wiping a mirror.



Read the use instructions that come with the Super Cool<sup>™</sup> Polyvinyl-Alcohol (PVA) Cleanroom Sponge. This sponge is delivered moist in a plastic package. If allowed to dry, the sponge will become very hard, but as specified in the instructions will resoften when rinsed with DIW. The Super Cool<sup>™</sup> PVA Cleanroom Sponge should be able to dry about 3 records before requiring a squeeze to expel excess DIW moisture. The PVA sponge is quite robust and can be wrung-out without damage. Lint-free microfiber cloths are good for drying your hands and can be used to absorb water from the PVA sponge. Note that the PVA sponge is good for about 6-12 months. Using only with gloved hands extends life since body oils and detritus are not transferred to the sponge allowing mold to form.

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Beware of cotton cloth – it can produce a lot of fibers and lint. I was using a cotton dish cloth to dry my gloved hands in-between steps. At the completion of a cleaning session when I inspected the record with the UV light, the record was covered with lint. The source was the cotton dish cloth that transferred lint to my gloved hands and they then transferred the lint to everything I touched.



Figure 24 – Step 11: Drying with Super Cool™ PVA Cleanroom Sponge

V.Step.12 Second Dry: Using the Kinetronics<sup>™</sup> Tiger anti-static cloth, with very little pressure, final dry the record in a circular motion after which there should be very little moisture left and the surface will be free of static charge. Then, away from the sink, give the record a good two (2) shakes to dislodge moisture that is under the edges of the Record Label Protector. Wipe away any visible drops. This will minimize wetting the label when the record label protector is removed.

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When shaking the record, grasp tightly the Record Label Protector handle/knob so you don't accidentally throw the record across the room.



Figure 25 – Step 12: Drying with Kinetronics™ Anti-static Cloth



The Kinetronics<sup>™</sup> Tiger anti-static cloth is mostly lint-free, but the cloth edges are not finished or sealed, so some lint may be produced during use. Avoid exposing the cloth edges to the record. Otherwise, lint from the Kinetronics<sup>™</sup> Tiger anti-static cloth is visible in normal lighting and is easily removed by lightly brushing the record with the cloth. When using the Kinetronics<sup>™</sup> Tiger anti-static cloth to remove lint, periodically shaking the cloth during use (away from the record) will minimize transferring lint and particles from the cloth onto the record.

V.Step.13 <u>Disassemble RLP</u>: Place record with Record Label Protector on hard surface. If the RLP has knobs on both ends such as the Groovemaster<sup>™</sup>, a block of foam (or other material) with hole cut-out for the knob may ease disassembly by allowing

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it to lay flat (see **Figure 14**). Grasp the Record Label Protector and remove handle/knob and outer record label protector. A few water drops are normal. Wipe away any visible drops with the Kinetronics<sup>™</sup> Tiger anti-static cloth. Flip record and wipe away any visible drops with the Kinetronics<sup>™</sup> Tiger anti-static cloth.



Figure 26 - Step 13: Record Label Protector Disassembly



This process instruction has been designed for batch cleaning of up to about six (6) records. If cleaning only one (1) record, and time is not critical, the record can be left in the **Record Label Protector** to completely dry before proceeding to disassembly by V.Step.13. However, the longer the record stays exposed to the ambient environment the greater the risk of invisible airborne particulate (such as fine lint that is visible with the UV Blacklight) depositing on the clean record.

V.Step.14 Final Dry: If cleaning more than one record, remove record from the Record Label Protector, place in dish rack such as the OXO<sup>™</sup> Good Grips Dish Rack (*has soft rubber tips and can stack 6-records*), and repeat the process starting with V.Step.2. Otherwise proceed to V.Step.15. Records should be fully dry in less than 15-minutes depending on the ambient humidity. During the dry-winter months, the record can be fully dry in 5 minutes.

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Figure 27 – Step 14: Records Drying on Rack



Using a portable room or desk-type high efficiency particulate air (HEPA) filter can reduce the risk of the records being contaminated with airborne particulate during the drying step. Room or desk-top HEPA air filters are readily available at prices (and quality) that start at about \$75 and can increase to many hundreds of dollars for units such as those manufactured by Austin Air<sup>™</sup> and Dyson<sup>™</sup>. The HEPA air filter elements are generally rated for about 2,500-hours of use or greater. Replacement HEPA air filters for small-room or desk-top units are generally about \$50 and greater. Selecting a stable supplier will ensure availability of replacement filters.

V.Step.15 Once completely dry, place clean record(s) in an anti-static, archival quality record sleeve. Inspection with optional UV light may show lint/particulate that can be removed by lightly brushing with the Kinetronics<sup>™</sup> Tiger anti-static cloth. If cleaning three or more records, the first record will likely be dry and ready to sleeve after cleaning the third record.

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Do not view a UV-Blacklight directly to avoid eye injury.



Minimize handling the PVA sponge and microfiber cloths with bare-hands to keep the sponge and cloths clean. Dry hands shed dead skin cells constantly. The PVA sponge and the microfiber cloth with gloved hands can be cleaned/rinsed with DIW. If the PVA sponge or drying cloths become so dirty to require detergent laundering, they should be replaced.

- V.Step.16 Using the DIW spray or wash/rinse bottle, flush the Record Doctor™ Clean Sweep Record Brush, let dry and recommend storing in clean plastic bag or container to maintain cleanliness. Squeeze excess water from PVA sponge and store moist in a plastic bag or container. Hang microfiber cloth(s) to dry and once dry shake to remove any particulate, then recommend storing in clean plastic bag or container to maintain cloth cleanliness. Remove nitrile gloves and dispose, or if using reusable nitrile gloves, dry and store for future use.
- V.Step.17 <u>Acid-Soak</u>. Some new, but especially used records even after the full cleaning process can still be noisy; the likely source is very fine tenacious particles – see paragraphs IV.8 and VIII.12 for additional details. Longer exposure to acid can dissolve or swell the particle(s) enough to be removed.



When handling acid follow all safety precautions listed V.Step.6.

V.Step 17.1 Place the record on plastic bowl/cup that only contacts the label protector as shown Figure 28.

V.Step 17.2 Level the record and apply a liberal coating of the ACID (1.5% Alconox™ Citranox™) so the record is uniformly wet, and allow to sit for about 15 minutes.

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V.Step 17.3 Rinse with lukewarm to warm tap-water and assist with brush similar to V.Step.7.
 Then spray the rinsed acid-soaked side with DIW. Flip and repeat Steps 1 and 2 above.



As an alternate to V.Step 17.1 to V.Step 17.3, fill a sink or shallow plastic container of sufficient diameter/depth to complete submerge the record **with 1.5% Alconox™ Citranox™** for 15-min. This process will take less time but will use much more DIW & acid.

V.Step 17.4 After the 2<sup>nd</sup> side has been acid-soaked and rinsed with tap-water, proceed to
 V.Step.6 Acid-Clean and complete the remaining cleaning process for the entire record. This process helps to remove particles that are swollen and can be removed with a little more acid and agitation. Additionally, the follow-on final clean step ensures all the acid is removed.



Figure 28 – Step 17: Record Acid Soak

V.Step.18 <u>Tenacious Spots</u>. If after the complete manual cleaning process and acid-soak, visible detritus of unknown origin remains – see paragraph VIII.13 for two safe options; isopropyl-alcohol swab or detergent-enzyme-soak; and then two lastditch options.

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