Glass Restoration Standards

Reference Handbook 2025

-IWCA Edition-

In Association with:

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The **International Window Cleaning Association (IWCA)**, promotes the success of members through standards of safety, education, advocacy, and research.

The IWCA would like to acknowledge the efforts of Cody Thomas, owner of **GlassRenu**, and an IWCA Glass Education Committee member, for researching and compiling this valuable resource, as well as the development of their unique system The result is a wealth of technical information providing a comprehensive technical manual that provides guidelines for architectural glass restoration and mechanical field polishing.

The goal of the IWCA Glass Education Committee is to research trends and apply hands-on experience in unison with ongoing technical analysis related to the chemistry of architectural glass surface maintenance. This guide is valuable in addition to our Technical Bulletins and best practices publications.

This publication is a groundbreaking document, identifying common types of damage and stains or deposits with step-by-step restoration processes.

The IWCA has numerous resources available and encourages regular maintenance of glass. For additional information, visit **www.IWCA.org**

Tom Trinen, Chairman, IWCA Glass Education Committee

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Hello Window Cleaning Professionals,

My name is Cody Thomas, and I'm the proud owner and founder of GlassRenu. Over the past 18 years, I've worked alongside many of you, gaining insight into the challenges you face every day. At GlassRenu, our mission has always been to deliver exceptional customer service, expert technical support, and innovative solutions for addressing surface damage on glass.

We've been in business for 18 years, proud members of the International Window Cleaning Association (IWCA) for 16 years, and I've had the honor of serving on the IWCA Educational Committee for the past 6 years. Through this work, I've been committed to sharing knowledge and raising industry standards.

In line with this mission, I'm thrilled to introduce the **"Glass Restoration Standards Reference Handbook: 2025 Edition."** This comprehensive guide is designed to help you elevate your skills and expand the services you offer your clients. It builds on our earlier primer and dives deeper into the techniques, standards, and practices of professional glass restoration.

Here's what you'll find inside:

- **An Introduction to Glass Restoration**: Essential processes, procedures, and tools for successful restoration.
- **Addressing Common Challenges**: Solutions for hard water stains, scratches, and damage from improper cleaning materials.
- **Industry Standards and Best Practices**: Guidelines for consistent, high-quality results every time.

This handbook isn't just a resource—it's your roadmap to expanding your services, refining your expertise, and providing cost-effective, high-value solutions to your clients.

Whether you're new to restoration or looking to enhance your skills, the tools, products, and support you need are available through our collaboration with Window Cleaning Resource or directly through GlassRenu.

If you have any questions after reading the handbook, don't hesitate to reach out. We're here to support you every step of the way.

Wishing you clear skies and clearer windows,



Owner – GlassRenu

Cody Thomas

Special Dedication

The GlassRenu Glass Restoration Standards Reference Handbook is a testament to the dedication, expertise, and passion of professionals who have worked tirelessly to advance the field of glass restoration. This handbook would not exist without the countless contributions, insights, and support of industry leaders, innovators, and collaborators from around the world.

At GlassRenu, we live by the belief that “the only stupid question is the one you don’t ask” and that “the only problems we can’t solve are the ones we don’t know about.” These principles embody our commitment to open collaboration, constant learning, and the pursuit of excellence in everything we do.

Written By:
Cody Thomas, C. Logan McIntire

Edited By:
Cody Thomas, C. Logan McIntire

Special Editor:
Keith Thomas

With Special Thanks To:

- Rick Evans
- Cole Pasjuta
- Andrew Chung
- Marion Bogdanich
- Matt Fong
- Matthew Betton
- John Carolla
- Steve Dillon
- Dr. Ing. Dino Zandonella Necca
- Lorenza Dal Maso
- Alessandro Satori
- Craig Osbourne
- Jim Algyre
- Tom Mirandi
- Chris Lambrinides
- Alex Lambrinides
- "Jersey" Josh Cronin
- Tim Rollo
- Mark Villhauer
- Gary Van Velsor
- Marc Tanner
- Tom Trinin
- Paul West
- Sheila Smeltzer
- Jack Evans
- The IWCA Glass Education Committee Members
- **All GlassRenu Members Worldwide**

This handbook is dedicated to the professionals who continue to push boundaries, challenge the status quo, and inspire innovation in glass restoration. Your commitment to craftsmanship and your willingness to ask questions and share challenges have helped us provide the solutions and resources contained within these pages.

Thank you for being part of this incredible journey and for shaping the future of glass restoration.

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C 1.0.0.0- Understanding Glass

Glass, one of mankind's oldest and most versatile materials, has transformed our lives in myriad ways, from the magnifying glass that broadened our understanding of the microcosm, to the windows that enclose our habitats while allowing in the sun's radiant light. Understanding its nature, structure, and potential uses is crucial for many industries.

The origin of glass dates back to 4,000 B.C., where it was found as a by-product when cooking pots were made from a special type of soil (sand) in fire. Since then, mankind's innovation and science have advanced the properties and uses of glass, making it an indispensable component of modern society.



Fig. 1000A

C 1.1.0.0 - How Glass Is Made

Glass manufacturing is a fascinating process, beginning primarily with the melting of raw materials like sand (silicon dioxide), soda ash, and limestone in a furnace at temperatures exceeding 1,700°C. This liquid "molten" glass is then formed into sheets or various shapes using a range of techniques, depending on the desired end product.

Once shaped, the glass undergoes an annealing process, wherein it is slowly cooled to relieve any internal stresses. This ensures its structural integrity and durability. The result is a transparent, hard, and brittle material that can be further processed or finished for a myriad of applications.

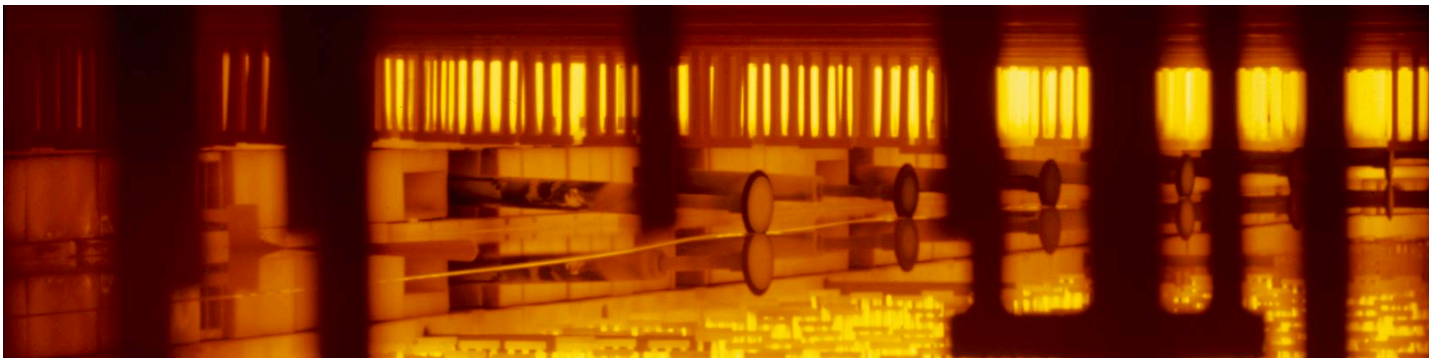


Fig.1100A

C 1.1.1.0 - Chemical Structure of Glass

Glass, primarily composed of silicon dioxide (SiO_2), has a unique place in both everyday use and specialized applications due to its distinct chemical and physical properties. As an amorphous solid, glass lacks a regular, crystalline structure, which is pivotal in giving it its transparency and brittleness. This lack of a crystalline structure in glass, often likened to a liquid in a very slow-moving state, is a source of many myths. One such myth suggests that old stained glass windows are thicker at the bottom due to 'flowing' over centuries, but in reality, the irregularities found in these windows stem from older manufacturing methods, not from any liquid-like behavior.

In the realm of commercial glass manufacturing, the basic silica structure is often enhanced with additional elements to adapt its properties for various uses. For instance, soda-lime glass, the most common form of glass used in windows and bottles, combines sodium carbonate (soda) and calcium carbonate (lime) with silica. The soda lowers the glass's melting point, while lime contributes to its stability. Another variant, borosilicate glass, known for its resistance to thermal shock, includes boron trioxide, allowing it to have a lower coefficient of thermal expansion. Lead glass, often used in decorative glassware for its sparkling appearance, incorporates lead oxide, which increases its refractive index. Additionally, alumina-silicate glass, which contains aluminum oxide, is renowned for its strength and is frequently used in high-strength applications like smartphone screens.

Understanding the varied chemical composition of glass is essential in the field of glass restoration. This knowledge not only fosters a deeper appreciation of the material's properties but also guides the selection of appropriate restoration techniques tailored to different types of glass, ensuring both effective and safe restoration practices.

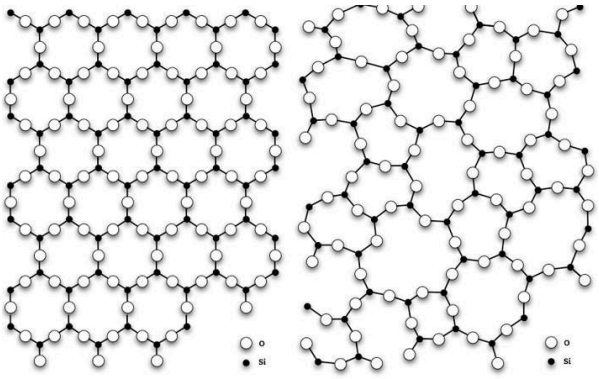


Fig. 1110A

C 1.1.2.0 - Cast Glass

Cast glass is a distinctive form of glass that is created through a process where molten glass is poured into molds. This method is particularly notable for its ability to produce glass with intricate shapes, textures, and detailed designs. Unlike other glass-making techniques, such as blowing or rolling, casting allows for a high level of precision and complexity in the final product.

The Casting Process:

- In the creation of cast glass, the first step involves melting the glass to a fluid state. This molten glass is then carefully poured into pre-designed molds. These molds can vary significantly in their complexity and detail, allowing for a wide range of artistic and architectural expressions. After pouring, the glass is left to cool and solidify within the mold. As it cools, the glass takes on the exact shape and texture of the mold's interior.



Fig. 1120A

Characteristics and Strength:

- One of the key characteristics of cast glass is its robustness. Typically, cast glass pieces are thicker and more substantial than those created through other methods, making them especially durable. The process also ensures that the glass is less prone to certain types of imperfections that are more common in blown or rolled glass. This results in a high-quality, visually stunning product that maintains its clarity and integrity over time.

Common Applications:

- Cast glass finds its place in a variety of applications, predominantly in the realms of art and architecture. In artistic endeavors, it is valued for its versatility and ability to capture intricate details, often used in sculptures, installations, and decorative elements. Architecturally, cast glass is employed in unique building features, such as bespoke windows, façades, and interior design elements. Its ability to be cast into specific shapes and textures makes it a favored choice for custom, design-centric projects.

C 1.1.3.0 - Float Glass

Float glass manufacturing stands as a groundbreaking development in the production of flat glass sheets, a process that has significantly influenced the modern glass industry. This innovative method involves a unique technique where molten glass is poured and 'floated' to a bed of molten tin, a process that has dramatically improved the quality and efficiency of flat glass production.

The Float Process:

- In float glass manufacturing, the molten glass is gently poured to a surface of molten tin. As it spreads across this tin bed, the combined forces of gravity and surface tension work together to shape the glass. This natural collaboration ensures the glass forms into a smooth, flat layer with a uniform thickness, eliminating many of the imperfections commonly associated with earlier methods. The molten tin provides a perfectly flat and smooth base, allowing the glass to solidify without the distortions that can arise from other production techniques.

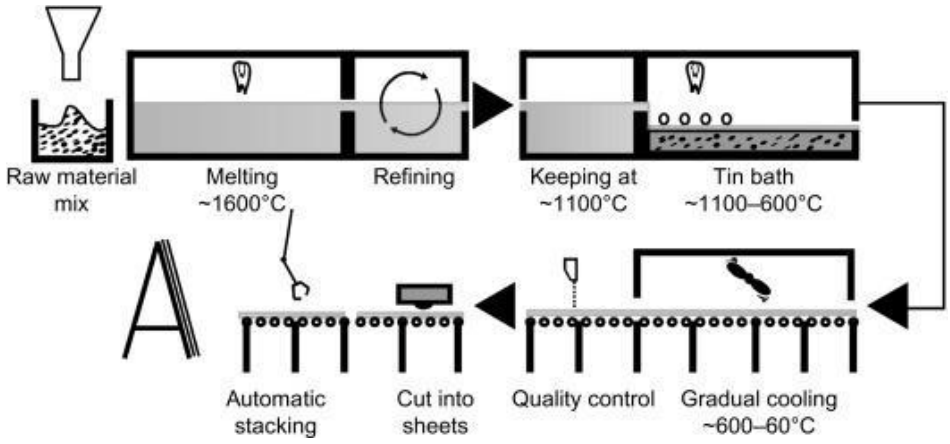


Fig. 1130A

Cooling and Quality Control:

- Once the glass sheet forms and sets on the tin, it enters a controlled cooling process known as annealing. This phase is crucial for relieving any internal stresses and ensuring that the glass is free from distortions. The careful control of the cooling environment allows the glass to maintain a consistent thickness and flatness, resulting in a superior quality product.

Applications in Modern Industry:

- The dominance of the float glass method in today's glass industry is largely due to the high-quality, clear glass sheets it produces. These sheets form the foundation for a myriad of applications, including windows in both residential and commercial buildings, mirrors, and various other glass products. The versatility and clarity of float glass make it a preferred choice for applications where visual quality and uniformity are paramount.

C 1.2.0.0 - Architectural Glass Applications

Architectural glass, a cornerstone in modern construction, marries functionality with aesthetic elegance. Its diverse applications, ranging from windows and doors to intricate partitions, not only serve practical purposes but also elevate the artistic essence of buildings. In the field of glass restoration, understanding these applications is crucial, as it informs the approach to preserving or enhancing these essential elements.

In architectural designs, glass introduces transparency and connectivity to the outdoors, imparting a sense of openness and expansiveness. This quality is paramount in creating inviting, light-filled spaces. However, the very transparency that makes glass so appealing also exposes it to various risks of damage, from environmental factors to accidental impacts. In the field of glass restoration, particularly with methods like GlassRenu, professionals are tasked with addressing these damages, restoring glass to its pristine condition without compromising its original clarity or distorting its intended aesthetic.

The role of glass in energy efficiency and structural integrity cannot be overstated. Innovations in glass technology, such as insulated glazing and solar control coatings, contribute significantly to a building's energy performance. These advancements, while beneficial, also present unique challenges in glass restoration. Professionals must navigate these complexities, ensuring that repairs uphold the glass's functional attributes while maintaining its visual standards.

Selecting the appropriate type of glass – be it annealed, tempered, mirrored, or laminated – depends on the specific requirements of each architectural application. Each glass type presents its own set of characteristics and potential vulnerabilities. Understanding these nuances is vital for glass restoration experts, as the nature of the glass dictates the restoration techniques and tools employed, such as the careful use of RenuDisks and the precise application of abrasion and polishing processes.

In summary, architectural glass is more than a material; it's an integral component of a building's design language and functionality. For those in the field of glass restoration, a deep appreciation of these various applications of glass is essential. It enables a thoughtful restoration approach that respects the original architectural intent, ensuring that each pane, whether part of a grand façade or a simple window, continues to play its vital role in the harmony of the built environment.

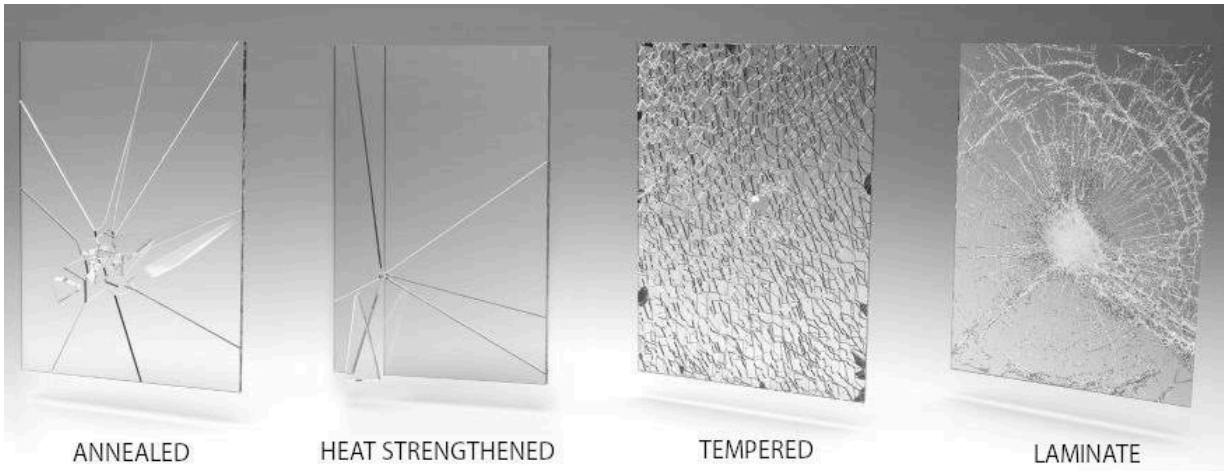


Fig. 1200A

C 1.2.1.0 - Annealed

Annealed glass, commonly referred to as standard or float glass, is a staple in architectural design due to its versatility and cost-effectiveness. This type of glass is produced through a controlled cooling process that effectively reduces internal stresses, rendering it suitable for a variety of applications where safety is not the primary concern.

Common Uses in Architecture:

- Annealed glass is frequently utilized in areas where the likelihood of impact or breakage is relatively low. It is a popular choice for fixed and sliding windows, storefronts, and internal glass features. The glass's clarity and neutrality make it a preferred option for applications that require unobstructed visibility and light transmission.



Fig. 1210A

Advantages and Fabrication Flexibility:

- One of the significant benefits of annealed glass is its cost-effectiveness, making it an accessible option for many projects. Additionally, it offers flexibility in terms of fabrication; annealed glass can be easily cut, shaped, and installed, which is advantageous in both residential and commercial construction. This ease of handling allows for a wide range of design possibilities.

Safety Considerations:

- Despite its widespread use, it's important to note that annealed glass does have limitations in terms of safety.When broken, it shatters into sharp and jagged shards that can pose significant safety hazards.

Strategic Implementation in Design:

C 1.2.1.0 - Annealed

- In architectural design, incorporating annealed glass requires a thoughtful assessment of the environment and intended use. It is often used in situations where the glass is not subject to high traffic or impact, and where its breakage would not lead to severe safety risks. Additionally, the application of safety films or lamination can mitigate some of the risks associated with its use.

C 1.2.2.0 - Tempered

Tempered glass stands out as a preferred material in modern architecture, prized for its enhanced strength and safety features. This type of glass undergoes a specialized thermal treatment process, involving rapid heating and cooling. This treatment creates balanced internal stresses, which fundamentally change how the glass behaves under impact.



Fig. 1220A

Safety and Breakage Characteristics:

- A defining characteristic of tempered glass is how it reacts when broken. Unlike standard annealed glass, which shatters into sharp shards, tempered glass fractures into small, granular pieces. These fragments are less likely to cause serious injury, making tempered glass an ideal choice in scenarios where human safety is a concern.

Ideal for High-Risk Areas:

- Given its safety properties, tempered glass is extensively used in areas where the risk of impact or accidental breakage is higher. It is commonly found in large windows, glass doors, shower enclosures, and balustrades. These applications benefit from the glass's ability to maintain integrity under stress and its safer breakage pattern.

Thermal Resistance and External Use:

- Another advantage of tempered glass is its increased resistance to thermal stress. This quality makes it particularly suitable for external architectural applications, where fluctuations in temperature are a norm. The glass can withstand changes in heat without compromising its structure, a crucial feature for outdoor environments.

Durability in Varied Conditions:

- The strength of tempered glass extends beyond its safety aspects. It is also less prone to breakage from wind, pressure, or environmental stressors, making it a robust option for architectural designs that must endure diverse conditions. This durability is a significant factor in its widespread use in both residential and commercial buildings.

C 1.2.3.0 - Mirrored

Mirrored glass represents a unique blend of functionality and aesthetic appeal in architectural design, merging the transparency of glass with the reflective capabilities of a mirror. Its application in interior design is both practical and decorative, making it a favorite among architects and designers for its versatility and visual impact.

Enhancing Interior Spaces:

- In interior settings, mirrored glass is frequently utilized in areas like bathrooms, dressing rooms, and as part of interior partitions. Its reflective quality creates an illusion of expanded space, making it an excellent choice for smaller rooms or areas where a sense of openness is desired. Additionally, mirrored glass can significantly enhance the lighting within a space, reflecting both natural and artificial light to brighten and enliven interiors.

Customization and Design Flexibility:

- One of the key advantages of using mirrored glass in architectural design is its adaptability to various stylistic preferences. These glass panels can be custom-cut to specific sizes and shapes, allowing for seamless integration into diverse design schemes. The framing of mirrored glass, too, can be tailored to match the overarching aesthetic of a space, whether seeking a modern, minimalist look or a more traditional, ornate style.



Fig. 1230A

C 1.2.3.0 - Mirrored

Considerations in Application:

- While mirrored glass adds a dimension of luxury and glamor to interior designs, its application requires careful consideration. The reflective nature of mirrored glass means it can significantly alter the perception of light and space. This characteristic, while often beneficial, needs thoughtful planning to avoid unintended effects on privacy and ambiance. Strategic placement and sizing of mirrored elements are essential to ensure they enhance rather than overpower a space.

C 1.2.4.0 - Laminated

Laminated glass is an advanced architectural material known for its robust safety and security features. Composed of multiple layers of glass bonded together with interlayer films, it offers enhanced protection and versatility in a variety of settings.

Safety and Security:

- The primary advantage of laminated glass is its capacity to maintain structural integrity even when shattered. The interlayer films are designed to hold the glass fragments together, thereby significantly reducing the risk of injury from broken glass. This feature makes laminated glass an ideal choice for environments where safety is a critical concern. It is extensively used in buildings that require heightened security measures, such as government facilities, banks, and museums. These settings often demand features like bullet resistance, blast mitigation, or protection against forced entry, all of which are effectively addressed by the properties of laminated glass.

Acoustic Insulation and UV Protection:

- Beyond its safety aspects, laminated glass offers substantial sound insulation properties. This makes it a valuable material in urban settings or areas where noise pollution is a concern, providing a quieter and more peaceful interior environment. Additionally, laminated glass is capable of filtering out harmful UV radiation while still allowing natural light to pass through. This quality is particularly beneficial in museums and art galleries, where protecting artifacts and artworks from UV damage is essential, yet natural illumination is desired.

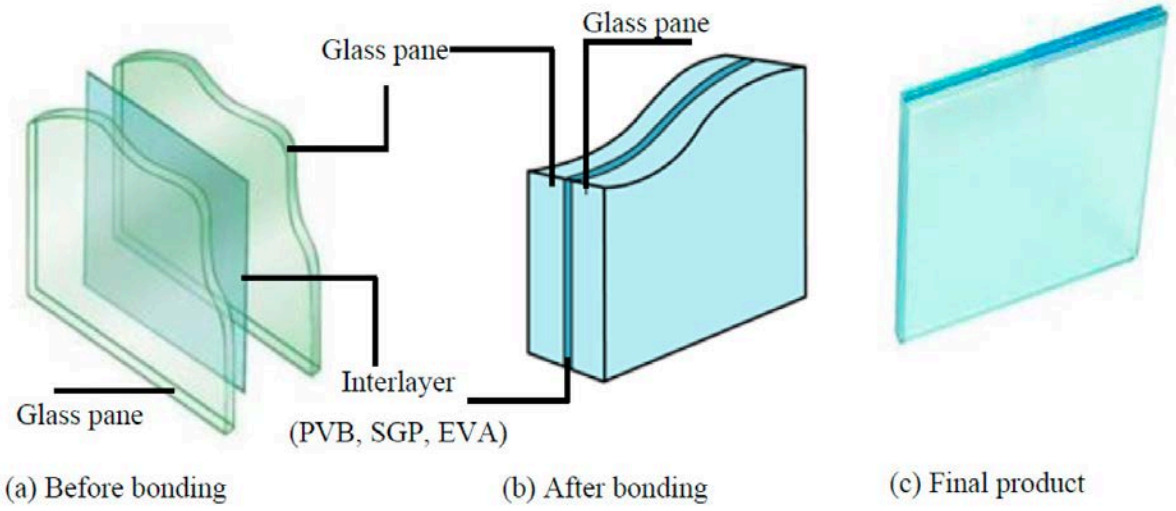


Fig. 1240A

Aesthetic and Functional Flexibility:

- Laminated glass not only contributes to the safety and security of a space but also enhances its aesthetic and functional appeal. Its clarity, coupled with the ability to incorporate various tints and finishes, allows architects and designers to use laminated glass creatively in facades, windows, and interior partitions. The material can be tailored to meet specific design requirements, blending seamlessly with different architectural styles and concepts.

The unique characteristics of laminated glass, encompassing safety, security, acoustic control, and UV protection, render it an indispensable material in contemporary architecture. Its application extends beyond mere functionality, enriching the comfort, aesthetics, and overall experience of architectural spaces.

C 1.3.0.0 - Automotive Glass Applications

Automotive glass applications play a vital role in ensuring the safety, comfort, and aesthetics of vehicles. These applications encompass a range of specialized glass types and technologies designed to meet the unique demands of the automotive industry. Whether it's the windshield (windscreen), side lites, rear screens, or specialty mirrors, automotive glass serves both structural and functional purposes, providing clear visibility and protection to drivers and passengers. The choice of the right type of glass in each application is pivotal, considering factors such as safety, impact resistance, and optical quality, to ensure a smooth and secure driving experience.



Fig.1300A

C 1.3.1.0 - Windscreens

Windshields are a critical component of automotive safety and visibility. In some older or less complex vehicle designs, annealed glass is used for the windshield. Annealed glass offers cost-effectiveness and ease of production, making it a viable choice for vehicles with lower safety requirements. However, one significant drawback of using annealed glass for windshields is that it does not shatter into small, safe fragments when broken, which could pose a safety risk in accidents. Therefore, it is less commonly used in modern vehicles, where laminated glass is the preferred choice due to its ability to hold together upon impact, reducing the risk of injury.

C 1.3.2.0 - Side Lites & Rear Screen

Side lites (side windows) and rear screens in vehicles are typically made from tempered glass. This type of glass is subjected to a specific tempering process that enhances its strength and safety characteristics. In the event of breakage, tempered glass shatters into small, blunt-edged pieces, reducing the risk of injuries to passengers. This safety feature makes tempered glass an ideal choice for side windows and rear screens where safety is a priority. Additionally, tempered glass is more resistant to thermal stress and impact compared to annealed glass, making it suitable for the demanding conditions that automotive glass often faces. It offers the advantage of easy production and customization, allowing for curved or uniquely shaped windows to be installed in vehicles, contributing to both aesthetics and safety.

C 1.3.3.0 - Mirrors

Mirrored glass in automotive applications serves a specialized purpose, mainly for aesthetics and practicality. While mirrors are an essential part of any vehicle's interior, mirrored glass is used for decorative or functional rearview mirrors. The "polish only" method allows for the creation of reflective surfaces on the glass, which are often used in rearview mirrors to provide a clear view of the road behind the vehicle. The polished surface reflects light and images effectively, helping drivers maintain situational awareness. However, it should be noted that mirrored glass, while aesthetically pleasing, is not typically used in large exterior panels of vehicles due to its limited impact resistance compared to other types of automotive glass.

C 1.3.4.0 - Other Applications

Some automotive glass applications combine the properties of laminated and tempered or annealed glass to meet specific safety and functionality requirements. For instance, laminated tempered glass offers enhanced safety, ensuring that the glass remains in place upon impact and minimizes the risk of injury. This combination is often found in rear windshields, where visibility is critical, and safety is a top priority. In contrast, laminated annealed glass is used in specific areas of vehicles where safety is not the primary concern, but where noise reduction and UV protection are valued. By selecting the right combination of laminated and tempered or annealed glass, automakers can tailor their vehicles to meet a variety of safety, functionality, and comfort standards.

C 1.4.0.0 - Technical Glass Applications

Technical glass applications extend far beyond standard clear automotive and architectural glass, venturing into a diverse range of specialized uses. These applications exploit the unique characteristics of glass to meet varied functional requirements in numerous industries. While not an exhaustive list, the following are some notable examples:

Through-Body Tinted Glass:

- In this type of glass, the tint is incorporated during the manufacturing process, resulting in a uniformly colored pane. It's used for both aesthetic and functional purposes, like reducing glare or providing privacy.

Art Glass:

- Art glass is often used for decorative purposes, showcasing the aesthetic versatility of glass in various colors, textures, and shapes.

Optical Lenses and Tech Applications:

- Glass plays a critical role in optical lenses, where clarity and precision are paramount. In tech applications, glass is utilized for its durability and optical properties in devices such as screens and cameras.

Film Tinting and Window Films:

- Applied post-manufacture, these films serve multiple purposes, such as improving privacy, reducing solar heat gain, or adding a decorative touch. They are used in various settings, from buildings to vehicles.

Coatings:

- Coatings, applied either during manufacturing or afterwards, enhance certain properties of glass. Examples include hydrophobic coatings for water resistance, UV filter coatings for sun protection, low-emissivity coatings for better thermal efficiency, and mirrored coatings for aesthetic appeal. These can be membrane coatings (like films) or non-membrane coatings that bond at a molecular level to provide specific functionalities.

These applications represent just a snapshot of the technical uses of glass. The field is continually expanding, with new innovations and uses being developed regularly. The adaptability and versatility of glass make it an invaluable material in a wide array of technical applications, both familiar and yet to be discovered.

C 1.4.0.0 - Technical Glass Applications

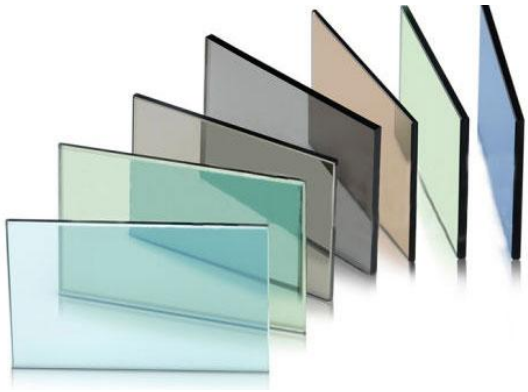


Fig 1400A



Fig. 1400B

C 1.5.0.0 - Current Applicable Published Standards

The glass industry relies on a comprehensive framework of published standards to ensure the quality, safety, and performance of glass products. These standards provide manufacturers, engineers, and designers with guidelines for the production, testing, and usage of various types of glass. Adherence to these standards is crucial for maintaining the integrity and reliability of glass products in different applications, from architectural to automotive and technical uses. Compliance with established standards, such as those developed by organizations like ASTM International, guarantees that glass products meet the stringent criteria necessary to ensure safety, durability, and quality.

C 1.5.1.0 - ASTM 1036 Flat Glass

ASTM C1036, titled "Standard Specification for Flat Glass," is a pivotal document in the glass industry. This standard outlines the requirements for various types of flat glass, such as annealed, heat-strengthened, and tempered glass. It addresses essential properties like thickness, dimensions, and flatness, ensuring that glass products meet established criteria. ASTM C1036 plays a significant role in architectural and automotive applications, guiding manufacturers in producing glass products that comply with safety and quality requirements. Architects and engineers often refer to this standard when selecting glass for building projects, as it provides a reliable basis for specifying the type and quality of glass to be used.

C 1.5.2.0 - ASTM 1048 Heat-Treated Flat Glass

ASTM C1048, titled "Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass," is a critical standard specifically focusing on heat-treated flat glass. It details the requirements for the physical and mechanical properties of heat-strengthened and fully tempered glass, including thickness, surface condition, and the ability to withstand thermal stress. This standard ensures that heat-treated glass products offer the necessary safety and performance characteristics. It is instrumental in the architectural and automotive industries, where heat-strengthened and tempered glass is used for a wide range of applications, from facades and windows to windshields and side windows.

C 1.5.3.0 - ASTM 1172 Laminated Architectural Flat Glass

ASTM C1172, titled "Standard Specification for Laminated Architectural Flat Glass," focuses on the quality and performance requirements of laminated glass in architectural applications. This standard provides detailed guidelines for the characteristics of laminated glass, including interlayer adhesion, thickness, and optical quality. It ensures that laminated glass products used in architectural contexts meet the necessary safety and performance standards. Architects and designers refer to this standard to specify laminated glass for applications such as safety glass in buildings, skylights, and partitions, where maintaining structural integrity and safety are paramount.

Notes:

C 2.0.0.0- Understanding Glass Polishing

C 2.1.0.0 - History Of Glass Polishing

The history of glass polishing is a testament to human ingenuity and the desire to enhance the beauty and utility of glass surfaces. Dating back to ancient civilizations, artisans used rudimentary tools like sand and emery cloth to manually polish glass surfaces. These early techniques were labor-intensive and often resulted in uneven finishes.

As time progressed, advances in materials and knowledge led to more sophisticated methods of glass polishing. In the 19th century, machinery and cerium oxide were introduced, revolutionizing the industry. The Industrial Revolution accelerated the mechanization of glass polishing, making it more efficient and consistent. Today, the science of glass polishing has reached new heights with precision machinery, advanced abrasive materials, and cutting-edge techniques. Glass can now be restored to levels of clarity and smoothness that were once unimaginable.



Fig. 2100A

C 2.2.0.0 - History Of Grinding Glass

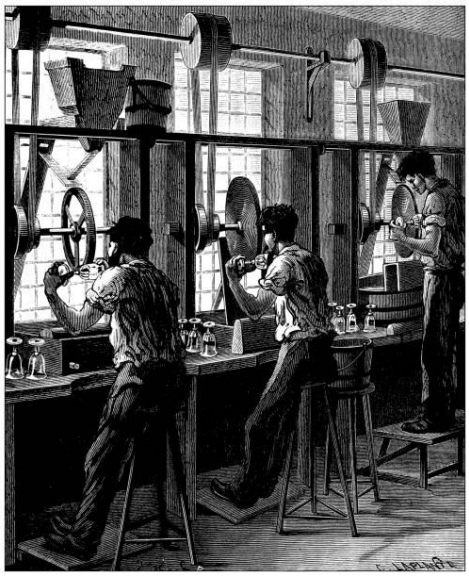


Fig. 2200A

The history of glass grinding is closely intertwined with the history of glass polishing, as both processes are vital for achieving smooth and clear glass surfaces. Grinding glass can be traced back to ancient civilizations where artisans manually used abrasive materials such as stones and sand to shape and size glass objects. Although these early methods helped create glass objects with the desired form, they often left rough and irregular surfaces that necessitated additional polishing. With technological advancements, grinding became more precise and mechanized. In the 19th century, steam-powered and later electrically driven grinding machines were developed, enhancing the efficiency and accuracy of glass grinding. Today, modern CNC (Computer Numerical Control) technology has further refined the process, enabling highly precise grinding that is crucial for manufacturing glass products with specific shapes and surface characteristics.



Fig. 2200B

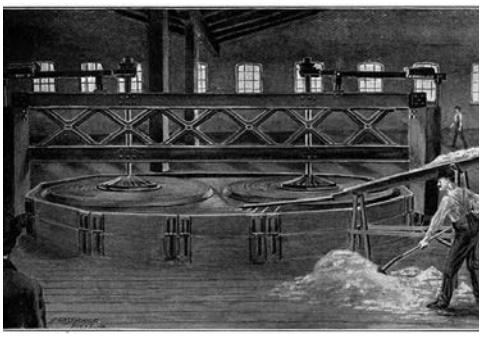


Fig. 2200C

C 2.3.0.0 - Types Of Glass Grinding For Scratch Removal

Various techniques are employed in glass grinding, primarily for the elimination of scratches and imperfections from glass surfaces. Among these, two primary methods stand out: wet grinding and dry grinding.

Wet grinding entails the utilization of water or other lubricants throughout the grinding process. This inclusion serves to regulate heat, mitigate friction, and cleanse away debris. While wet grinding excels in removing deeper scratches, it carries inherent drawbacks. Lensing or optical distortion may occur due to the introduction of liquid lubricants, compromising the clarity and visual integrity of the glass. Additionally, the utilization of lubricants often leads to a messy work environment, necessitating meticulous cleanup procedures.

In contrast, dry grinding is conducted without the incorporation of liquid lubricants. This method is particularly advantageous as it allows for the maintenance of a perfectly flat abrasive surface, eliminating the potential for optical distortion and ensuring distortion-free repairs. Dry grinding also offers ease of execution, especially when working on installed panes, as there is no risk of liquid leakage or spillage. Moreover, dry grinding possesses no inherent limitations concerning the depth or severity of scratch damage that can be effectively addressed, rendering it a versatile and reliable option for glass restoration projects.

In summary, while wet grinding may excel in certain scenarios, it is imperative to weigh its benefits against its drawbacks, particularly concerning optical distortion and messy working conditions. Dry grinding emerges as a superior alternative, offering impeccable precision, ease of execution, and versatility in addressing scratch damage on glass surfaces.

C 2.3.1.0 - Wet Grinding

Wet grinding of glass is a method of shaping glass with a host of different types, styles and kinds of abrasive materials in the presence of a liquid. This method of grinding glass is the standard for any and all use of diamond cutting media as diamonds will often degrade as heat is generated during the cutting and or grinding operation. By keeping the diamond cutting surface cool and flushing the cutting surface with a coolant liquid the lifespan of the cutting and or grinding instrument is lengthened and the quality of the cut is improved.

For surface, or planal grinding, some methods also apply liquid coolant to the grinding area. This coolant is used both as a lubricant as well as a heat mitigation tool to both ensure that the cutting surface of the grinding media is kept cool as well as the glass that is being worked on. Unfortunately however the introduction of a liquid when surface grinding will exacerbate some issues that are inherent in grinding a flat glass surface, namely distortion.

When a rotating abrasive disk is applied to a stationary planar surface and water is injected between the two surfaces several things happen. The first is that the hydrostatic pressure exerted upon the surface of the abrasive disk will cause the disk to lose contact with the stationary surface thus impeding the ability of the abrasives to make consistent and predictable contact with the surface being worked on. This “hydroplaning” of the abrasive disks thus slows down the process and can introduce variability across the cutting surface ultimately resulting in an uneven grind.

The second issue is that the rotational mass of the grinding disk will exert an inertial force on the liquid between the rotating disk and the stationary plane. This will cause the liquid to be accelerated from the center of the disk to the outer edge of the disk creating a buffer zone around the perimeter of the rotating disk. The liquid donut will ensure that the abrasives on the outer edge are less capable of making contact with the grinding surface, while the abrasives in the middle of the disk are able to make far greater contact with the grinding surface. This disparity in cutting/grinding efficiency will cause a “bowl” or lens shape to be cut into the flat surface of the material being worked on. While this is not a huge issue for opaque materials, when working with a transparent material like glass, any topographical change in the parallel nature of the material will affect the path that light takes through the material. This path change will cause light to be bent, thus creating a visible distortion across the area that is being worked. While this effect can be compensated for when using computer controlled equipment, when the process is controlled by a human operator it is all but impossible to avoid. Because of this fact wet grinding has been synonymous with distortion from its introduction to glass restoration.

C 2.3.2.0 - Dry Grinding

Dry grinding, in stark contrast to wet grinding, embodies a meticulously orchestrated process of surface grinding glass without the aid of liquid lubricants. This method relies on specialized abrasives designed for efficient material removal while minimizing thermal stress on the glass substrate. The absence of liquid enables consistent contact between the abrasive material and the glass surface, ensuring uniform material removal and preserving a parallel planar working surface. This meticulous control over the grinding process ensures that the restored glass maintains optical clarity and consistency, facilitating predictable light transmission with minimal distortion.

One of the significant advantages of dry grinding is its unparalleled capacity to produce distortion-free results. Through precise manual manipulation of the abrasive material, technicians can effectively address surface imperfections, including scratches, abrasions, and blemishes, with exceptional accuracy. This precision-driven approach extends beyond mere scratch removal, enabling technicians to achieve seamless repairs and refinements across various glass substrates and applications. The versatility of dry grinding empowers technicians to elevate glass restoration to a technical art form, delivering outcomes that meet rigorous standards of clarity and integrity. Dry grinding serves as a cornerstone methodology in glass restoration, providing reliable results that align with technical requirements and industry standards.

Notes:

C 2.4.0.0 - Historical Issues/Concerns Of Scratch Removal

The journey of glass scratch removal is one that has navigated through various challenges and innovations over time. In its earlier stages, the primary hurdles included issues like optical distortion and glass thinning. Artisans initially faced the challenge of optical distortion, where aggressive and uneven abrasive methods led to waviness and visual irregularities on the glass surface. This distortion was more than an aesthetic issue; it compromised the functional quality of glass, especially in applications requiring clear transparency.

Additionally, the pursuit of scratch-free glass often resulted in the thinning of the pane. Over-enthusiastic abrasive methods, lacking uniformity, would sometimes remove more material than necessary, weakening the structural integrity of the glass and reducing its resilience against environmental stresses.

The evolution of technology and techniques in glass restoration has been pivotal in overcoming these challenges. Modern solutions, like the GlassRenu system, blend the lessons learned from the past with contemporary technological advancements. These modern methods prioritize precision and controlled abrasion, ensuring that scratches are removed without introducing distortions or compromising the glass's thickness. This approach not only restores the glass to its pristine condition but also preserves its inherent strength and clarity, marking a significant leap forward from the historical methods of glass scratch removal.

C 2.4.1.0 - Distortion

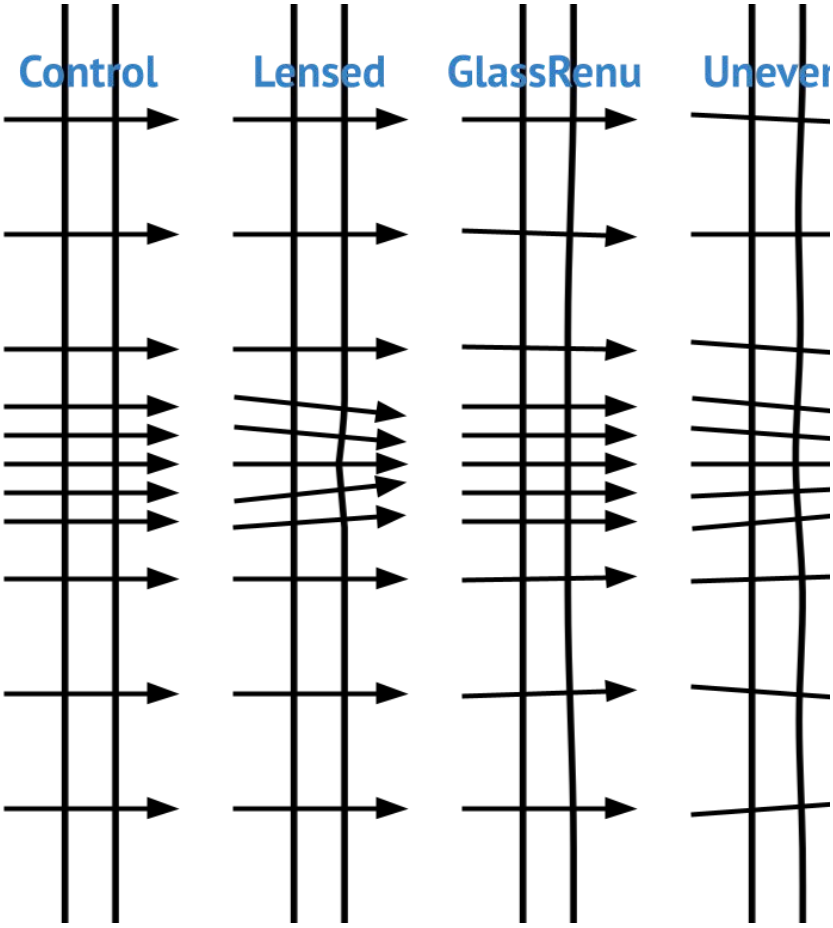


Fig. 2410A

In the field of glass scratch removal, distortion has always been a paramount concern. Early methods of scratch removal often relied on abrasive techniques that were not as refined or controlled as they needed to be. As a result, these methods frequently led to optical distortions or waviness on the glass surface, which severely compromised both the aesthetic and functional quality of the glass. Such distortions, manifesting as ripples or irregularities, altered the way light passed through the glass, leading to visual discomfort and rendering the glass unsuitable for applications where transparency and clarity were crucial.

Over time, there has been significant progress in addressing these distortion issues. Advancements in technology and methodology in glass restoration have been key to this evolution. Modern techniques, especially those employing precision machinery and carefully controlled abrasive actions, are designed to minimize any form of distortion. The focus of these contemporary methods is not just on removing scratches but also on preserving the glass's optical properties. This ensures that after the scratch removal process, the glass retains its original clarity and transparency, free from any distortions that could impair its visual quality.

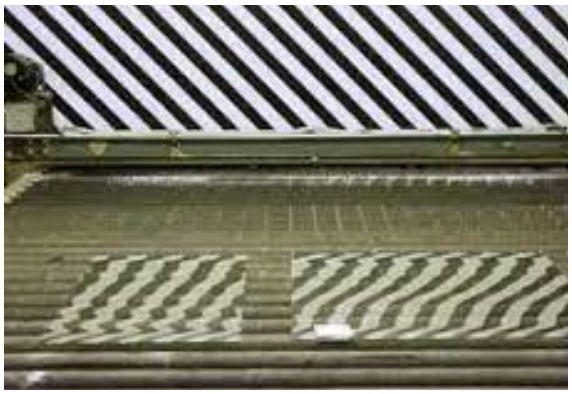


Fig. 2410B

Today's glass restoration solutions, informed by historical challenges and technological advancements, thus represent a sophisticated blend of precision, control, and a deep understanding of glass's properties. They ensure that the glass not only returns to its scratch-free state but also maintains its integral optical characteristics.

Notes:

C 2.4.2.0 - Glass Thinning

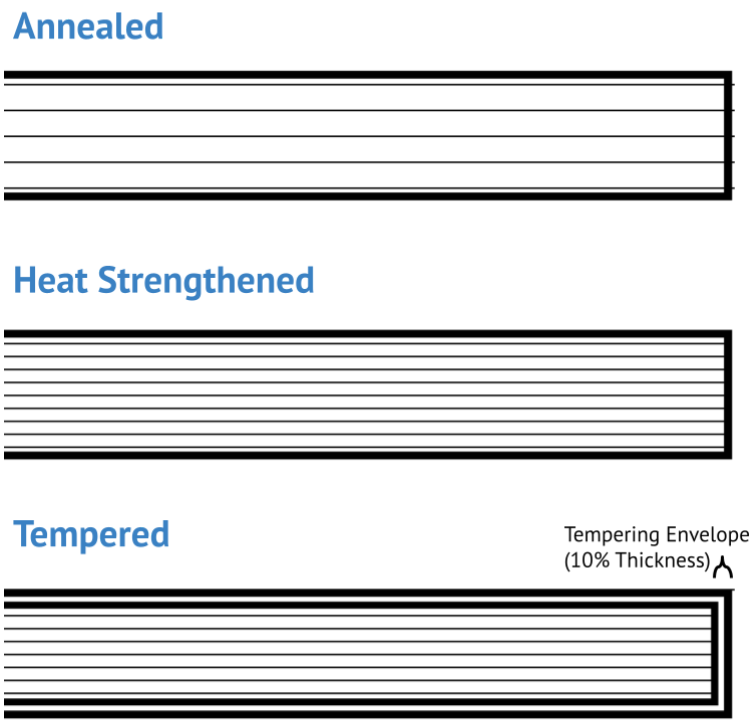


Fig. 2420A

Glass thinning is another historical concern associated with aggressive scratch removal processes. When excessive material is removed from the glass during restoration, it can result in the glass becoming thinner than its original specifications. This thinning compromises the structural integrity of the glass, reducing its ability to withstand mechanical stress and environmental factors. Fortunately however for most glass applications in architectural and technical environments the depth of surface damage that needs to be removed is insignificant when compared to the overall thickness of the glass being restored. Further with the increased use of tempered glass in these applications, and the improvements in the tempering processes, the removal of surface damage actually works to strengthen the structure of the glass compared to its damaged counterpart.

While thin glass is more susceptible to breaking, cracking, and failing safety standards, glass that has surface scratches and or defects will be an order of magnitude weaker as these damage points create internal stresses along the body of the pane of glass. These stress points will act as failure points along the planar surface and ultimately create a more dangerous and fragile panel than a thin piece of glass devoid of such stress points.

It is important as well to understand that the average surface scratch on a piece of glass may only range from 0.001" to 0.015" in depth, and the average thickness of architectural glass ranges from 0.0312 to 0.875". This means that even the deepest scratches are often only a fraction of the thickness of the glass. It is also important to understand that the force required to make a scratch that exceeds 10% of the thickness of a piece of glass will always exceed the compressive strength of that piece of glass and ultimately cause the panel of glass to crack and or break. Thus even the deepest of scratches when compared to the thickness of the glass in question will almost never approach 10% the thickness of said piece of glass. Therefore, while removing the scratch from the surface of the glass will effectively thin the pane of glass in that area, the overall strength of the glass will be restored within a negligible difference from its original state.

C 2.4.3.0 - Structural Integrity

Maintaining the structural integrity of glass is a critical aspect of the scratch removal process, especially in contexts where the glass is subjected to mechanical and environmental stresses, such as in architectural and automotive applications. Historically, certain scratch removal methods posed a risk of weakening the glass, thereby compromising its load-bearing capabilities and overall safety. This concern was particularly pronounced in methods that lacked precision and control.

In modern scratch removal practices, like those employed in the GlassRenu process, the emphasis is placed on preserving the structural integrity of the glass. This is achieved through highly controlled abrasion and the removal of material in extremely small increments. Each pass of the abrasive disk removes approximately 2.54µm (0.0001 inches) of material, ensuring that the process is minimally invasive.

For tempered glass, which is often used in demanding environments due to its enhanced strength, this precise approach is even more beneficial. The outer 10% of a pane of tempered glass forms the tempering envelope, which is crucial for its structural strength. The minimal material removal involved in modern scratch removal techniques ensures that this tempering envelope is not breached, even when dealing with extensive damage. As a result, the structural integrity of the tempered glass is not only preserved but often enhanced.

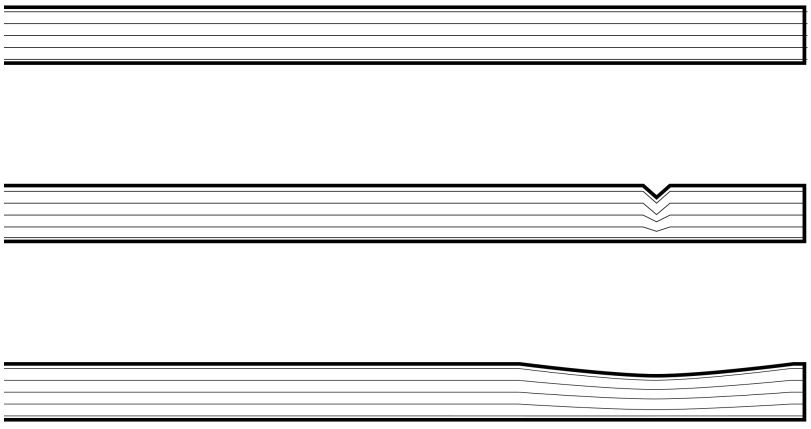


Fig. 2430A

Removing scratches from glass can actually increase its structural integrity. Scratches are potential stress points that can compromise the glass's strength. By eliminating these weak points, the scratch removal process effectively strengthens the pane, making it more resilient to future stresses.

In summary, modern scratch removal techniques have evolved to not only address aesthetic concerns but also to reinforce the structural integrity of glass. By employing precise, controlled abrasion and focusing on the integrity of the tempering envelope in tempered glass, these methods ensure that the glass remains strong and reliable for its intended use, enhancing safety and performance.

C 3.0.0.0- Before You Begin

C 3.1.0.0 - Safety Precautions

⚠ C 3.1.1.0 - Thermal Expansion

Type	Delta (Differential)	Maximum Temperature
Annealed	+80°FΔ	N/A
Tempered	+120°FΔ	N/A
Laminate- Annealed	+80°FΔ	145°F
Laminate- Tempered	+120°FΔ	145°F
Mirrored	+80°FΔ	N/A

Fig. 3110A

⚠ **IMPORTANT NOTE** ⚠**:** When undertaking glass restoration, it's crucial to account for the material's thermal expansion – its tendency to expand and contract with fluctuations in temperature. This characteristic, if not properly managed, can lead to the risk of cracks or breakage during the scratch removal process. To ensure safety, it is advisable to maintain the temperature within a specific differential range; surpassing this range can result in thermal stress, which may lead to the glass fracturing.

To control the risk of thermal stress, one must ensure the work area is allowed to cool sufficiently. Employing an infrared (IR) thermometer to consistently monitor the temperature can prevent the heat generated by abrasive disks and felts through friction from causing excessive thermal expansion. It is critical to keep the temperature of the heated section in balance with the rest of the glass to prevent any drastic temperature differences that could compromise the glass integrity.

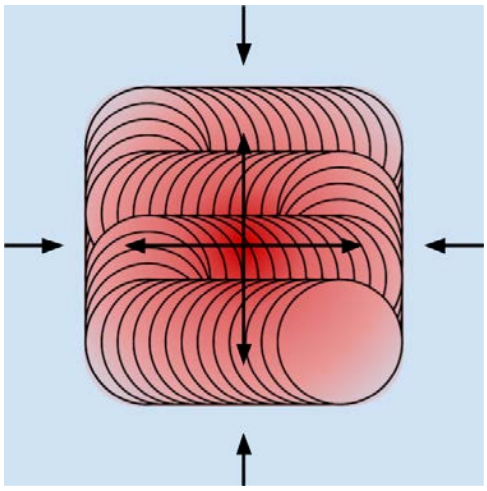


Fig. 3100B

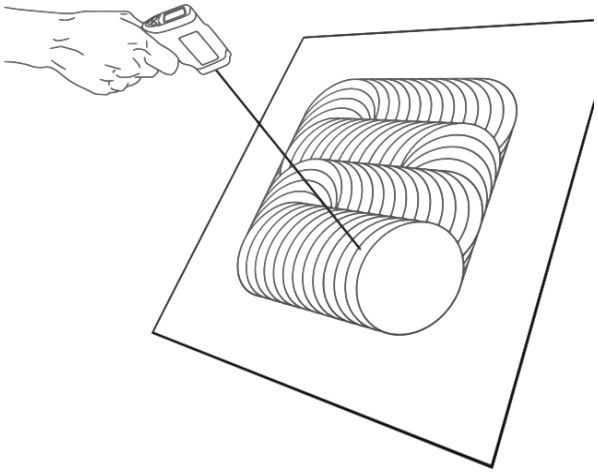


Fig. 3100C

While monolithic glass panes do not have a friction-induced maximum temperature limit and the scratch removal can, in theory, be conducted in various climates, this does not always hold true for laminated panes. Laminated panes have a set maximum temperature that should not be exceeded due to their distinct composition and structural properties. While the glass itself maintains a standard temperature differential, the interlayer (PVB, SGP, EVA, etc.) has a lower melting point, and as such has the propensity to deform when subjected to heat. While the glass unit itself may appear unaffected by excessive heat, a deformed interlayer may cast a distinct shadow.

Notes:

Masks & Respirators

Respiratory Hazards in Glass Restoration:

- The process of restoring glass surfaces inherently results in the release of glass particulate and silicate dust. These airborne particles present a significant health hazard, particularly to the respiratory system. Prolonged or frequent inhalation of these particulates can lead to serious respiratory conditions, including silicosis—a potentially fatal lung disease—and other debilitating respiratory illnesses.

Essential Protective Gear:

- To mitigate these risks, it is imperative to use appropriate respiratory protection. At a minimum, a face mask and a respiratory ventilation system with an N95 rating should be employed. However, for enhanced safety, especially in situations involving prolonged exposure or high volumes of dust, the use of a NIOSH-approved particulate respirator with a P100 rating is strongly recommended. These respirators provide a higher level of protection against the most penetrating particles, which are capable of causing severe lung damage.

Ventilation and Air Filtration:

- Alongside personal protective equipment, proper ventilation and robust air filtration in the work area are crucial for controlling the concentration of airborne particulates. These measures help to reduce the overall exposure to harmful dust.

Training and Protocol Adherence:

- It is essential that all operatives involved in glass restoration are thoroughly trained in the correct usage and regular maintenance of respiratory protection equipment. Strict adherence to safety protocols and guidelines is vital to ensure the health and safety of everyone involved in the restoration process.

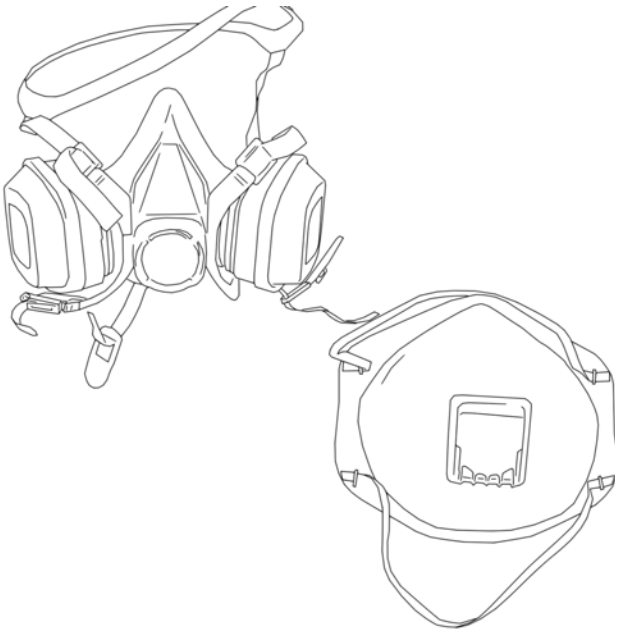


Fig 3120A

Protective Eyewear

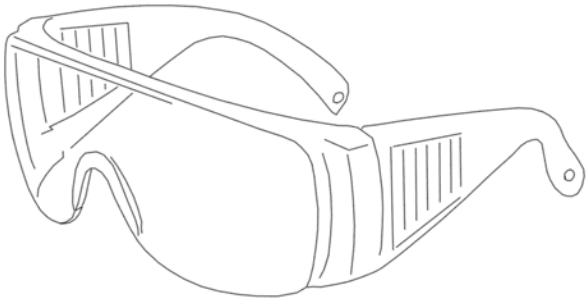


Fig. 3120B

Potential Eye Hazards:

- While the risk of eye injury in glass restoration may not be as pronounced as respiratory risks, it is nonetheless present and should be addressed with appropriate caution. The process can involve the scattering of minute glass fragments or dust, which, if they come into contact with the eyes, can cause irritation, discomfort, or even scratches to the eye surface.

Importance of Eye Protection:

- As a precautionary measure, wearing protective eyewear is strongly advised during glass restoration work. Safety glasses or goggles provide a barrier against airborne particles, significantly reducing the risk of eye irritation or injury.

Selection of Protective Eyewear:

- Choose safety glasses or goggles that conform to recognized safety standards. Eyewear should fit comfortably, provide a clear field of vision, and, ideally, include features such as anti-fogging and scratch-resistant lenses. For environments with higher particulate concentrations or in situations where glass shards are more prevalent, goggles that seal around the eyes offer enhanced protection.

Best Practices:

- It is good practice to wear protective eyewear at all times during restoration work, even if the perceived risk is low. Regular cleaning and inspection of the eyewear for any damage or wear are also important to ensure they provide effective protection.

Notes:

Gloves

Potential Risks from Rotary Polisher and Heat:

- In the glass restoration process, using a rotary polisher equipped with abrasive disks can present certain risks. While direct exposure to the spinning disk is typically minimal, there is still a chance of accidental contact. Moreover, the head of the polisher can generate significant heat during the polishing process, potentially causing discomfort or minor burns over prolonged use.

Gloves as a Recommended Safety Measure:

- While the use of gloves in glass restoration is optional, it is recommended for added safety and comfort. Gloves act as a protective layer, offering a degree of insulation against the heat from the polisher and minimizing the risk of abrasions from incidental contact with the spinning disk.

Selecting Suitable Gloves:

- If you choose to wear gloves, opt for a pair that balances protection and functionality. The ideal gloves should be resistant to heat and mild abrasion, while still allowing for sufficient dexterity and tactile feedback necessary for precise control of the polisher and handling of glass materials.

Comfort and Heat Protection:

- Gloves can also enhance comfort, especially during lengthy restoration sessions, by providing a barrier against the heat generated by the polisher. This can help maintain focus and efficiency without the distraction of heat discomfort.

Regular Inspection and Replacement:

- For those opting to use gloves, regular checks for wear and damage are essential to ensure they continue to offer adequate protection. Replace gloves as necessary to maintain their protective qualities.

While gloves are not mandatory in glass restoration, their use is recommended for an added layer of protection and comfort. They serve as a simple yet effective means to safeguard against the minor risks associated with the rotary polisher and heat during the restoration process.



Fig. 3120C

Notes:

C 3.2.0.0 - Our Tools

C 3.2.1.0 - RenuDisks

The GlassRenu system utilizes three grades of silicone carbide based abrasives, called RenuDisks, to remove material from glass surfaces, allowing the resurfacing of damaged areas, restoring glass to like-new luster. RenuDisks are available in three grades of abrasivity, and four size classes.

	3”	5”	6”	8”
Red		x	x	x
Black	x	x	x	x
Grey	x	x	x	x

Fig. 3210A



Fig. 3210B

C 3.2.1.1 - Grey RenuDisk

Also referred to as the “Pre-Polish Disk,” the Grey RenuDisk is the final abrasive disk used in the GlassRenu system. Used at three different speeds, this disk refines the work area to a fine haze, allowing us to quickly polish the glass back to full luster.

Item	Part. No. (Standard)	Part. No. (Original)
3” Grey RenuDisk	106-4035	108-4035
5” Grey RenuDisk	106-4055	108-4055
6” Grey RenuDisk	106-4065	108-4065
8” Grey RenuDisk	106-4085	N/A

Fig. 3211A



Fig. 3211B

C 3.2.1.2 - Black RenuDisk

The Black RenuDisk is the first abrasive disk used in the GlassRenu system for CAT-2 and CAT-3 damage. The Black RenuDisk is a more robust abrasive, allowing the expedient removal of light and medium damage.

Item	Part. No.
3” Black RenuDisk	106-4033
5” Black RenuDisk	106-4053
6” Black RenuDisk	106-4063
8” Black RenuDisk	106-4083

Fig. 3212A



Fig. 3212B

C 3.2.1.3 - Red RenuDisk

The Red RenuDisk is the first abrasive disk used in the GlassRenu system for CAT-4 damage. The Red RenuDisk is the most robust abrasive, allowing the expedient removal of heavy damage.

Item	Part. No.
3” Red RenuDisk	N / A
5” Red RenuDisk	106-4051
6” Red RenuDisk	106-4061
8” Red RenuDisk	106-4081

Fig 3213A



Fig. 3212B

C 3.2.2.0 - Polishing Felts

The GlassRenu Polishing Felt is used in conjunction with GlassRenu Polishing Compound in the final step of the GlassRenu System in order to restore glass to full luster.

Item	Part No.
3” Polishing Felt	106-4003
5” Polishing Felt	106-4005
6” Polishing Felt	106-4006

Fig. 3220A



Fig. 3220B

C 3.2.3.0 - Foam Finishing Pads

GlassRenu Foam Finishing Pads are used in conjunction with GlassRenu Cutting Compound in the first step for removing CAT-1 damage.

Item	Part No.
5” Finishing Foam (3 Pack)	106-4357
5” Finishing Foam (5 Pack)	106-4557
6” Finishing Foam (3 Pack)	106-4367
6” Finishing Foam (5 Pack)	106-4567

Fig. 3230A



Fig. 3230B

C 3.2.4.0 - Backing Pads

GlassRenu Backing Pads serve as the interface between the Renudisks, Polishing Felts, and Foam Finishing Pads and the Polisher.

Backing Pads are available in SAE (⅝-11) and Metric (M14) threadings.

Item	Part No. (SAE)	Part No. (Metric)
3” Backing Pad	106-1113	107-1113
5” Backing Pad	106-1115	107-1115
6” Backing Pad	106-1116	107-1116
8” Backing Pad	106-1118	107-1118

Fig. 3240A



Fig. 3240B

C 3.2.5.0 - Compounds

GlassRenu Compounds are a proprietary blend of high purity rare earth minerals designed to quickly and efficiently restore and polish glass surfaces.

The Polishing Compound is used during the full GlassRenu Restoration process, where as the cutting compound can be used independently for most CAT-1 Hard Water/ Mineral Damage

Item	Part No.
Polishing Compound - 16 oz	106-4001
Polishing Compound - 1lb	106-4011
Cutting Compound - 16 oz	106-3001
Cutting Compound - 1lb	106-3011

Fig. 3250A



Fig. 3250B



Fig. 3250C

C 3.2.6.0 - Polisher

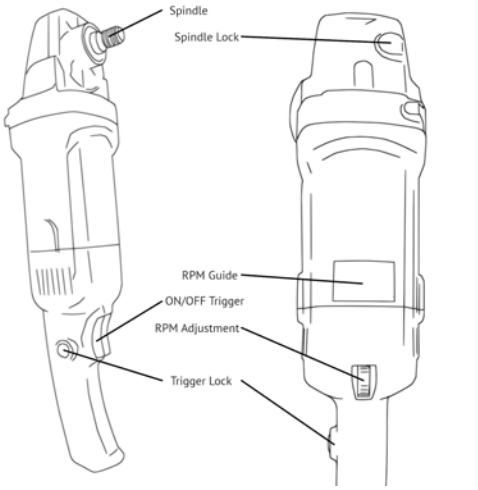


Fig. 3260A

Polisher Minimum Requirements	
Power Source	Corded
Drive Action	Direct Rotary
RPM Range	600- 3000
Arbor	⅝-11 (SAE) / M14 (Metric)
Common Brands/ Model Number	
Makita	9227C/ 9237C
Dewalt	DWP849X
Milwaukee	5540
Bauer	56792

Fig. 3260B

On/Off Trigger:

- The On/Off Trigger is the primary control for the polisher's power. Pressing this button activates the polisher's spindle rotary drive action. This feature allows for easy start and stop of the polishing process, ensuring precision and control during operation.

Trigger Lock:

- The Trigger Lock is a safety feature that locks the power trigger in its active state. Engaging the trigger lock during operation allows the operator to adjust their grip and move their hand without causing unintended pressure changes or operational interruptions. This feature helps maintain consistent operation and reduces hand fatigue.

RPM Adjustment:

- With the RPM Adjustment knob, operators can finely tune the operational speed of the polisher. This control allows for precise adjustments to the rotational speed, accommodating different stages of the restoration process and different types of damage on the glass.

RPM Guide:

- An RPM Guide, typically located directly on the polisher, provides a reference for the operational speed. In cases where the guide is not present on the tool, users should refer to the owner's manual for detailed information on speed settings and recommendations.

Spindle:

- The Spindle is the threaded component that protrudes from the head of the polisher and rotates during operation. GlassRenu Backing Pads are designed to be threaded directly onto this spindle, ensuring a secure and stable attachment for effective restoration work.

Spindle Lock:

- The Spindle Lock is a mechanism used to secure the spindle in place when the polisher is not in use. This feature is particularly useful for changing or removing the backing pad safely and efficiently, without the risk of the spindle turning.

C 3.2.7.0 - IR Non-Contact Thermometer

In glass restoration, the infrared (IR) temperature gun is an essential tool, crucial for ensuring the safety and effectiveness of the restoration process. This non-contact device enables technicians to accurately monitor the surface temperature of the glass, providing vital real-time feedback crucial for maintaining optimal working conditions.

Monitoring for Safety and Efficiency:

- Different glass types respond uniquely to temperature variations, particularly when damaged. The IR temperature gun plays a pivotal role in ensuring that the glass is kept within safe temperature ranges during the restoration process. Understanding and managing these temperature differentials are essential to minimize the risk of thermal stress or damage, especially important when working with various types of glass such as annealed, tempered, or laminated.

Understanding Temperature Implications:

- The use of the IR temperature gun, while straightforward, requires an understanding of how temperature variations impact different types of glass. Technicians must be adept at interpreting the temperature data and understanding its implications on their restoration strategy. This understanding is critical for adjusting techniques in real time, particularly when employing heat-generating tools, to prevent excessive heating and ensure the structural integrity of the glass.



Fig. 3270A

The integration of an IR temperature gun in glass restoration showcases a commitment to precision and careful handling. It highlights the importance of adapting restoration techniques to the thermal characteristics of each type of glass, ensuring high-quality restoration outcomes and the preservation of the glass's integrity.

Notes:

C 3.2.8.0 - Rasp File

In the toolkit of glass restoration, the metal rasp file is an indispensable tool, specifically designed to enhance the longevity and efficiency of other essential tools. Featuring a dual-sided design with both a flat and a slightly rounded side, each having mild and aggressive halves, this rasp file is aptly suited for a range of tool maintenance tasks.

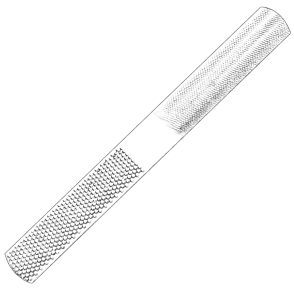


Fig. 3280A

Maintaining Abrasives:

- The file's flat, less aggressive side is ideal for removing glass stock or dust from abrasive surfaces. This gentle tapping technique re-exposes the abrasive material, crucial for maintaining the effectiveness of these tools over extended periods.

Caring for Polishing Felts:

- Conversely, the more aggressive, rounded side of the file is adept at two key maintenance tasks for polishing felts. It effectively removes caked-on polishing compounds and is instrumental in raising the natural fibers of the felts, ensuring they continue to provide a consistent and high-quality polish.

The true value of the metal rasp file in glass restoration lies in its utility beyond direct restoration work. It plays a pivotal role in the upkeep and optimization of other tools, directly impacting the quality and efficiency of the restoration process. Its use is a prime example of how proper tool maintenance is integral to achieving excellent glass restoration results, highlighting the interdependence of tools in this meticulous craft.

C 3.2.9.0 - Glass/ Frame Cleaning Agent(s)



Fig. 3290A

In the process of glass restoration, the use of cleaning agents, while seemingly straightforward, is an essential step in both preparing for and finalizing the restoration work. Any standard glass cleaning agent that is safe for use on glass surfaces can be effectively employed in this context. The primary function of these cleaning agents is to ensure that the glass is free from surface contaminants before the commencement of the restoration and to remove any residual compounds after the polishing phase.

Agents such as a diluted solution of Dawn dish soap and water, pure water systems, or commercial glass cleaners like Windex and Spray Away are all suitable for these purposes. Prior to the abrasive and polishing stages, a thorough cleaning helps in providing a clear and uncontaminated surface, which is crucial for the effectiveness of the abrasion process. This initial cleaning step helps in revealing the true extent of the damage and ensures that the abrasives and polishing compounds work directly on the glass without interference from surface debris.

Post-restoration, these cleaning agents play a vital role in removing any excess polishing compound, ensuring that the restored glass is not only structurally sound but also visually pristine. The objective is to leave the glass surface spotless and streak-free, showcasing the results of the meticulous restoration process.

C 3.4.0.0 - Tool Preparation and Maintenance

C 3.4.1.0 - Attaching Backing Pad

- Verify that the threading of the GlassRenu backing pads matches that of your polisher. GlassRenu backing pads come in both SAE and Metric threadings, and it's crucial that these are compatible to ensure a secure and effective fit.
- Attach the backing pads directly to the spindle of the polisher. This step is important for ensuring that the backing pad is securely fastened and aligned correctly for optimal performance during restoration.
- Secure RenuDisks to the black 'hook' surface of the backing pad. Proper attachment of these disks is key to achieving uniform abrasion and polishing results.
- When storing the polisher, remove the backing pads. This practice helps to prolong the life of both the backing pad and the polisher spindle.
- Store the backing pads in a way that avoids prolonged pressure on them. Excessive pressure can compress and deform the soft interface of the pad, potentially causing imbalance and uneven wear when the tool is next operated.

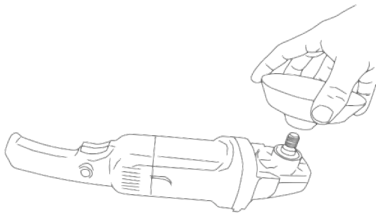


Fig. 3400A

Notes:

C 3.4.2.0 - Attaching and Maintaining RenuDisks

- Each RenuDisk has two distinct sides: a rough 'abrasive' side for the restoration work, and a soft 'loop' side for attachment to the backing pad.
- Secure the RenuDisk to the backing pad by aligning the loop side of the disk with the pad's hook surface. It's important to use a RenuDisk that matches the size class of the backing pad and to center the disk accurately for balanced operation.
- As you use the RenuDisk, glass stock will accumulate on its surface. To maintain optimal performance, periodically unclog the disk:
  - Ensure the polisher is switched off and the disk is stationary.
  - Use the flat, non-aggressive side of a rasp file or a wire brush for cleaning.
  - Apply gentle tapping motions on the RenuDisk surface to dislodge the accumulated glass stock. Avoid brushing as it can damage the disk.
- If the abrasive surface of black or red RenuDisks remains intact after use, they can be cleaned, carefully removed, and stored for future restoration projects.
- Store RenuDisks in a way that maintains their integrity. Avoid bending, folding, or applying pressure, as these actions can damage the disk and affect its performance in future uses.

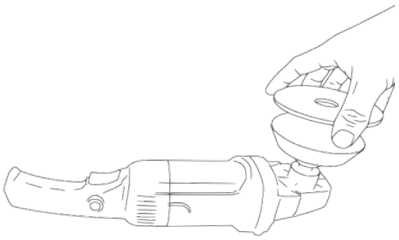


Fig. 3420A

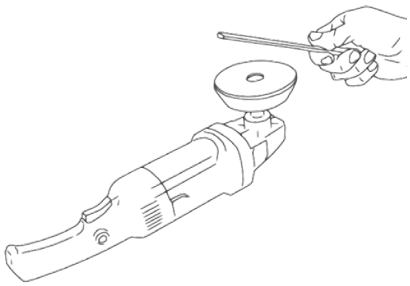


Fig. 3420B



Fig. 3420C

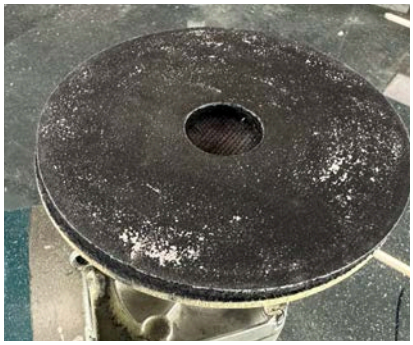


Fig. 3420D

C 3.4.3.0 - Attaching and Maintaining Polishing Felts

- Polishing Felts have two sides; an off-white wool felt side, and a black felt “loop” side.
- Polishing felts are secured to the backing pads’s hook surface via the loop side of the felt.
- Always use the same size class Polishing Felt as the backing pad.
- Align the Polishing Felt directly in the center of the backing pad.
- Before every use of the Polishing Felt, lightly abrade the surface of the felt side (Fig. 3430A) of the backing pad, removing leftover compound and simultaneously gently raising the natural fibers.
- Polishing Compound is applied directly to the Polishing Felt.
- Polishing Felts will last well over 200+ Sq Ft. when taken care of properly
- Store in a clean, dry environment to avoid any potential surface contaminants.

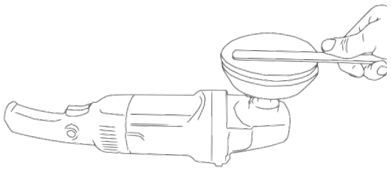


Fig. 3430A

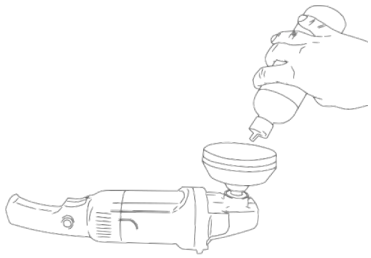


Fig. 3420B

C 3.4.4.0 - Preparing Polishing Compound and Cutting Compound

Bottle:

- Fill the 16oz (475ml) bottle to the top with clean water. Shake well to evenly disperse the compound before every use.

1lbs Jar:

- Add 45g (one scoop if compacted, two scoops if loose) of polishing compound to a 16oz (475ml) bottle. Fill the bottle to the top with clean water. Shake well to evenly disperse the compound before every use.

Polishing Compound is applied directly to the Polishing Felt. Apply 3-4 squirts (approx. ¼-½ oz.) around the circumference of the Polishing Felt.



Fig. 3440A



Fig. 3440B

C 3.5.0.0 - Restoration Environment/ Workspace

This section focuses on the environment or workspace recommendations and considerations for field repairs (Repairs done on glass panes that have been installed, glazed, framed, etc.) and repairs done in house, on glass that has yet to be installed.

C 3.5.1.0 - Window Cleaning Environment/ Workspace Considerations

Field repairs in glass restoration present unique challenges and requirements compared to in-house repairs. Understanding these differences is key to executing successful repairs in various field settings. Here are some critical considerations and best practices for field glass restoration:

Orientation and Location of Glass Panes:

- Field repairs are predominantly performed on glass panes in a vertical orientation, already installed within the building envelope, or as partitions in offices and other spaces. These panes often extend beyond the ideal 'Strike Zone' as defined in Section C 3.8.3.0 - Body Positioning and Strike Zone. To accommodate this, technicians may need to use workbenches, ladders, scaffolding, or powered lifts to access and effectively restore the entire area of the glass.

Considerations for Framing and Glazing:

- In field settings, special attention must be given to the framing or glazing of the window. These elements can impact the repair area and necessitate extra precautions to protect the existing facade. It's recommended to use masking tools such as painters tape, paper, drop cloths, and tarps. Additionally, having receptacles for collecting glass stock and disposing of used disks is essential to maintain cleanliness and safety.

Power Requirements for Equipment:

- Field repairs require careful planning regarding power supply for polishers and other equipment. In some cases, it may be necessary to use separate fuses, breakers, or generators, especially if the available power sources are limited or if there are concerns about overloading existing circuits.

Temperature Considerations in Restoration:

- Temperature plays a crucial role in field glass restoration, especially when working with laminated glass. To avoid deformation of the interlayer(s), it is important to keep the maximum temperature below 145 degrees Fahrenheit, as detailed in Section C 3.1.1.0 - Thermal Expansion. High temperatures can also cause the water in the polishing compound to evaporate quickly, reducing the effectiveness and ease of the polishing process. Depending on the ambient temperature, it may be beneficial or necessary to use cooling techniques. Tools like shade cloths, tents, or tarps can be used to block direct sunlight, while fans can provide consistent airflow over the work area to help maintain a steady temperature.

In conclusion, field repairs in glass restoration require a nuanced approach, considering the unique aspects of each job site. By addressing orientation and location challenges, being mindful of framing and glazing, ensuring adequate power supply, and managing temperature effectively, technicians can ensure high-quality restoration results even in the most challenging field conditions.



Fig. 3412A

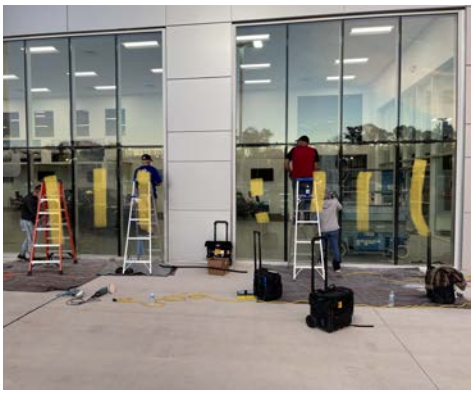


Fig. 3412B

C 3.5.2.0 - Manufacturer Environment/ Workspace Considerations

In-house or in-facility glass restoration presents a different set of conditions compared to field repairs, primarily due to fewer environmental factors to contend with. These settings offer greater flexibility and control over the repair process, particularly in terms of the orientation and positioning of the glass panes. Here are some essential factors to consider for successful in-house glass restoration:

Optimal Setup for Horizontal Repairs:

- When performing repairs horizontally, it's advantageous to use a work table at about waist height. This height allows for increased ease of use and better control over the polisher, facilitating a more comfortable and effective restoration process. For optimum results, it's also recommended to elevate the glass pane slightly above the work table, especially if the table surface is solid. This elevation enhances airflow around the glass, promoting quicker heat dissipation and helping to maintain a safe working temperature.
- Using a non-slip material under the glass pane is crucial to prevent any unintentional movement caused by the polisher's torque. This stability is key to ensuring precise and consistent restoration work without the risk of the glass shifting or sliding during the process.

Maintaining a Clean and Organized Workspace:

- Just as in field repairs, maintaining a clean and organized workspace is vital in-house. Utilize receptacles for collecting glass stock and disposing of used RenuDisks. Keeping the restoration area tidy not only makes the process more efficient but also minimizes the risk of glass stock becoming airborne and posing a safety hazard.

Managing Heat Generation:

- Monitoring and managing the heat generated on the glass pane is as important in-house as it is in the field. Refer to Section C 3.1.1.0 - Thermal Expansion for guidelines on safe operating temperatures. Employ fans or other cooling tools to ensure that the temperature of the glass remains within safe limits. This consideration is particularly crucial when working with laminate glass or in conditions where the temperature might rise significantly during the restoration process.

In-house glass restoration offers certain advantages in terms of control and flexibility but still requires careful attention to setup, stabilization, cleanliness, and temperature management. By adhering to these best practices, technicians can ensure that in-house repairs are conducted safely, efficiently, and to the highest quality standards.

C 3.6.0.0 - Damage Assessment

Mechanical Damage Assessment Matrix

Damage Type	Category	Specification Sheet
Suction Cup Marks	CAT- 1	C 5.1.0.0
Fines And Ticks	CAT-2	C 5.6.0.0
Cleaning Abrasive	CAT-2	C 5.7.0.0
Metallic Rub	CAT-2	C 5.8.0.0
Glass On Glass	CAT-2	C 5.9.0.0
Razor Blade	CAT-3	C 5.10.0.0
Masonry/ Rock	CAT-3	C 5.11.0.0
Graffiti Scratch- Light	CAT-3	C 5.14.0.0
Severe Scratches	CAT-4	C 5.16.0.0
Graffiti Scratch- Heavy	CAT-4	C 5.17.0.0
Metal Grinding Debris	CAT-4	C 5.18.0.0
Media Blast Damage	CAT-4	C 5.19.0.0
Welding Slag	CAT-4	C 5.20.0.0
Large Chip	CAT-4	C 5.21.0.0

Fig. 3600A

Chemical Damage Assessment Matrix

Damage Type	Category	Specification Sheet
Heat Haze	CAT-1	C 5.2.0.0
Mineral Deposits	CAT-1	C 5.3.0.0
Mineral Staining	CAT-1	C 5.6.0.0
Mineral Etching	CAT-2	C 5.9.0.0
Light Acid	CAT-3	C 5.12.0.0
Medium Acid	CAT-3	C 5.13.0.0
Heavy Acid	CAT-3	C 5.15.0.0

Fig. 3600B

The initial phase of any glass restoration effort hinges on a meticulous damage assessment. This critical evaluation is methodically performed to discern the integrity and aesthetics of the glass surface, categorizing the damage detected into one of two principal types: mechanical or chemical. Mechanical damage is typically inflicted through physical means such as contact with objects, while chemical damage is caused by corrosive interactions with environmental substances. Additionally, it is imperative that the damage assessment accurately determines which surface the damage is on, and if there are other potential physical characteristics that need to be addressed. A good example of this would be determining if the damaged surface has a surface treatment or "coating" present.

To determine the surface that is damaged, inspection with variable light sources will offer a clear indication of the location of the damage. It is important, especially with Insulated Glass Units (IGU's), to ensure that the damage is on an exterior surface and therefore accessible and repairable. If the damage is between the two panes of glass that comprise the IGU, the damage will not be repairable.

To determine if the surface that is damaged has a coating present, a simple field refraction test, commonly known as "an eraser test," is a quick and simple method to ensure that the damage restoration will not affect or remove any surface coatings that may be present. To perform this test, place a cylindrical object on the surface of the glass and view the reflection from a 20-30 degree angle. If the bottom surface of the object is visible as an offset reflection, there is no coating on the test surface. If the bottom of the cylinder is not visible, nor is there a "ghost reflection" that is offset by the approximate thickness of the glass pane, there is a coating present on the damaged surface. Restoration of the damage will consequently remove the coating as well. This can affect the performance of the window system and/or the appearance of the glass post-restoration and should be noted and discussed with the client prior to beginning the restoration process.

Prior to inspecting the actual damage, it is crucial that restoration technicians inspect the quality of the window system, looking at overall structural integrity. If the glass is not firmly glazed (i.e., it moves in the frame) or the glass has any structural failures (large chips or cracks present), these defects should be noted, and extreme caution should be taken during the restoration process. In general, if the glass is not firmly glazed or structural failures are detected, it is recommended that the glass be either replaced or the glazing repaired prior to restoration activity.

Once a clear picture of the aforementioned variables is in hand, it is then time to assess the actual damage that is going to be restored.

To facilitate a structured analysis, damage is further delineated into four categories based on severity:

C 3.6.1.0 - Category One (Faint) (CAT-1)

This includes the most minor imperfections which are often challenging to detect and generally do not significantly affect the glass's structural integrity or clarity. Can be seen but not felt. This category includes deposits, staining, and minor imperfections on the surface of the glass ranging from mineral deposits

C 3.6.1.0 - Category One (Faint) (CAT-1)

to metallic rub. The category one glass restoration process does not require the use of abrasive disks for damage removal and is the least invasive process possible. While the category one methodology is designed primarily for damage that hasn't penetrated the surface of the glass, it can be effective at removing incredibly minor scratches (primarily things that can barely be seen and not felt at all).

C 3.6.2.0 - Category Two (Light) (CAT-2)

Visible flaws that can typically be felt with a fingernail but are shallow enough to not necessitate extensive repairs. Can be seen and felt with clean damage edges. This category includes damage such as hard water or mineral etching through light glass-on-glass damage (hook damage). The Category two restoration process requires the use of an Original Grey RenuDisk or a Black RenuDisk to abrade the surface of the glass, a Grey Renudisk to refine the abrasion, and a final polish. CAT-2 mechanical damage can generally be described as light scratches that are visible on the pane, are clean lines devoid of any chipping, and may be able to be felt with a fingernail. CAT-2 chemical damage generally involves extreme hard water or mineral damage or very light acid damage.

C 3.6.3.0 - Category Three (Medium) (CAT-3)

Defects are prominent and may impede the transparency of the glass or its structural integrity, requiring more involved restoration techniques. Can be felt and begin to exhibit minor chipping along the edges of the damage. This category includes damage stemming from improper razor blade/scraper use to intentional acid etching (graffiti). The category three restoration process requires the use of a Black RenuDisk, a Grey RenuDisk, and a final polish. Category three mechanical damage can be described visually as prominent scratches on the pane that may exhibit distinct refractions and may have very light chipping along the edge. Mechanical CAT-3 damage can be easily felt with a fingernail but not deep enough to fully catch the tip of the nail. Category three chemical damage generally results from chemical misuse and/or vandalism that has etched the surface of the glass. CAT-3 acid damage has a distinct milky white appearance, and the surface may appear lightly modeled.

C 3.6.4.0 - Category Four (Heavy) (CAT-4)

The most severe level of damage, often deep and extensive, posing a risk to both the appearance and the structural stability of the glass, which may necessitate advanced restoration solutions or even replacement. Can be seen and felt, and exhibiting significant chipping. This category includes damage such as welding slag, metallic overspray, carbide scribe/diamond tooling, media blast, etc. Category four damage encompasses many types of extreme damage, almost exclusively mechanical in nature. As a scratch, category four can be described as visually exhibiting more pronounced chipping along the edge with more pronounced refraction. This type of damage is very easily felt, and it is likely easy to catch a fingernail. As welding slag and metallic overspray, it may appear spotted, discolored, bits of metal lodged inside the pane, small pin-sized holes, etc. Because of the open-ended nature of category four, strict definitions don't quite exist.

C 3.6.5.0 - Hard Water

Hard Water, or mineral damage on glass is when foreign minerality is deposited on the surface of a glass pane. This type of damage commonly begins as dissolved solids in water (irrigation), dissolved solids that leach into water (building run-off), and dissolved solids in the atmosphere (precipitation, sea air, etc.). Hard water/mineral damage can be thought of in three stages: Deposits, Staining, and Etching.

Deposits

- Hard Water Deposits represent the very beginning of hard water damage. Deposits are minerality that has been left on the pane usually through the evaporation of water, leaving a distinct outline of the droplet(s) on the pane. In the early stages, deposits can easily be removed using traditional methods and solvents. Deposits can be described as existing solely on the surface of the glass, with minor adherence. Deposits are typically salts that have formed on the surface of the glass between alkaline and alkaline earth minerals bonding with halogens found in either the dissolved solids or within the glass itself. Salts are built upon ionic bonds that often can be dissociated by solvents and cleaned away. Deposits represent the only "Hard Water Damage" that can be effectively removed by chemical intervention; mechanical polishing is also extremely effective without the need to test chemistry.

Stains

- Hard Water Staining occurs when deposits have been left on the pane long enough for the minerality of the deposit and the minerality of the glass to begin forming bonds. Fluctuating temperature, changing UV exposure, and time will all contribute to the bonding of these materials. Most staining cannot be removed with traditional methods and requires the use of mechanical polishing to remove. Visually, staining can appear as faint discoloration where deposits were or resembling the deposits themselves depending on the severity. Hard water stains present as "shadows" or discoloration that is left on the surface of the glass post-deposit removal. This damage will persist after solvents have been used to dissociate the salts and cleaning has been done. These stains are created by stronger and more persistent covalent bonds between trace elements in the glass and dissolved elements present in affecting water. Because staining penetrates the surface of the glass, intermingling with material deeper than the surface, mechanical polishing or abrading is the only effective method for restoration.

Etching

- Hard Water/mineral etching occurs when minerality has bonded deeply into the surface of the glass, removing actual silicate material in the process. Hard water etching can be difficult to accurately determine before deposits and staining have been removed. When deposits and staining have been removed, etching presents as a faint "ghost-like" outline of where the deposit/staining was. Sans additional damage, the glass should present as perfectly clear, with a textured appearance where the surface has been eroded. Etching occurs on a longer exposure timeline between the glass and the staining agents and will often be found beneath heavy deposit "crusting." As the outer layers of glass are exposed to the staining elements, the glass will begin to shed bits of material, leaving behind a textured surface resembling an "orange peel" appearance and feel. Once the stains have entered the etching phase, mechanical polishing and abrasion are the only viable options for restoration. Because etching has penetrated the surface of the glass, it is classified as CAT-2 damage and requires the use of abrasive disks to resurface the affected area.

C 3.6.6.0 - Acid Damage

Acid damage occurs when harsh chemicals or acidic substances come into contact with the glass, causing etching or severe staining. This type of damage can result from improper chemical use, such as using the wrong cleaning agents, or from intentional vandalism like graffiti. The severity of acid damage varies depending on the type of acid used, the amount of acid applied, and its dwell time on the glass. Heavier acid damage tends to exhibit mild surface modeling, while lighter acids may not leave any noticeable modeling. Despite appearing more extensive than scratch damage, the restoration process for acid etch damage is the same as for other types of damage. Mechanical polishing and abrasion are used to remove the damaged layer and restore the glass to its original clarity and smoothness.

C 3.6.7.0 - Edges and Corners

Edges and corners present unique challenges in glass restoration. While it is possible to work all the way to the edge with frameless or unframed panes, frames and seals need to be considered once installed. Round disks and rotary tools prevent working all the way into corners of framed panes. Planning the repair area and ensuring enough room for mandatory expansions during the pre-polish step is crucial. For damage that extends to the frame or seal, allow a minimum of 2 inches surrounding the edge of the pane to ensure thorough restoration.

C 3.6.8.0 - Non-Repairable Damage

Throughout the damage assessment process, it is important to understand that not all damage is equal, and there will be situations where restoration no longer makes sense. While these situations are few and far between, it is imperative that as a restoration technician, you identify those times when the best course of action is to replace the glass rather than perform restoration.

Key “no-go” factors include but are not limited to:

- **Structural Failure:** If the glass has any cracks, chips, or holes. This type of damage can create micro fissures and cracks in the body of the glass that can lead to catastrophic failure during the restoration process.
- **Extremely Deep Damage:** If the damage appears to penetrate beyond 30% of the thickness of the glass, this damage will create an extremely unstable work piece and can lead to structural failure during the repair process.
- **Wired Security Glass:** This is glass that has a wire mesh or “chicken wire” embedded within the body of the glass. This wire mesh can act as a heat sink, pulling heat throughout the glass in an unpredictable way that often leads to cracking and/or breaking during the repair process.
- **Technician Confidence:** From time to time, aspects of different restoration jobs will cause the restoration technician to be wary. If there is an aspect of the project that causes the technician to be timid or wary of performing the restoration, it is likely a good indication that the project either falls beyond their skill level or presents an aspect beyond their ability. Trust your gut.

Beyond these few limitations, the restoration methods and procedures presented within this guide are more than sufficient to deliver repeatable, reliable, and high-quality repairs. Should a situation arise where you are not sure, this is a good time to reach out to the tool manufacturer for guidance.

Notes:

C 3.7.0.0 - Determining Work Area

Initial Assessment and Planning:
Prior to initiating any glass repair process, a crucial preliminary step involves assessing and delineating the approximate area of work. This initial planning is not just about identifying the damage but also about strategically considering the need for expansion, especially around edges and corners. This foresight is essential in setting the stage for an effective and efficient repair process.

Addressing Different Categories of Damage:
In the field of glass restoration, damage is often categorized, with CAT-1 and CAT-2 representing cases where minimal material removal is required. However, for more severe damages like CAT-3 and CAT-4, a key aspect of the GlassRenu Process involves an expansion of the work area right from the first step. This expansion is not merely about removing material from the pane but is a deliberate strategy to prevent optical distortion. By carefully and progressively enlarging the work area during the abrasion process, it becomes possible to maintain the optical clarity of the glass, ensuring that the pane remains free from any distortions that could impair its transparency or appearance.

Considering Physical Constraints:
An additional consideration in this process is the distinction between frameless and framed glass. With frameless glass, the technician has the liberty to work across the entire surface, from edge to edge. However, framed windows introduce a physical limitation that must be accounted for. When planning the repair area for framed windows, it is imperative to acknowledge these boundaries and allocate sufficient space not just for the initial steps but also for the potential expansion of the work area. This careful planning is crucial to effectively mitigate distortion and achieve a seamless repair.

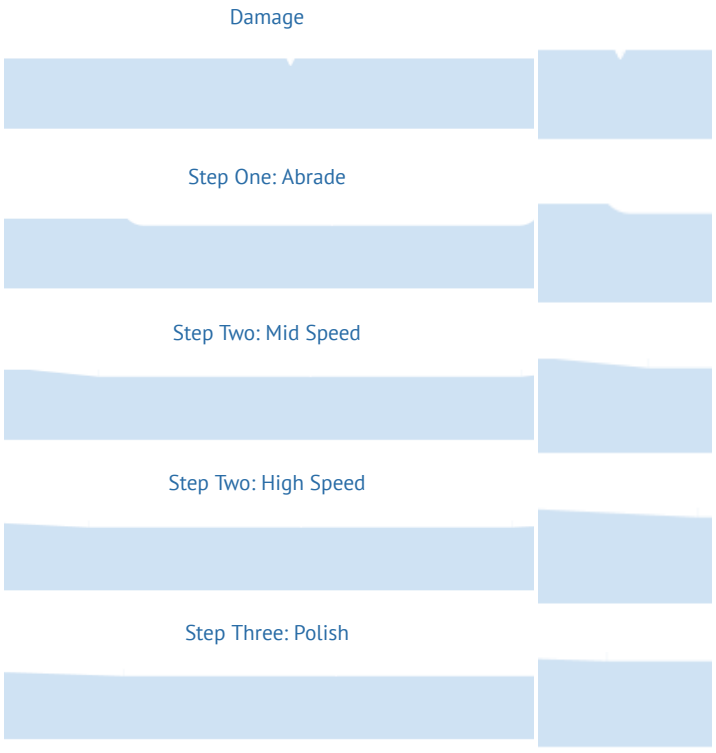


Fig. 3700A

Practical Implications:
Understanding and implementing the concept of work area expansion is a cornerstone of effective glass grinding and restoration, particularly for more severe types of damage. This approach not only ensures the structural and aesthetic integrity of the glass but also enhances the overall quality of the repair. By integrating these considerations into the repair process, technicians can achieve results that are both functionally sound and visually impeccable, upholding the highest standards of glass restoration.

C 3.7.1.0 - CAT-1

When dealing with Category One damage on glass surfaces, the focus is on precise and localized restoration. This category predominantly encompasses issues like hard-water/mineral deposits and staining, which, while potentially covering the entire pane from edge to edge, do not typically penetrate deeply into the glass structure. As such, the containment of the work area can be efficiently limited to the specific regions where the damage is evident.

The nature of Category One damage allows for a straightforward restoration process, primarily utilizing foams, felts, and specialized compounds. These methods are surface-oriented and do not necessitate aggressive abrasion or deep structural intervention. Consequently, there are no extensive requirements for expanding the work area beyond the immediate vicinity of the damage. This approach ensures that the restoration process is both effective and efficient, targeting the damage directly without impacting the surrounding areas of the glass pane.

C 3.7.2.0 - CAT-2

Category Two damage on glass surfaces necessitates a more involved restoration approach, specifically the use of abrasive disks. This type of damage typically extends beyond superficial surface blemishes, requiring a methodical removal process. Given the nature of the abrasives involved, it is essential to thoroughly consider both the extent and the location of the damage on the pane when planning the restoration work.

The utilization of abrasive disks implies a need for a broader work area compared to Category One damage. This expanded area accounts for the potential spread of abrasives and the controlled, even application required to effectively remove the damage without causing additional harm to the glass. Additionally, the position of the damage on the pane plays a crucial role in determining the approach and safety precautions necessary during the restoration process. Careful planning and execution are key to ensuring that the restoration is conducted efficiently, minimizing the risk of collateral damage to the glass or surrounding areas.

C 3.7.3.0 - CAT-3

Category Three damage on glass surfaces demands a more intensive restoration approach, despite using the same RenuDisk as in the Category Two process. The distinguishing factor for Category Three damage lies in the depth of the imperfections, which requires significantly more extensive surface abrasion to effectively reach and remedy the bottom of the damage.

Given the depth and severity of the damage, it is crucial to strategically expand the work area in a slow and systematic manner during the abrasion process. This gradual expansion is essential to ensure thorough coverage and uniform treatment across the damaged area. By methodically increasing the scope of the work area, technicians can maintain control over the restoration process, ensuring that each layer of damage is addressed with precision and consistency. This approach not only aids in achieving optimal restoration results but also helps in minimizing the risk of unintentional damage to adjacent areas of the glass pane.

C 3.7.4.0 - CAT-4

Category Four damage represents the most severe level of impairment on glass surfaces, necessitating the most comprehensive and extensive abrasion approach for effective restoration. The key challenge in addressing Category Four damage lies not only in the depth and severity of the damage but also in minimizing the resultant optical distortion that can occur with such intensive restoration processes.

To successfully restore glass affected by Category Four damage, it is imperative to progressively expand the work area. This expansion is crucial in ensuring a gradual and balanced abrasion, which is essential for reducing the likelihood of noticeable distortion in the glass. The process demands a meticulous balance between reaching the full depth of the damage and maintaining the uniformity of the glass surface.

Given the intricate nature of this restoration work, a strategic and carefully controlled approach is paramount. This involves a thoughtful progression of abrasion intensity and scope, aimed at restoring the glass's clarity and integrity while preserving its optical properties to the greatest extent possible.

C 3.7.5.0 - Edges and Corners

In the field of glass restoration, addressing edges and corners requires special consideration, especially when dealing with framed windows. This subsection expands on the "Determining Your Work Area" topic, focusing on the unique challenges presented by edges and corners and how to effectively plan for them.

Challenges with Edges and Corners:

- Unlike frameless or unframed panes where working up to the edge is relatively straightforward, framed windows introduce physical boundaries that must be taken into account. The presence of frames and seals creates constraints that can impact the restoration process. Additionally, the nature of round disks and rotary tools used in the GlassRenu process inherently limits the ability to reach into the very corners of framed panes, as fitting a round tool into a square corner remains a geometrical challenge.

Planning for Work Area Expansion:

- The GlassRenu process typically requires at least two separate expansions of the initial work area for CAT-2 damage, with potentially more expansions needed for CAT-3 and CAT-4 damage. Effective planning of the repair area is crucial, particularly when the damage is close to the frame or seal. It's important to anticipate the space needed for these expansions to ensure the process is thorough and effective.

Recommendations for Framed Panes:

- When dealing with damage near frames or seals, a strategic approach is necessary. It is advisable to allow a minimum clearance of 2 inches around the entire edge of the pane. This clearance ensures there is adequate room for the mandatory expansions during the pre-polish step. Properly accounting for this space prevents any compromise in the quality of the restoration, particularly in maintaining an even and consistent finish up to the edges.

Consideration for Seals and Frames:

- In planning the work area, special attention should be given to protect seals and frames. Employing masking tools such as painters tape can safeguard these areas from accidental abrasion or damage during the restoration process.

By anticipating and effectively planning for the challenges posed by edges and corners in framed windows, technicians can ensure a comprehensive and high-quality restoration process. This careful approach ensures that the entire pane, including areas near frames and seals, is uniformly restored, maintaining the aesthetic and structural integrity of the glass.

Notes:

C 3.8.0.0 - Maintaining the Parallel Nature of Glass

In the field of glass restoration, maintaining the correct technique throughout the entire process is critical. The concept of "Staying Flat" – keeping the abrasive surface of the disk completely parallel to the glass pane – is central to this technique. Proper adherence to this practice ensures consistent abrasion and pre-polish, thereby preventing additional damage to the glass and avoiding optical distortion due to unintended lensing. Here are some advisements and tips to help maintain the "Staying Flat" principle during operation:

Pressure Application:

- Apply pressure directly behind the spindle of the polisher. This helps ensure even distribution of force across the RenuDisk, helping to maintain its flat alignment with the glass surface. Uniform pressure is key to consistent abrasion and pre-polish, minimizing the risk of creating uneven surfaces on the glass.

Sensory Feedback from the Disk:

- Pay attention to the physical feedback you receive from the polisher. If the disk comes on edge, you will likely feel the polisher pulling in one direction or another. This sensation is a clear indicator that the disk is no longer parallel to the glass and needs to be adjusted. Sensory feedback is a valuable tool in maintaining the correct posture and pressure during the restoration process.

Observing Glass Dust and Disk Trail:

- Monitor the glass dust generated during abrasion and the trail or path left by the RenuDisk on the pane. If you notice glass dust flying off in a particular direction or if the trail left by the disk is not the full width of the disk, these are signs that the disk is not perfectly flat against the glass. The trail should reflect the entire width of the disk, indicating a flat and uniform contact with the glass surface.

Training and Practice:

- Developing the skill to 'Stay Flat' efficiently takes practice. Engage in regular training sessions, focusing specifically on mastering these techniques. Over time, maintaining the correct posture and pressure will become more intuitive.

By incorporating these tips into your glass restoration practice, you can significantly improve the quality of your abrasion technique. "Staying Flat" is not just a technique but a cornerstone of professional glass restoration, ensuring the integrity of the glass and the quality of the restoration work.

C 3.8.1.0 - Pressure Application

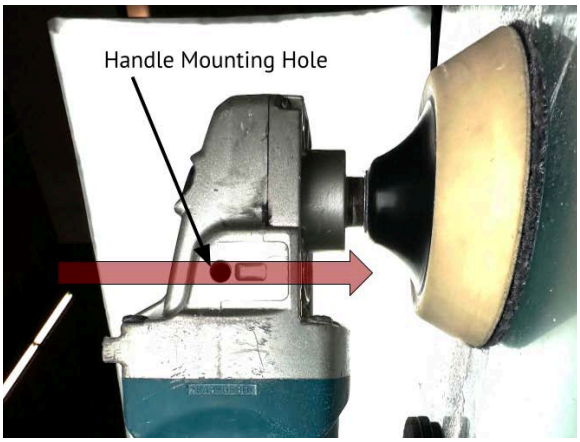


Fig. 3810A



Fig. 3810B

In the GlassRenu process, the way pressure is applied plays a crucial role in determining the quality of the repair. Achieving a high-quality result hinges on the ability to apply pressure both evenly and consistently throughout the process. This careful management of pressure not only controls the amount of material being removed from the glass pane more predictably but also enhances control over the RenuDisk and polisher.

Handling the Polisher:

- The design of the polisher often includes a handle (either side or loop handle) for operation. However, using these handles is not recommended for the GlassRenu process. The reason lies in the fact that the handles' mounting holes are typically offset from the polisher's spindle. This offset can create an imbalance, requiring additional compensation towards the rear of the polisher and complicating the pressure balance. A more effective technique is to remove the handle and grip the head of the polisher directly behind the spindle. This grip allows for pressure that is centered and aligned with the backing pad and RenuDisk, leading to a more balanced and controlled abrasion.

Using the Trigger Lock and Managing the Trigger Hand:

- Engaging the trigger lock during operation is a key technique. It eliminates the need to firmly grip the polisher's handle, which can inadvertently apply downward pressure at the rear of the machine and cause imbalance. Once the trigger is locked, the hand that would normally control the power can instead lightly adjust to correct any pressure imbalances. Furthermore, locking the trigger provides greater freedom to move the polisher around the glass surface during abrasion. This mobility is invaluable, as it allows for continuous checking of the haze quality and ensuring that the abrasion pattern is consistent and effective.

By adhering to these techniques for pressure application and polisher handling, the GlassRenu process becomes more manageable, precise, and effective. These methods not only improve the quality of the glass restoration but also make the process more ergonomic and user-friendly for the technician.

C 3.8.2.0 - Physical Feedback from RenuDisks and Polishing Felts

In the GlassRenu restoration process, the feedback you receive from the RenuDisk or polishing felt is a critical aspect of achieving optimal results. This feedback, particularly the physical sensation during active abrasion, pre-polishing, and polishing, provides essential insights into the effectiveness of your technique.

The Importance of Disk Feedback:
The RenuDisk or polishing felt communicates vital information about your technique and the glass surface. Understanding and interpreting this feedback is key to maintaining the correct approach throughout the restoration process.

Visualization:
- It's helpful to visualize the rotational action of the RenuDisk or felt while in operation. When the surface of the disk is completely parallel to the glass pane and pressure is evenly distributed, all forces are in equilibrium. This balanced state results in a steady, stable sensation, indicating that the disk is properly aligned.

Sensation of Balance and Movement:
- With the disk parallel and forces evenly distributed, the polisher should feel balanced and generally stationary on the glass. You should be able to move the RenuDisk across the pane with minimal resistance, indicating a smooth and effective abrasion or polishing action.

Recognizing and Adjusting for Misalignment:
- If the disk is not parallel to the glass during operation, you may notice a distinct "pull" in the direction opposite to the disk's rotation. This sensation is a clear indicator that an adjustment is needed. By learning to recognize this pull, you can promptly adjust the polisher's angle or your pressure distribution to realign the disk parallel to the glass surface.

Practice and Sensitivity Development:
- Developing sensitivity to the feedback provided by the disk is a skill that improves with practice. Regularly engaging in the GlassRenu process and paying close attention to the sensations and responses of the disk will enhance your ability to quickly and accurately make necessary adjustments for optimal glass restoration.

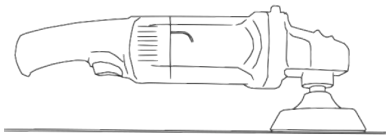


Fig. 3810A

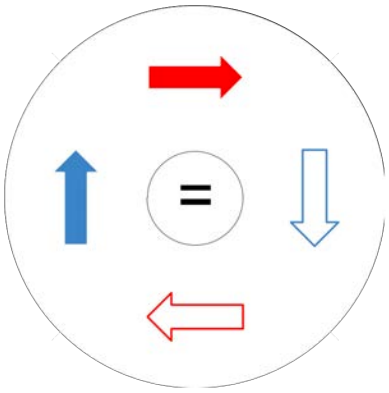


Fig. 3810B

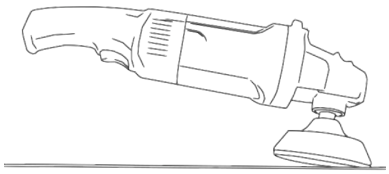


Fig. 3810C

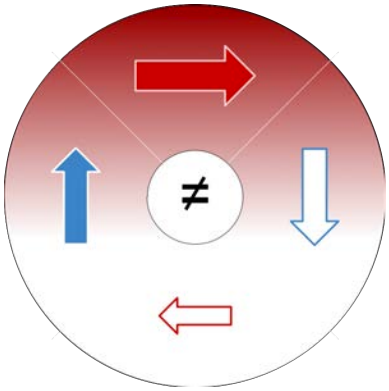


Fig. 3810D

Notes:

C 3.8.3.0 - Visual Feedback from RenuDisks and Polishing Felts

In the GlassRenu process, understanding the feedback provided by RenuDisks and polishing felts is crucial for achieving a high-quality repair. This feedback offers insights into how the glass is responding to the restoration process, allowing for necessary adjustments. Here are some key aspects to focus on:



Fig. 3820A

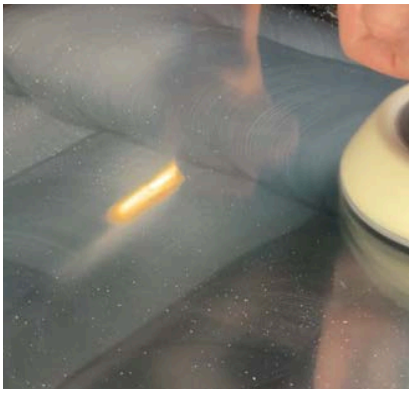


Fig. 3820B

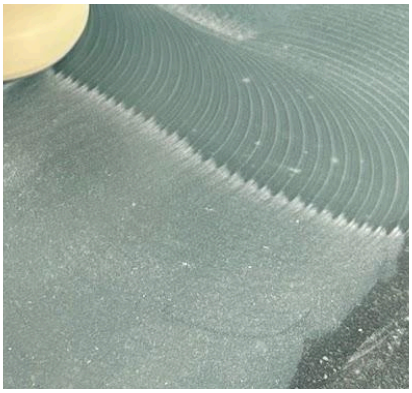


Fig. 3820C



Fig. 3820D

Recognizing the Path of the RenuDisk:

- As the RenuDisk moves across the glass surface, its path should be clearly visible on the pane. Ideally, this path mirrors the full width of the disk, which is a strong indicator of the disk being mostly flat against the surface. A well-defined path ensures uniform abrasion and minimizes the risk of uneven removal or additional damage. Conversely, if the path becomes fragmented, narrower than the full width of the disk, or appears wispy, it's a clear sign that the disk is not fully flat against the glass. This requires immediate adjustment to realign the disk for even contact with the surface.

Monitoring Glass Dust Accumulation:

- The process of abrasion naturally results in the accumulation of glass dust (glass stock) within the abrasive surface of the RenuDisk. When the disk is perfectly parallel to the glass pane, this accumulated glass stock should remain trapped between the pad and the glass. However, if you notice larger chunks of glass dust dislodging from the disk during the abrasion process, it's a telltale sign that the disk is not entirely flat against the glass. This observation is crucial as it calls for immediate correction to ensure the disk's flatness and to maintain the effectiveness of the abrasion.

Conditioning of the Grey RenuDisk:

- While the Black and Red RenuDisks used in Step One should leave a clearly defined path almost immediately, the Grey RenuDisk used in subsequent steps requires a bit of conditioning. This initial conditioning is essential for the disk to reach its full effectiveness and provide accurate feedback.

Notes:

⚠ C 3.8.3.0 - Body Positioning and Strike Zone

Importance of Proper Technique:

- In the field of glass restoration, the significance of correct body positioning and tool handling cannot be overstressed. These techniques are pivotal not only in mitigating the risk of inadvertent damage to the glass pane during restoration but also in reducing physical strain on the technician. A key concept here is the establishment of an effective “Strike Zone.” This zone, ideally spanning from the tip of the nose down to mid-chest and not extending beyond the width of the shoulders, serves as a guideline for maintaining optimal control over the polishing equipment.

Strike Zone and Tool Control:

- By confining the movement of the polisher within this strike zone, technicians can ensure that the tool remains parallel to the glass surface, which is crucial for consistent and precise work. Deviating from this zone often leads to unintentional pressure variations and uneven contact between the Renudisk and the glass, potentially causing further damage. The strike zone concept not only aids in quality control but also enhances the safety of the operation, ensuring that the tool is handled in a controlled and stable manner.

Optimizing Movement and Reducing Fatigue:

- To cover a larger working area without compromising the integrity of the strike zone, a specific stance is recommended. Technicians should position their feet slightly apart, aligning their heels under their shoulders. This wider stance, coupled with a slight bending of the knees, allows for greater stability and flexibility. This posture enables the upper body, particularly the arms and shoulders, to remain steady within the strike zone. Such positioning allows for the lower half of the body to pivot, facilitating movement across a larger area without straining the upper body.

Best Practices:

- Emphasizing these body positioning and tool handling techniques in glass restoration is not just about achieving optimal results; it's also about ensuring the well-being of the technician. Adopting these methods leads to a more efficient restoration process, minimizes the potential for errors, and significantly reduces muscle fatigue and stress. This approach underscores the importance of ergonomic practices in the field, marrying quality of workmanship with the physical health of the technician. As these practices become more ingrained, technicians will likely experience fewer work-related discomforts and greater overall job satisfaction.



Fig. 3130A



Fig. 3130B



Fig. 3130C

Notes:

C 4.0.0.0 - Our Process I: Introduction

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section ⚠ C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80℉ Δ	N/A
Tempered	+120℉ Δ	N/A
Laminate- Annealed	+80℉ Δ	145℉
Laminate- Tempered	+120℉ Δ	145℉
Mirrored	+80℉ Δ	N/A

Fig. 4000A

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Black (or) Red RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Preparation Phase: Setting Up for Glass Restoration

Before diving into the restoration process, it's essential to prepare the glass and the tools. This preparatory phase lays the foundation for a successful repair, ensuring that the restoration is done efficiently and effectively.

Glass Inspection and Assessment:

- Begin by thoroughly cleaning the glass pane to be repaired. It's crucial to ascertain the type of glass you're dealing with, be it annealed, tempered, or laminated. Inspect the entire pane for any pre-existing damage or potential structural integrity issues. Also, check for any coatings or films on the glass and identify the specific damage or "target damage" that needs to be addressed.
- Assess the severity and type of damage (Refer to C 3.5.0.0 - Damage Assessment). Understanding the damage's depth and nature will guide you in selecting the appropriate RenuDisk, whether black or red.

Planning the Repair Area:

- Based on the damage category, plan the repair area. CAT-1 and CAT-2 damages typically require a more localized approach, whereas CAT-3 and CAT-4 damages might need a significantly larger work area (See C 3.6.0.0 - Determining Work Area). Visualizing the steps on the pane beforehand is helpful, especially to account for potential obstructions like frames or logos.
- Choose the suitable size class for the repair from the available options (3", 5", 6", 8"). The correct size class will align with the severity of the damage and the size of the work area.

Temperature Monitoring and Safety Gear:

- Use an IR Non-Contact Thermometer to take several temperature readings around the pane. These readings are crucial for understanding thermal expansion and ensuring the glass stays within safe working temperatures (See ⚠ C 3.1.1.0 - Thermal Expansion).
- Equip all required personal protective equipment (PPE) to ensure safety during the restoration process. (See C 3.0.0.0 - Before You Begin)

Workspace Considerations:

- Platforms, ladders, scaffolding, drop cloths, power, ventilation, fans, etc.

Notes:

C 4.1.0.0 - Step One: Abrasion

The aim of step one is to use abrasive disks to equally remove a layer of glass from the pane until we've reached the bottom of the target damage. Using a black or red RenuDisk, depending on the depth of damage, allows us to quickly and efficiently abrade the surface.

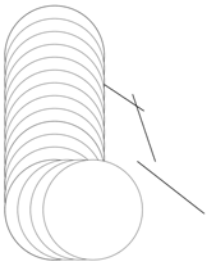


Fig. 4100A



Fig. 4100B



Fig. 4100C



Fig. 4100D

1. Secure a Black or Red RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
4. Engage the polisher's power trigger, and trigger lock.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Black RenuDisk.
9. Continue to [Step Two: Pre-Polish].

Important Notes on Step One: Abrasion:

- All target damage must be removed during Step One. If the target damage is not removed after 4-5 full passes, expand the work area by ~25%.
- **Disk**: The black or red RenuDisk may need to be cleaned during the abrasion process, depending on the size of the repair. Disks can be cleaned, gently removed, and saved if the abrasive surface is still intact after the repair.
- **Haze**: After all damage is removed, the haze on the glass should appear thickly frosted white. Both concentric circling from the disk, and underlying criss-crossing rotary tool imprinting should be evident.

Tool Setup:

- Attach the RenuDisk to the backing pad. Ensure the disk's loop surface aligns perfectly with the hook surface of the backing pad, and it is centered correctly for balanced operation.
- Set the operational speed of the Polisher to 1800 RPM, as per the guidelines in C 3.2.6.0 - Polisher.

Beginning Abrasion:

- Place the surface of the RenuDisk on the glass, parallel to the plane. Choose a point around the damaged area that will center the damage in the work area.
- With the surface of the RenuDisk flat against the pane, engage the power trigger and trigger lock.
- Start abrading in a cross-hatch pattern, a reliable and easy-to-learn approach that ensures uniform contact with the work area. Key to a high-quality repair is maintaining the parallelism between the two surfaces of the glass pane (Surface 1 and Surface 2) as closely as possible. This precision helps minimize or eliminate optical distortion. Apply a consistent pressure of about 7-9 pounds for uniform abrasion.

Observation and Adaptation:

During the abrasion step in the GlassRenu system, continuous vigilance and adaptability are key to achieving the desired outcome. Here are some essential practices to ensure effective and even abrasion:

Observation and Perspective:

- Regularly change your viewing angle to closely monitor the path of the RenuDisk. This step is crucial to assess the uniformity of the abrasion. By observing from different perspectives, you can better understand the repair progress, especially how different light reflections reveal the quality of the work. This constant adjustment in viewpoint helps in identifying any remaining damage and ensuring a consistent abrasion pattern.

Adapting to Damage Severity:

- The abrasion extent varies depending on the damage category. Category two damage generally requires less abrasion, while categories three and four might need more extensive work. For deeper or more severe damage, refer to C 3.6.0.0 - Determining Work Area for specific guidelines. This ensures that the abrasion is adequate to address the depth and severity of the damage without overworking the glass.

Even Abrasion Across Varying Depths:

- As you abrade the surface, you may notice that the damage tends to disappear quicker in some areas than in others due to varying depths. It's essential to continue even abrasion across the entire established work area. This approach prevents uneven removal of glass material and avoids any undesired lensing effect, which can occur when glass is abraded unevenly.



Fig. 4100E



Fig. 4100F

Maintenance of the RenuDisk:

- During the abrasion process, glass stock (glass dust, silicate dust, or glass powder) will start to accumulate on the RenuDisk, potentially clogging its surface. If you find the abrasion becoming less effective, consult C 3.4.2.0 - Attaching and Maintaining RenuDisks for guidance on cleaning the RenuDisk. Cleaning and re-exposing the abrasive surface is crucial for maintaining the efficiency of the abrasion.

Post-Abrasion Protocol:

- Once you have confirmed that all target damage has been completely removed, carefully remove the RenuDisk from the glass pane and disengage the polisher's power trigger. This step marks the conclusion of the abrasion phase.

Quality of Haze:

Post-abrasion, the quality of the haze left on the glass is an important indicator of the effectiveness of the initial restoration step. Proper inspection of this haze provides insight into the thoroughness of the process and readiness for subsequent steps. Here's what to look for:

Inspection from Multiple Perspectives:

- Examine the work area from various angles. This comprehensive check is crucial to confirm that all damage has been completely removed. Different angles will highlight various aspects of the haze, ensuring a thorough assessment.

Characteristics of the Haze:

- The path created by the RenuDisk should be distinctly visible across the pane. This path should reflect the full width of the disk, indicating that the disk was kept flat during the abrasion process. Additionally, there should be clear concentric circles, resembling the trailing edge of the pad, a sign of uniform movement.
- Beneath the surface-level path and concentric circles, look for the distinct imprinting left by the rotary tool. This imprinting will differ from the concentric circles; it's typically less uniform, often crisscrossing and presenting a “cat-scratch” appearance (Fig 4100I.) This pattern is a normal result of the cross-hatch abrasion technique.
- Ensure that all target damage has been entirely removed. The absence of visible damage at this stage is crucial before moving on to the next phase of the restoration.

Readiness for Next Steps:

- The inspection of the haze is not just about confirming the removal of damage; it's also about preparing the glass for the finer work in the upcoming stages. A well-executed first step sets the stage for a smoother and more effective restoration process.

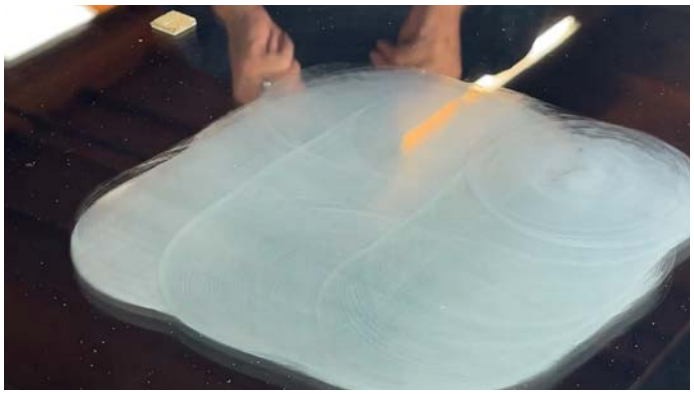


Fig. 4100H



Fig. 4100I

C 4.2.0.0 - Step Two: Pre-Polish

Step Two: Pre-Polish is broken down into three distinct sub-steps: Low Speed, Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

C 4.2.1.0 - Mid Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 1800 RPM.
2. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
3. Engage the polisher's power trigger, and trigger lock.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger.
8. Ensure the Grey RenuDisk surface is completely coated in glass stock.
9. Continue to High Speed Pre-Polish.

Important Notes on Mid Speed Pre-Polish:

- It is important to expand the work area established in Step One.
- The Grey RenuDisk will create a light haze around the outside edge of the work area as it is expanded. After several passes, the Grey RenuDisk will accumulate glass stock on its surface. As this happens, the quality of the haze will quickly begin to change.
- **Disk**: The Grey RenuDisk should be fully coated in glass stock by the end of the Mid Speed Pre-Polish. **DO NOT** clean the disk before proceeding.The glass stock should be bubbly and flaky in consistency for best High Speed Pre-Polish results.
- **Haze**: All light rotary imprinting should be fully removed. The haze should be light, "milky" white in color, consistent from edge to edge. Light concentric circles in the path of the disk will be evident.

C 4.2.2.0 - High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
3. Engage the polisher's power trigger, and trigger lock.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

Important Notes on High Speed Pre-Polish:

- It is important to expand the work area established in the Mid Speed Pre-Polish sub-section.
- **Haze**: The Mid Speed and High Speed Pre-Polish sections look very similar. There will be a light reduction in haze, and the concentric circling will appear closer together, or tighter. It is imperative in this step to maintain sharp clean edges and transitions around the edge of the entire work area.

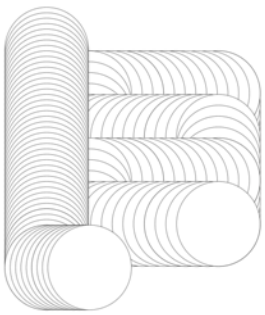


Fig. 4200A

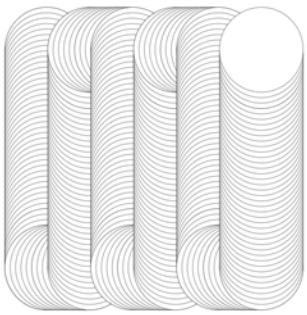


Fig. 4200B

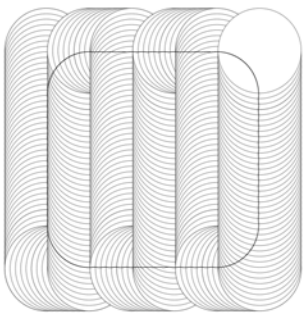


Fig. 4200C

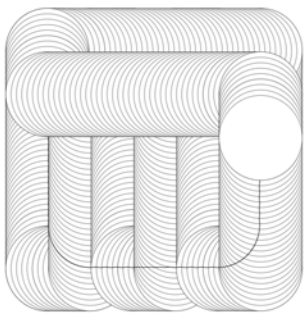


Fig.4200D

C 4.2.2.0 - Mid Speed Pre-Polish

Objectives of Mid Speed Pre-Polish:

Expanding the Work Area:

- A key aim during this phase is to expand the work area that was established during Step One. This expansion is necessary to ensure that the restoration is comprehensive and encompasses all areas affected by the initial damage and the subsequent repair processes. By broadening the work area, you ensure a seamless and uniform finish across the entire pane.

Removing Rotary Tool Imprinting:

- Another important goal is to eliminate any rotary tool imprinting left from Step One. These imprints, if left unaddressed, can affect the final appearance and quality of the glass surface. The mid-speed pre-polish is designed to smooth out these marks, ensuring that the glass surface is evenly prepared for the final polishing.

Accumulating Glass Stock on the RenuDisk:

- As the Grey RenuDisk moves across the glass at this intermediate speed, it accumulates glass stock – fine particles of glass that are crucial for the polishing process. This accumulation is a vital part of preparing the RenuDisk for the final polish. It ensures that when you reach the final polishing step, the disk is optimally primed to achieve a smooth, flawless finish.

The Mid Speed Pre-Polish sub-step is, therefore, an integral part of the GlassRenu process. It fine-tunes the work area and prepares both the glass surface and the RenuDisk for the crucial final polishing step, ensuring a high-quality restoration result

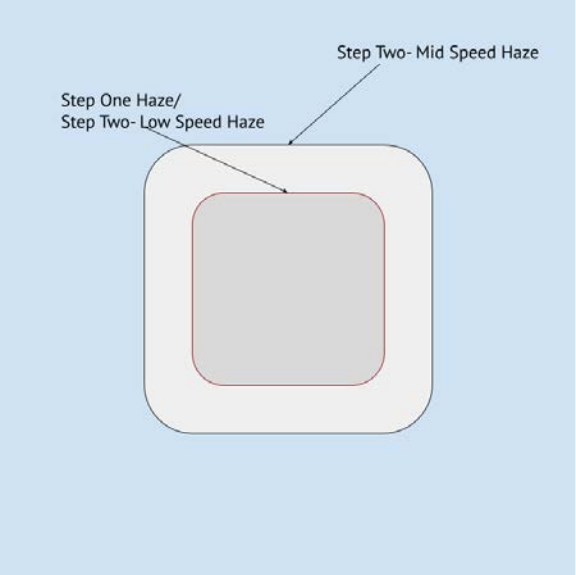


Fig. 4220A

Mid Speed Pre-Polish Tool Setup:

- Set the operational speed of the Polisher to 1800 RPM, as per the guidelines in C 3.2.6.0 - Polisher.

Beginning Mid Speed Pre-Polish:

- Align the surface of the RenuDisk on the glass, parallel to the pane, overlapping the established work area by approximately ½ the width of the RenuDisk. It is necessary in this sub-step to expand the established work area.
- With the surface of the RenuDisk flat against the pane, engage the power trigger and trigger lock.
- Start pre-polishing in a cross-hatch pattern, making sure to extend past the haze established in Step One, and create a new edge. Apply a consistent pressure of about 7-9 pounds during the course of abrasion.

Observation and Adaptation:

The Mid Speed Pre-Polish phase in the GlassRenu system is characterized by significant transformations in the glass haze. Careful observation and adaptation are vital to ensure the desired outcome. Here's a closer look at what to expect and how to manage this step:

Observing Initial Haze Changes:

- At the start of the Mid Speed Pre-Polish using the Grey RenuDisk, you'll notice a very faint haze overlapping the step one haze by about half the disk's width. This indicates the beginning of the pre-polish phase (Fig 4220D.)
- A discernible path will be left by the RenuDisk; the rotary tool imprinting left during Step One will likely be visible beneath.
- The opacity of the haze should start decreasing rapidly, by approximately 20-30%, indicating effective abrasion.



Fig. 4220D

Observation and Adaptation:

Noting Final Haze Changes:

- After several passes at 1800 RPM, the initially faint white haze will transform into a softer, “milky” white haze. The edges of the RenuDisk’s path will become more pronounced, leaving more visible trails.
- Rotary tool imprinting from the initial abrasion should gradually disappear.
- Continue the Mid Speed Pre-Polish until the work area is uniformly expanded and all traces of the initial abrasion haze are indistinguishable, ensuring a smooth transition to the next phase.

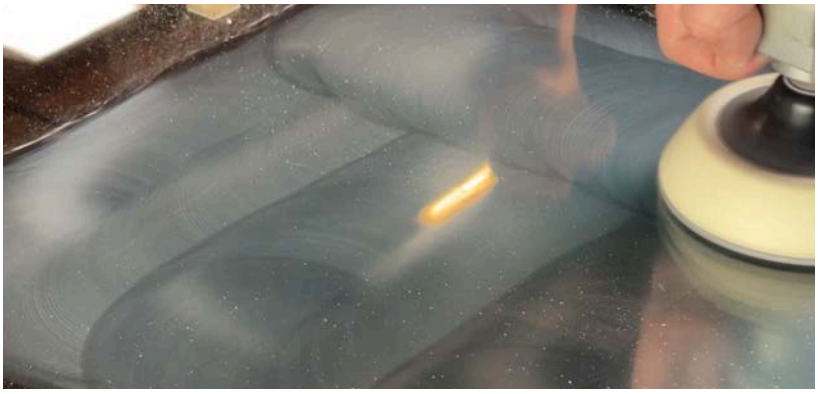


Fig. 4220F

RenuDisk Maintenance:

- Throughout this phase, glass stock will accumulate on the RenuDisk, potentially decreasing its effectiveness. If the abrasion seems less effective, refer to C 3.4.2.0 - Attaching and Maintaining RenuDisks for cleaning guidelines.
- By the end of this sub-step, the Grey RenuDisk should be almost completely covered in glass stock. This full coverage is crucial for the next step in the restoration process. If cleaning of the RenuDisk is required at any point, ensure to continue pre-polishing until full accumulation is achieved once again.
- When done correctly, the glass stock accumulated on the surface of the RenuDisk should be loose and flaky (Fig. 4220H) for best results. While glass stock adhered to the surface of the RenuDisk (Fig. 4220I) will still eventually yield a quality High Speed Pre-Polish, it can prolong the pre-polish and the polishing step. This is often a sign of not keeping completely flat, an over exertion of pressure, too much time spent pre-polishing, or a combination of the three.

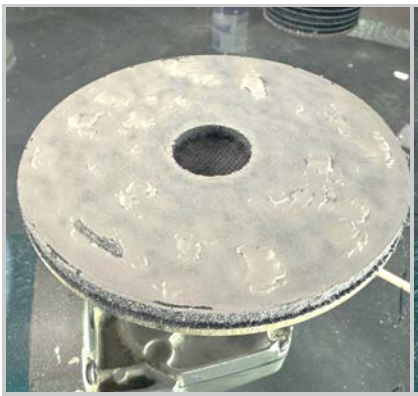


Fig. 4220H

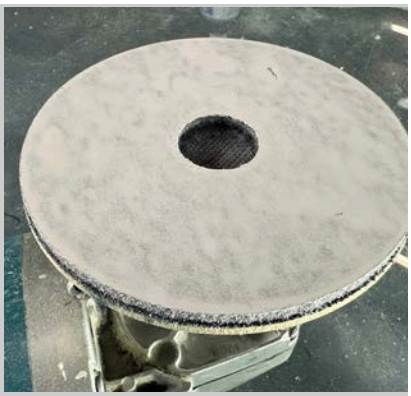


Fig. 4220I

Regularly adjusting your perspective during the Mid Speed Pre-Polish step is crucial for a comprehensive understanding of the progress. These observations allow for timely adjustments and ensure that the glass surface is being uniformly prepared for the final stages of the restoration process.

Post-Abrasion Protocol:

- Once you have confirmed that all target damage has been completely removed, carefully remove the RenuDisk from the glass pane and disengage the polisher's power trigger. This step marks the conclusion of the mid speed pre-polish sub-step.

Quality of Haze and RenuDisk Surface:

Post-Mid Speed Pre-Polish, the quality of the haze left on the glass is an important indicator of the effectiveness of the mid speed pre-polish restoration step. Proper inspection of this haze provides insight into the thoroughness of the process and readiness for subsequent steps. Here's what to look for:

Inspection from Multiple Perspectives:

- Examine the work area from various angles. This comprehensive check is crucial to confirm that all damage has been completely removed. The different angles will highlight various aspects of the haze, ensuring a thorough assessment.

Quality of Haze and RenuDisk Surface:



Fig. 4220K

Visibility and Uniformity of the RenuDisk Path:

- The path created by the RenuDisk should be distinctly visible across the pane. This path should reflect the full width of the disk, indicating that the disk was kept flat during the mid speed pre-polish process. Additionally, there should be clear concentric circles, resembling the trailing edge of the pad, a sign of uniform movement.
- All rotary tool imprinting left during Step One should have been fully removed.

Transition from Low-Speed to Mid-Speed Pre-Polish:

- The haze created during Step One should now be fully integrated or indistinguishable in the newly established work area (Fig 4220K.) This blending indicates a successful transition between the low-speed and mid-speed pre-polish stages, crucial for achieving a smooth, consistent finish.

Readiness for Next Steps:

- The inspection of the haze is not just about confirming the removal of damage; it's also about preparing the glass for the finer work in the upcoming stages. A well-executed mid speed Pre-Polish sets the stage for a smoother and more effective restoration process.

In summary, the quality of the haze after the mid speed pre-polish is a critical aspect of the GlassRenu process. It serves as a checkpoint for the quality of work done and guides the technician on the readiness of the glass for further restoration tasks.

C 4.2.3.0 - High Speed Pre-Polish

Objectives of High Speed Pre-Polish:

Utilizing a Fully Coated Grey RenuDisk:

- In this sub-step, it's essential to use a Grey RenuDisk that is fully coated in glass stock (Fig.4220H). This coating is a result of the earlier Mid Speed Pre-Polish process and is critical for the effectiveness of the high-speed pre-polish. The glass stock on the disk aids in smoothing the glass surface, preparing it for the final polish.

Expanding the Work Area:

- The primary goal during the High Speed Pre-Polish is to further expand the work area established during the Mid Speed Pre-Polish. This expansion ensures that any slight imperfections or uneven areas from the previous steps are thoroughly addressed.

Refining the Work Area:

- Beyond mere expansion, this phase is about refining the work area. The high-speed rotation of the fully coated disk facilitates a finer smoothing of the glass surface, eliminating minor imperfections and ensuring a uniform texture across the entire work area.

Preparation for Final Polish:

- By the end of this sub-step, the glass surface should be smooth, even, and ready for the final polish. This final refinement sets the stage for achieving a flawless, clear finish in the last phase of the GlassRenu process.

The High Speed Pre-Polish sub-step is thus a vital transition point, bridging the preparatory work with the final polishing stage. It ensures that the glass surface is not only expanded but also refined to a level of smoothness necessary for a successful final polish.

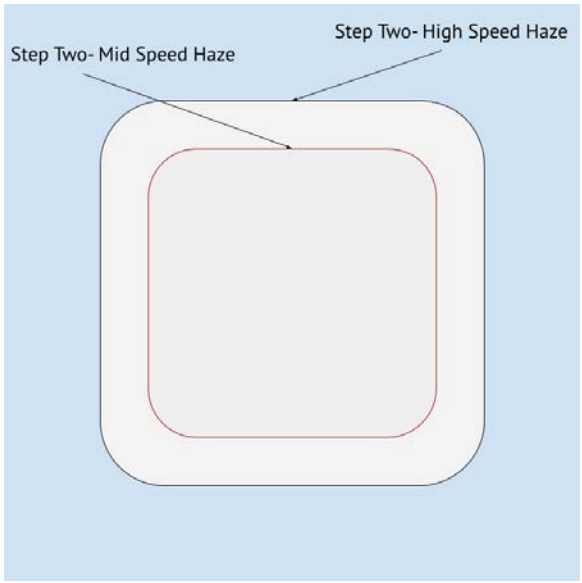


Fig. 4230A

Notes:

High Speed Pre-Polish Tool Setup:

- Ensure that the Grey RenuDisk surface has a full accumulation of glass stock (Fig. 4220H.)
- Set the operational speed of the Polisher to 3000 RPM, as per the guidelines in C 3.2.6.0 - Polisher.

Beginning High Speed Pre-Polish:

- Align the surface of the RenuDisk on the glass, parallel to the pane, overlapping the established work area by approximately ½ the width of the RenuDisk. It is necessary in this sub-step to expand the established work area.
- With the surface of the RenuDisk flat against the pane, engage the power trigger and trigger lock.
- Start pre-polishing in a cross-hatch pattern, making sure to extend past the haze established in the previous sub-step and create a new edge. Apply a consistent pressure of about 7-9 pounds for uniform abrasion.

Observation and Adaptation:

In the High Speed Pre-Polish phase of the GlassRenu system, keen observation and understanding the evolving nature of the haze are key to ensuring a successful restoration process. Here's a closer look at what to expect and manage during this critical phase:

Observation and Perspective:

- Regularly adjusting your viewing angle is crucial to effectively monitor the path of the RenuDisk. Different perspectives allow for a more comprehensive understanding of the repair progress. Pay particular attention to how light reflects off the glass surface at various angles, as this will reveal the quality and consistency of the work being done.

Haze Change:

- You will notice that the opacity of the haze, which was established during the Mid Speed Pre-Polish phase, will start to lighten almost immediately. This change is a positive indicator that the high-speed pre-polish is effectively refining the glass surface.
- A faint edge will begin to form, outlining the area worked on in the Mid Speed Pre-Polish phase (Fig. 4230B.) This edge will become more homogeneous with the rest of the work area as you continue making additional passes with the RenuDisk.
- During this phase, the RenuDisk will start leaving a more discernible path, indicating that it is effectively smoothing and refining the glass surface.
- A significant portion of the glass pane's reflectivity will begin to return, a sign that the surface is being restored to its original clarity and smoothness.

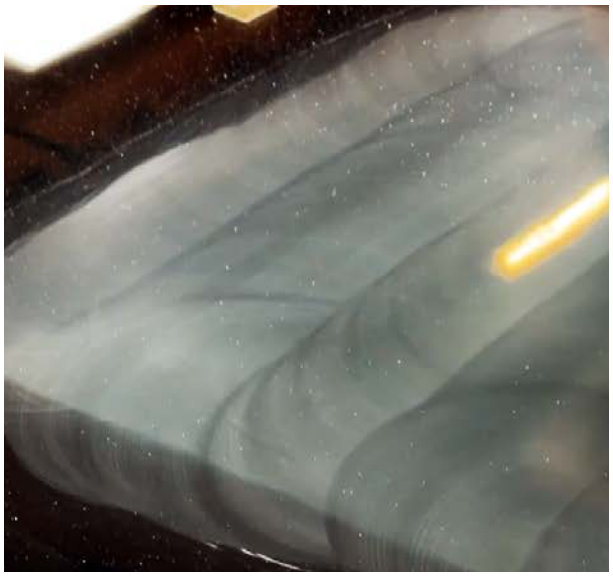


Fig. 4230B

Maintenance of the RenuDisk:

- Throughout the High Speed Pre-Polish sub-step, the Grey RenuDisk should maintain full glass stock accumulation. This continuous accumulation is essential for the effectiveness of the disk during this phase.
- Importantly, no disk maintenance should be necessary during the High Speed Pre-Polish. The disk should remain fully functional and effective throughout this phase without the need for cleaning or other maintenance.

Post-Abrasion Protocol:

- Once the previously established work area has been adequately expanded, made uniform edge to edge, and all remnants from the previous step are indistinguishable in the newly established work area, carefully remove the RenuDisk from the glass pane and disengage the polisher's power trigger. This step marks the conclusion of Step Two: Pre-Polish.

Notes:

Quality of Haze:

After completing the high-speed pre-polish phase in the GlassRenu restoration process, careful examination of the resulting haze is essential. This assessment ensures that the glass is correctly prepared for the final stages of restoration. Here's what to focus on:

Inspection from Multiple Perspectives:

- Examine the work area from various angles. This comprehensive check is crucial to confirm that all damage has been completely removed. The different angles will highlight various aspects of the haze, ensuring a thorough assessment.

Visibility and Uniformity of the RenuDisk Path:

- The path created by the RenuDisk across the pane should be distinctly visible. Look for a path that reflects the full width of the disk, a clear indication that the disk was maintained flat during the high-speed pre-polish process. This uniformity is crucial for an evenly polished surface.
- Observe for tight, clear concentric circles along the trail of the pad. These circles should be consistent and uniform across the entire work area, signifying a uniform movement of the RenuDisk across the pane.

Transition from Mid-Speed to High-Speed Pre-Polish:

- The haze created during the mid-speed pre-polish sub-step should now be fully integrated or indistinguishable in the newly established work area (Fig 4230E.) This blending indicates a successful transition between the pre-polish sub-steps, crucial for achieving a smooth, consistent finish.

Clean Edges and Clear Distinction:

- Inspect the edges of the repair area. They should be clean (Fig. 4230C) and free from any wisping (Fig 4230D). A precise boundary between the established work area and the surrounding glass is essential.
- There should be a stark distinction between the treated area and the untreated glass. This clear demarcation is evidence of precise control during the polishing process, ensuring that the restoration is localized and effective.

The assessment of haze quality at this stage is a critical checkpoint, confirming that the pre-polish process has been executed with the necessary precision and setting the stage for the final polish. It's these finer details that contribute to the overall success of the GlassRenu restoration process.

Readiness for Next Steps:

- The inspection of the haze is not just about confirming the removal of damage; it's also about preparing the glass for the finer work in the upcoming stages. A well-executed first step sets the stage for a smoother and more effective restoration process.

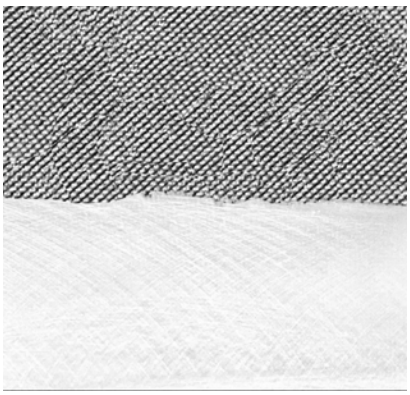


Fig. 4230C

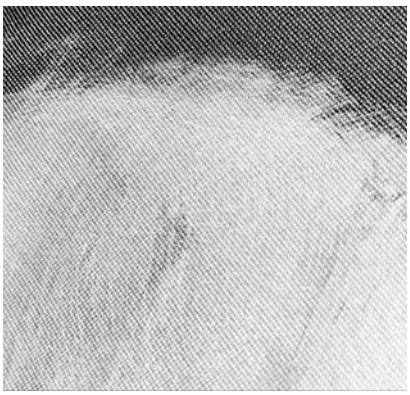


Fig. 4230D

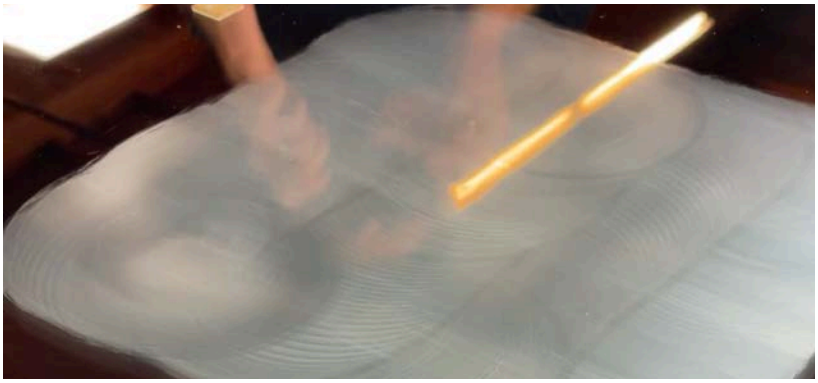


Fig. 4230E

Notes:

C 4.3.0.0 - Step Three: Polish

Step Three: Polish

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

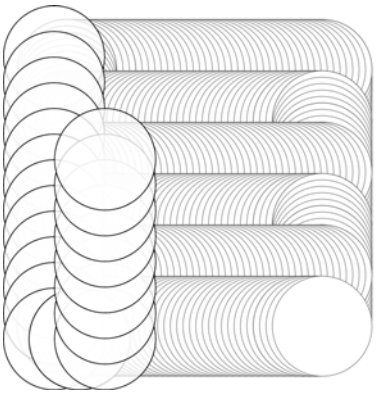


Fig. 4300A

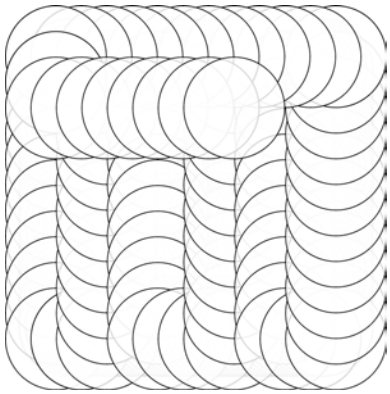


Fig. 4300B



Fig. 4300C

Fig. 4300D

Important Notes on Step Three: Polish:

- The body of the repair should begin polishing out quickly. Edges and corners typically take a bit longer to polish back to perfect. A 1.5:1- 2:1 ratio of time spent on edges and corners vs. body of the repair is not uncommon.
- High pressure during polishing is a large contributing factor to a quick and efficient polish.
- As the polish begins to dry and thicken on the pane, it may be useful to increase the rotational speed of the polisher to ~1000 RPM. The increased speed can offer increased ease of movement.
- It is not uncommon to reapply Polishing Compound, and continue polishing multiple times.

Tool Setup:

- Attach the Polishing Felt to the backing pad. Ensure the felts loop surface aligns perfectly with the hook surface of the backing pad, and it is centered correctly for balanced operation.
- Using the rounded, more aggressive half of the rasp file, lightly abrade the surface of the polishing felt
- Apply the Polishing Compound to the Polishing felt.
- Set the operational speed of the Polisher to 600 RPM, as per the guidelines in C 3.2.6.0 - Polisher.

Beginning Polishing:

- Place the surface of the Polishing Felt on the glass, parallel to the plane.
- With the surface of the Polishing Felt flat against the pane, engage the power trigger and trigger lock.
- Start polishing in a cross-hatch pattern. Apply as much pressure as is safe to exert on the pane. High pressure contributes to a faster and more efficient Polishing step.

Notes:

As you polish:

- Continue to polish until all of the compound has been worked into the pane.
- The center, or “body,” of the repair will quickly begin to clear. The outer edges, corners and transitions have a tendency to persist a bit longer. A ratio of 2:1 of time spent on edges, corners, and transitions is not uncommon.
- When all polish has been worked into the glass, if any remnants of a repair persist, repeat Step Three. Multiple applications in a single area is not uncommon.



Fig. 4300E



Fig. 4300F

Notes:

C 4.4.0.0 - Category One (CAT-1): Faint Damage

CAT-1 Damage can generally be described as surface level, Using Foam Finishing Disks, Cutting Compound, Polishing Felts, and Polishing Compound, we are able to remove surface debris, staining, hazing, and even some hairline scratches.

Damage Types:
Suction Cup Marks
Heat Haze
Hard Water Deposit
Hard Water Staining



IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80℉ Δ	N/A
Tempered	+120℉ Δ	N/A
Laminate- Annealed	+80℉ Δ	145℉
Laminate- Tempered	+120℉ Δ	145℉
Mirrored	+80℉ Δ	N/A

Fig. 4400A

TIME ADVISORY	Approximate Time per Square Foot
Suction Cup Marks	3-5 min.
Heat Haze	3-5 min.
Hard Water Deposits	4-7 min.
Hard Water Staining	7-12 min.

Fig. 4400B

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Foam Finishing Disk(s)
- ☐ Cutting Compound
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

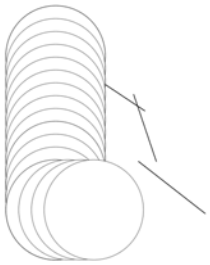


Fig. 4410A



Fig. 4410B

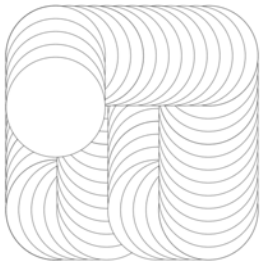


Fig. 4410C

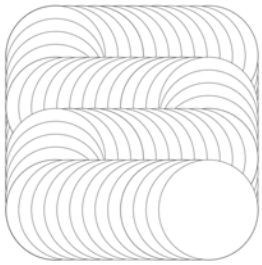


Fig. 4410D

C 4.4.1.0 - Step One: Cutting utilizes a Foam Finishing Disk to quickly remove target damage.

1. Secure a Foam Finishing Disk (Fig. 4110E) to the designated backing pad.
2. Apply 1/4 - 1/2 oz. of Cutting Compound (Fig. 4110F) to the surface of the Foam Finishing Disk.
3. Adjust the polisher to operate at a rotational speed of 600 RPM.
4. Align the Foam Finishing Disk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Engage the polisher's power trigger, and trigger lock.
6. Employ a systematic cutting approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue cutting until all damage has been removed.
7. Disengage the Foam Finishing Disk from the glass pane.
8. Disengage the polisher's power trigger. Ensure the disk is stationary.
9. Detach the Foam Finishing Disk.
10. Continue to Step Two: Pre-Polish.

NOTE: Over the course of cutting, it may be necessary to reapply Cutting Compound to the Foam Finishing Disk. If the Cutting Compound has been fully worked into the glass, or if the Cutting Compound becomes dry on the pane:

- **Disengage the polisher, ensuring the disk is stationary.**
- **apply 1/4 - 1/2 oz. of Cutting Compound to the surface of the Foam Finishing Disk.**



Fig. 4410E



Fig. 4410F



Fig. 4410G

Notes:

C 4.4.2.0 - Step Two: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants from multiple angles. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

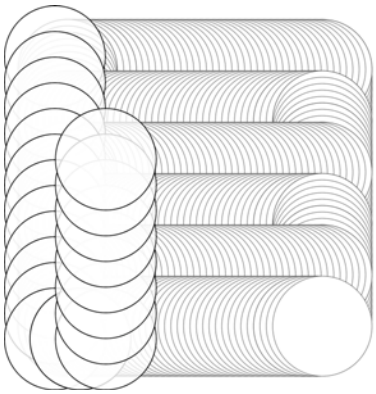


Fig. 4420A

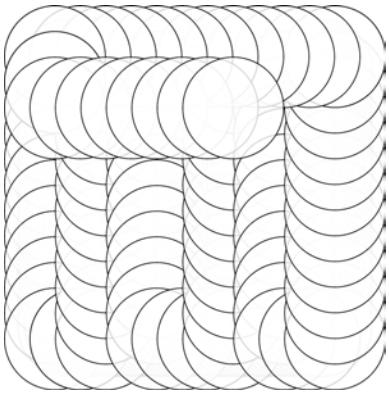


Fig. 4420B



Fig. 4420C

Fig. 4420D



Fig. 4420E



Fig. 4420F

Notes:

C 4.5.0.0 - Category Two (CAT-2): Light Damage

CAT-2 damage begins encompassing light and passive chemical damage, as well as mechanical damage that has begun to penetrate the factory surface of the pane. Using Black and Grey RenuDisks, Polishing Felts, and Polishing Compound, we can quickly and efficiently remove light damage.

DAMAGE TYPES:
Hard Water Etching
Fines And Ticks
Cleaning Abrasive
Metallic Rub
Glass On Glass






IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80℉ Δ	N/A
Tempered	+120℉ Δ	N/A
Laminate- Annealed	+80℉ Δ	145℉
Laminate- Tempered	+120℉ Δ	145℉
Mirrored	+80℉ Δ	N/A

Fig. 4500A

TIME ADVISORY	Approximate Time per Square Foot
Hard Water Etching- Light	12-15 min.
Hard Water Etching- Medium	15-20 min.
Hard Water Etching- Heavy	15-20 min.
Fines and Ticks	15-20 min.
Cleaning Abrasive	15-20 min.
Metallic Rub	12-15 min.
Glass on Glass	15-20 min.

Fig. 4500B

Notes:

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Black RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Notes:

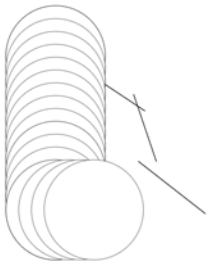


Fig. 4510A



Fig. 4510B

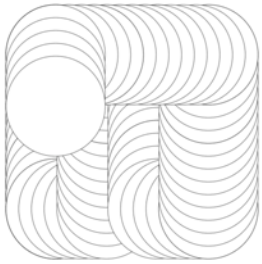


Fig. 4510C

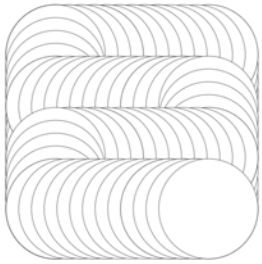


Fig. 4510D

C 4.5.1.0 - Step One: Abrasion utilizes a Black RenuDisk to quickly remove target damage.

1. Secure a Black RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Black RenuDisk.
9. Continue to [Step Two: Pre-Polish].

Important Notes on Step One: Abrasion:

- All target damage must be removed during Step One. If the target damage is not removed after 4-5 full passes, treat damage as CAT-3. Proceed to: C 4.6.1.0.
- **Disk**: The black RenuDisk may need to be cleaned during the abrasion process, depending on the size of the repair. Disks can be cleaned, gently removed, and saved if the abrasive surface is still intact after the repair.
- **Haze**: After all damage is removed, the haze on the glass should appear thickly frosted white. Both concentric circling from the disk, and underlying criss-crossing rotary tool imprinting should be evident.





Notes:

C 4.5.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

C 4.5.2.1 - Mid Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 1800 RPM.
2. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
3. Engage the polisher's power trigger, and trigger lock.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern (Fig. 4220A - D). Maintain uniform pressure.
5. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger.
8. Ensure the Grey RenuDisk surface is completely coated in glass stock.
9. Continue to High Speed Pre-Polish.

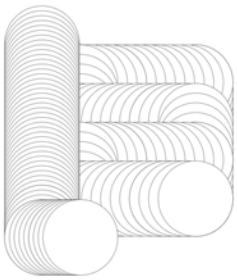


Fig. 4520A

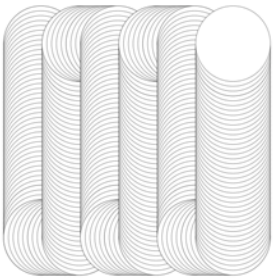


Fig. 4520B

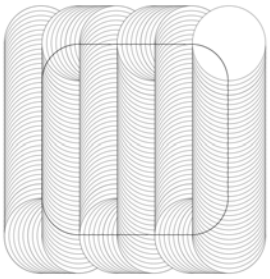


Fig. 4520C

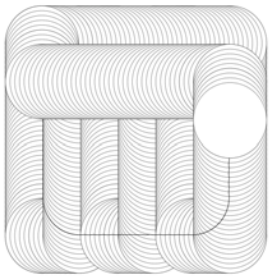


Fig. 4520D

Important Notes on Mid Speed Pre-Polish:

- It is important to expand the work area established in Step One.
- The Grey RenuDisk will create a light haze around the outside edge of the work area as it is expanded (Fig. 4222A -B). After several passes, the Grey RenuDisk will accumulate glass stock on its surface. As this happens, the quality of the haze will quickly begin to change.



Fig. 4521A

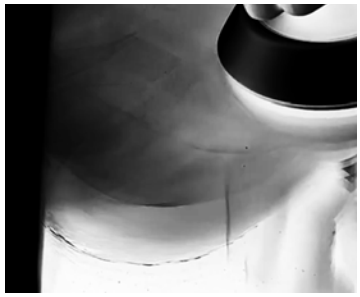


Fig. 4521B

- **Disk**: The Grey RenuDisk should be fully coated in glass stock by the end of the Mid Speed Pre-Polish. **DO NOT** clean the disk before proceeding.The glass stock should be bubbly and flaky in consistency for best High Speed Pre-Polish results.
- **Haze**: All light rotary imprinting should be fully removed. The haze should be light, "milky" white in color, consistent from edge to edge. Light concentric circles in the path of the disk will be evident.

C 4.5.2.2 - High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].



Fig. 4522A

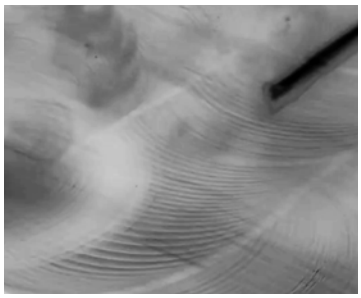


Fig. 4522B

Important Notes on High Speed Pre-Polish:

- It is important to expand the work area established in the Mid Speed Pre-Polish sub-section.
- **Haze**: The Mid Speed and High Speed Pre-Polish sections look very similar. There will be a light reduction in haze, and the concentric circling will appear closer together, or tighter. It is imperative in this step to maintain sharp clean edges and transitions around the edge of the entire work area.

C 4.5.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

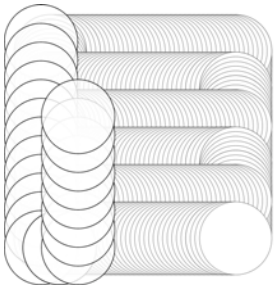


Fig. 4530A

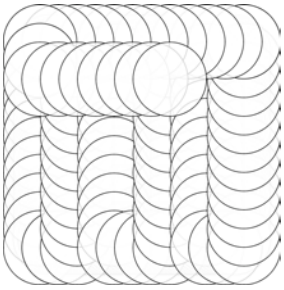


Fig. 4530B



Fig. 4530C

Fig. 4530D



Fig.



Fig.

Notes:

C 4.6.0.0 - Category Three (CAT-3): Medium Damage

CAT-3 damage begins addressing damage that is deep enough to catch a fingernail. The majority of glass vandalism, post construction clean up, and improper chemical use falls under this category. Using Black and Grey RenuDisks, Polishing Felts, and Polishing compounds, we will begin expanding our work area further out, mitigating potential optical distortion as we remove deeper, more aggressive damage types.

DAMAGE TYPES:
Razor Blade
Masonry/ Rock
Graffiti Scratch- Light
Acid- Light
Acid- Medium







IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80℉ Δ	N/A
Tempered	+120℉ Δ	N/A
Laminate- Annealed	+80℉ Δ	145℉
Laminate- Tempered	+120℉ Δ	145℉
Mirrored	+80℉ Δ	N/A

TIME ADVISORY	Approximate Time per Square Foot
Razor Blade	15-25 mins.
Masonry Damage	20-30 mins.
Graffiti Scratch- Light	20-30 mins.
Acid- Light	15-30 mins.
Acid- Medium	15-30 mins.

IMPORTANT NOTE:

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Black RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Notes:

C 4.6.1.0 - Step One: Abrasion utilizes a Black RenuDisk to quickly remove target damage.

1. Secure a Black RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern.
6. After every 4-5 full passes over the entire work area, if the damage has not been removed, expand the work area by ~25%. Continue repeating this step until all damage has been removed.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger. Ensure the disk is stationary.
9. Detach the Black RenuDisk.
10. Continue to [Step Two: Pre-Polish].

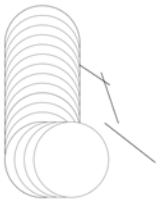


Fig. 4610A



Fig. 4610B

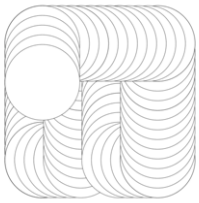


Fig. 4610C

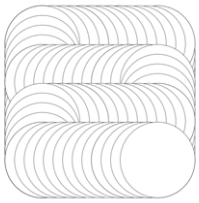


Fig. 4610D

Important Notes on Step One: Abrasion:

- All target damage must be removed during Step One. If damage persists past 3-4 expansions, consider treating the damage as CAT-4 and proceed to: C 4.7.1.0.
- If working on framed glass, keep physical boundaries in mind while expanding. There are two additional necessary expansions in the subsequent step, Step Two.
- **Disk**: The black RenuDisk may need to be cleaned during the abrasion process, depending on the size of the repair. Disks can be cleaned, gently removed, and saved if the abrasive surface is still intact after the repair.
- **Haze**: After all damage is removed, the haze one the glass should appear thickly frosted white. Both concentric circling from the disk, and underlying criss-crossing rotary tool imprinting should be evident.

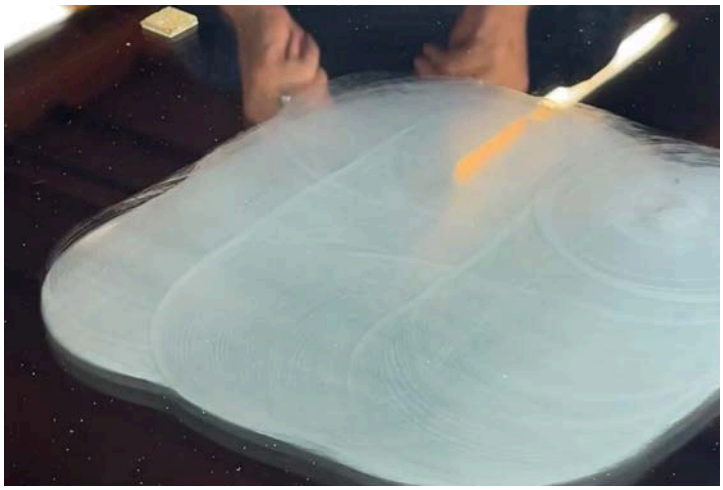


Fig. 4610E

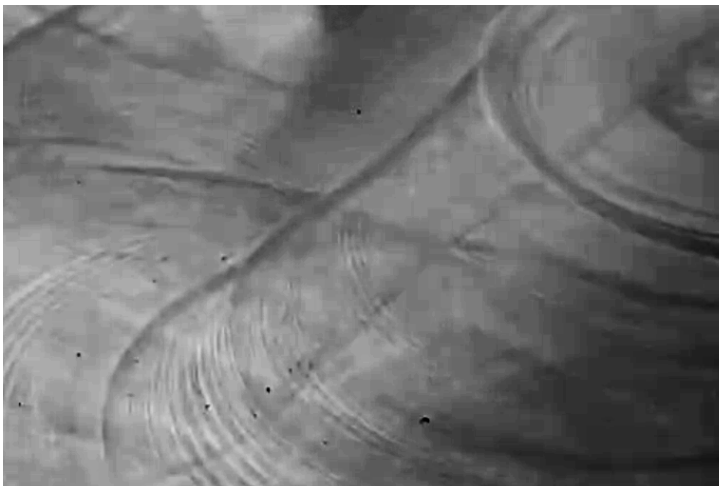


Fig. 4610F

Notes:

C 4.6.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

C 4.6.2.2 - Mid Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 1800 RPM.
2. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
3. Engage the polisher's power trigger, and trigger lock.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern (Fig. 4220A - D). Maintain uniform pressure.
5. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger.
8. Ensure the Grey RenuDisk surface is completely coated in glass stock.
9. Continue to High Speed Pre-Polish.

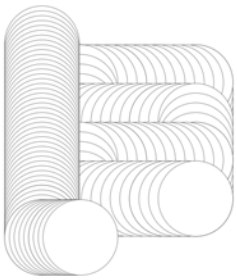


Fig. 4620A

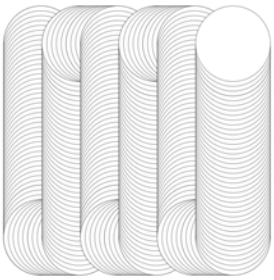


Fig. 4620B

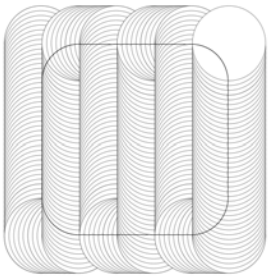


Fig. 4620C

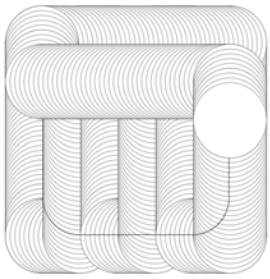


Fig. 4620D

Important Notes on Mid Speed Pre-Polish:

- It is important to expand the work area established in Step One.
- The Grey RenuDisk will create a light haze around the outside edge of the work area as it is expanded (Fig. 4222A -B). After several passes, the Grey RenuDisk will accumulate glass stock on its surface. As this happens, the quality of the haze will quickly begin to change.



Fig. 4621A

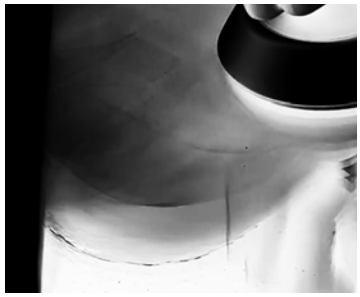


Fig. 4621B

- **Disk**: The Grey RenuDisk should be fully coated in glass stock by the end of the Mid Speed Pre-Polish. **DO NOT** clean the disk before proceeding.The glass stock should be bubbly and flaky in consistency for best High Speed Pre-Polish results.
- **Haze**: All light rotary imprinting should be fully removed. The haze should be light, "milky" white in color, consistent from edge to edge. Light concentric circles in the path of the disk will be evident.

C 4.2.2.3 - High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].



Fig. 4623A

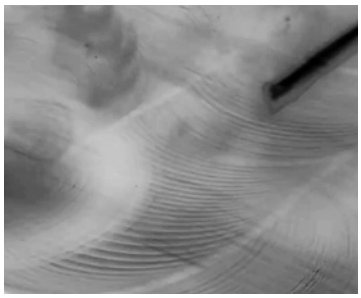


Fig. 4623B

Important Notes on High Speed Pre-Polish:

- It is important to expand the work area established in the Mid Speed Pre-Polish sub-section.
- **Haze**: The Mid Speed and High Speed Pre-Polish sections look very similar. There will be a light reduction in haze, and the concentric circling will appear closer together, or tighter. It is imperative in this step to maintain sharp clean edges and transitions around the edge of the entire work area.

C 4.6.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

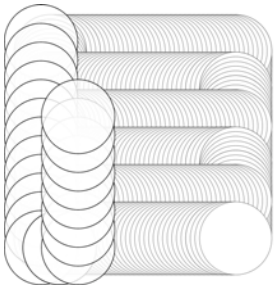


Fig. 4630A

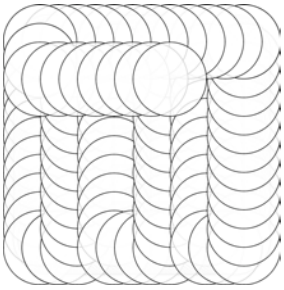


Fig. 4630B

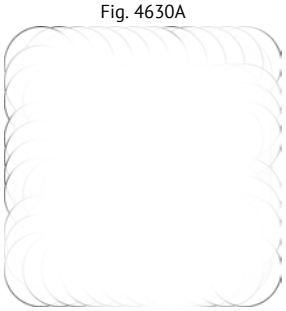


Fig. 4630C

Fig. 4630D





Notes:

C 4.7.0.0 - Category Four (CAT-4): Heavy Damage

CAT-4 Damage encompasses the most extreme damage that can be restored. Using a Red RenuDisk, we can remove damage ranging from severe chemical etching and burning, to molten metal and other welding slag, diamond and carbide tooling,

DAMAGE TYPES:
Severe Scratches
Graffiti Scratch- Medium
Graffiti Scratch- Heavy
Metallic Overspray
Media Blast Damage
Welding Slag
Glass Chipping
Heavy Acid





IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow. Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80℉ Δ	N/A
Tempered	+120℉ Δ	N/A
Laminate- Annealed	+80℉ Δ	145℉
Laminate- Tempered	+120℉ Δ	145℉
Mirrored	+80℉ Δ	N/A

TIME ADVISORY	Approximate Time per Square Foot
Severe Scratches	25+ mins.
Graffiti Scratch- Medium	25+ mins.
Graffiti Scratch- Heavy	25+ mins.
Metallic Overspray	35+ mins.
Media Blast Damage	40+ mins.
Welding Slag	45+ mins.
Glass Chipping	120+ mins.
Heavy Acid	60+ mins.

IMPORTANT NOTE:

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Red RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

C 4.7.1.0 - Step One: Abrasion utilizes a Red RenuDisk to quickly remove target damage.

1. Secure a Red RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern.
6. After every 2-3 full passes over the entire work area, if the damage has not been removed, expand the work area by ~25%. Continue repeating this step until all damage has been removed.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger. Ensure the disk is stationary.
9. Detach the Red RenuDisk.
10. Continue to [Step Two: Pre-Polish].

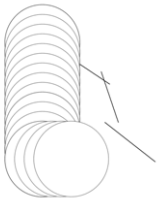


Fig. 4710A



Fig. 4710B

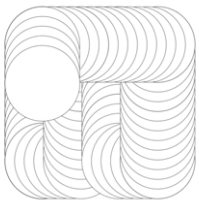


Fig. 4710C

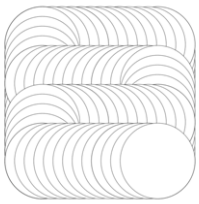


Fig. 4710D

Important Notes on Step One: Abrasion:

- All target damage must be removed during Step One. Expand as far as is necessary to remove all damage. If physical constraints such as a window frame or edge have been met, it is likely that some optical distortion will be present.
- Keep the two additional necessary expansions in the subsequent step, Step Two, in mind during the expansion process.
- **Disk**: The red RenuDisk may need to be cleaned during the abrasion process, depending on the size of the repair. Disks can be cleaned, gently removed, and saved if the abrasive surface is still intact after the repair.
- **Haze**: After all damage is removed, the haze on the glass should appear thickly frosted white. Both concentric circling from the disk, and underlying criss-crossing rotary tool imprinting should be evident.

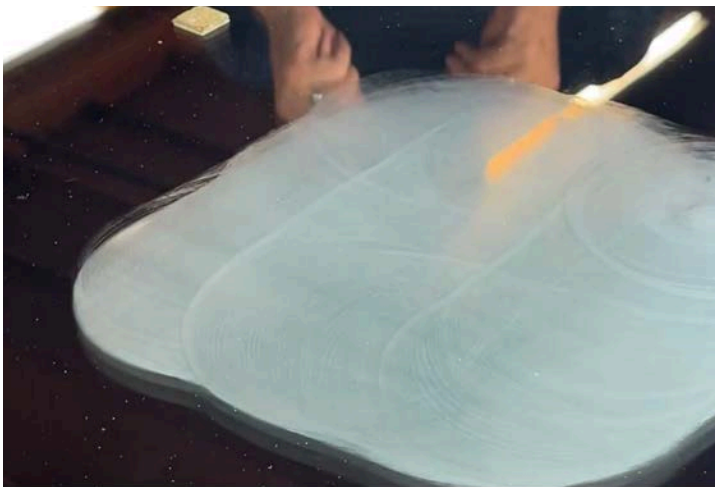


Fig. 4710E

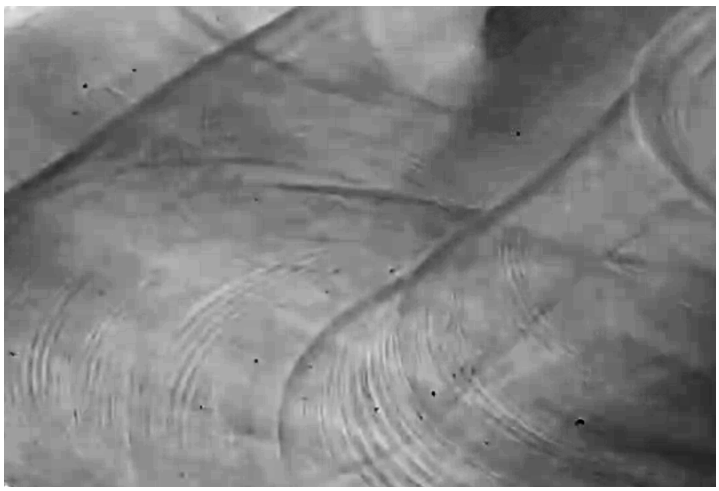


Fig. 4710F

Notes:

C 4.7.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

C 4.7.2.1 - Mid Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 1800 RPM.
2. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
3. Engage the polisher's power trigger, and trigger lock.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern (Fig. 4720A - D). Maintain uniform pressure.
5. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger.
8. Ensure the Grey RenuDisk surface is completely coated in glass stock.
9. Continue to High Speed Pre-Polish.

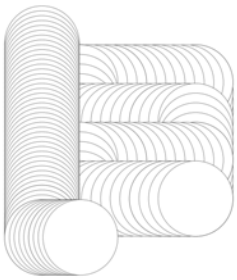


Fig. 4720A

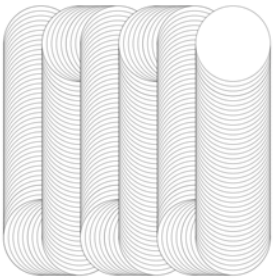


Fig. 4720B

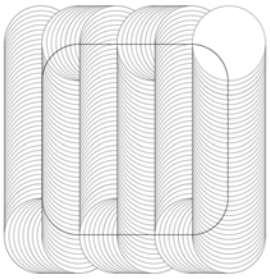


Fig. 4720C

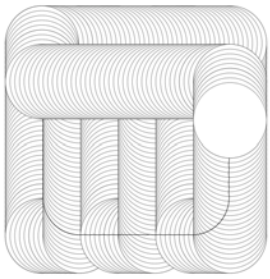


Fig. 4720D

Important Notes on Mid Speed Pre-Polish:

- It is important to expand the work area established in Step One.
- The Grey RenuDisk will create a light haze around the outside edge of the work area as it is expanded (Fig. 4222A -B). After several passes, the Grey RenuDisk will accumulate glass stock on its surface. As this happens, the quality of the haze will quickly begin to change.



Fig. 4721A

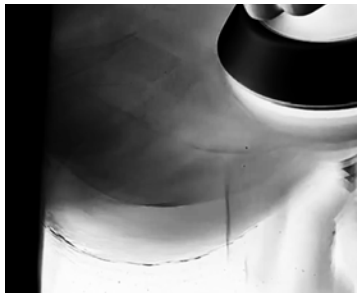


Fig. 4721B

- **Disk**: The Grey RenuDisk should be fully coated in glass stock by the end of the Mid Speed Pre-Polish. **DO NOT** clean the disk before proceeding.The glass stock should be bubbly and flaky in consistency for best High Speed Pre-Polish results.
- **Haze**: All light rotary imprinting should be fully removed. The haze should be light, "milky" white in color, consistent from edge to edge. Light concentric circles in the path of the disk will be evident.

C 4.7.2.2 - High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].



Fig. 4723A

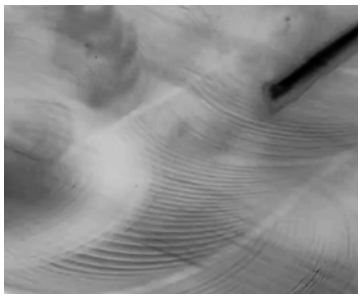


Fig. 4723B

Important Notes on High Speed Pre-Polish:

- It is important to expand the work area established in the Mid Speed Pre-Polish sub-section.
- **Haze**: The Mid Speed and High Speed Pre-Polish sections look very similar. There will be a light reduction in haze, and the concentric circling will appear closer together, or tighter. It is imperative in this step to maintain sharp clean edges and transitions around the edge of the entire work area.

C 4.7.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

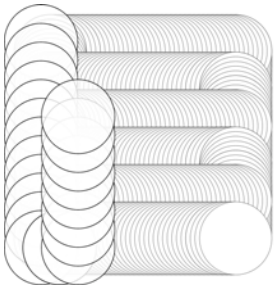


Fig. 4730A

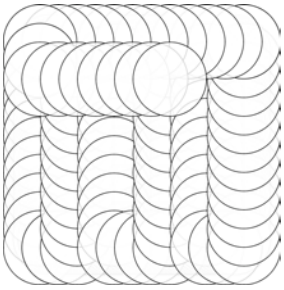


Fig. 4730B

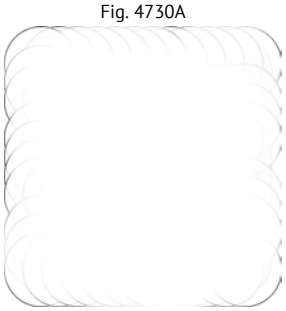


Fig. 4730C

Fig. 4730D





Notes:

C 5.0.0.0- Our Process II: Damage Specification Sheets

C 5.1.0.0 - Suction Cup Rings [CAT-1]

APPROXIMATE TIME PER SQUARE FOOT: 3 - 5 minutes

Suction Cup Rings on glass surfaces are a faint but discernible imperfection, often encountered after the use of suction cups on the pane. The result is a slight but noticeable alteration in the glass's surface appearance, which may affect both its aesthetic and optical qualities.



Fig. 5100A

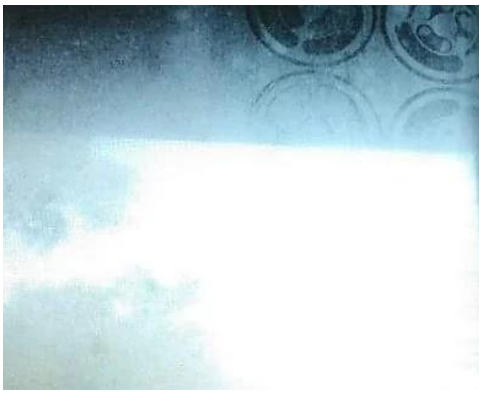


Fig. 5100B

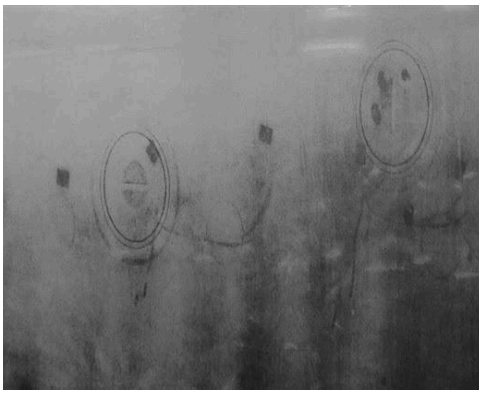


Fig. 5100C

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80℉ Δ	N/A
Tempered	+120℉ Δ	N/A
Laminate- Annealed	+80℉ Δ	145℉
Laminate- Tempered	+120℉ Δ	145℉
Mirrored	+80℉ Δ	N/A

Fig. 5100D

Tool Checklist

- [ ] Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- [ ] Backing Pad
- [ ] Foam Finishing Disk(s)
- [ ] Cutting Compound
- [ ] Polishing Felt
- [ ] Polishing Compound
- [ ] Rasp
- [ ] IR Thermometer
- [ ] PPE

Workspace Checklist

- [ ] Power Access
- [ ] Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- [ ] Masking Tools
- [ ] Drop Clothes/ Tarps/ Waste Receptacles
- [ ] Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- [ ] Confirm Glass Type
- [ ] Confirm Damage Type
- [ ] Inspect Glass System Integrity (Framing, Glazing, Etc.)
- [ ] Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- [ ] Identify Damage Location(s)

Notes:

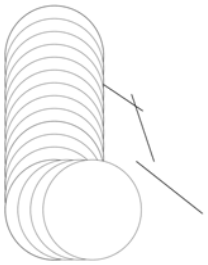


Fig. 5110A



Fig. 5110B

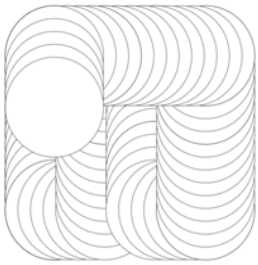


Fig. 5110C



Fig. 5110D

C 5.1.1.0 - Step One: Cutting utilizes a Foam Finishing Disk to quickly remove target damage.

1. Secure a Foam Finishing Disk to the designated backing pad.
2. apply 1/4 - 1/2 oz. of Cutting Compound to the surface of the Foam Finishing Disk.
3. Adjust the polisher to operate at a rotational speed of 600 RPM.
4. Align the Foam Finishing Disk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Engage the polisher's power trigger, and trigger lock.
6. Employ a systematic cutting approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue cutting until all damage has been removed.
7. Disengage the Foam Finishing Disk from the glass pane.
8. Disengage the polisher's power trigger. Ensure the disk is stationary.
9. Detach the Foam Finishing Disk.
10. Continue to [Step Two: Polish].

NOTE: Over the course of cutting, it may be necessary to reapply Cutting Compound to the Foam Finishing Disk. If the Cutting Compound has been fully worked into the glass, or if the Cutting Compound becomes dry on the pane:

- **Disengage the polisher, ensuring the disk is stationary.**
- **apply 1/4 - 1/2 oz. of Cutting Compound to the surface of the Foam Finishing Disk.**



Fig. 5110E



Fig. 5110F



Fig. 5110G

Notes:

C 5.1.2.0 - Step Two: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

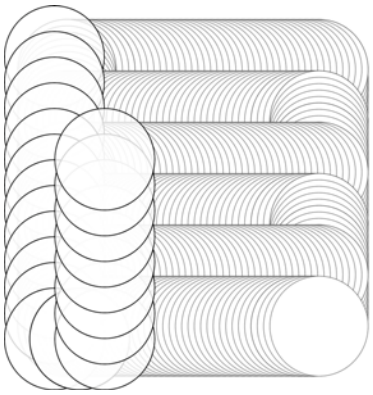


Fig. 5120A

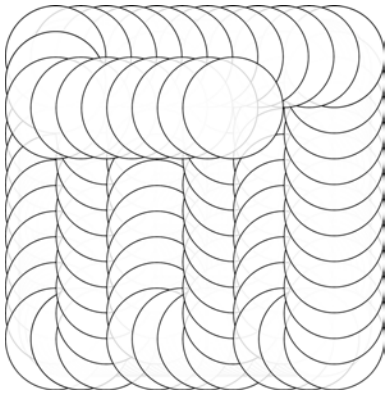


Fig. 5120B

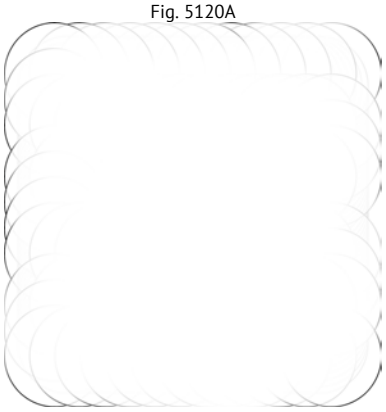


Fig. 5120C

Fig. 5120D



Fig. 5120E



Fig. 5120F

Notes:

C 5.2.0.0 - Heat Haze [CAT-1]

APPROXIMATE TIME PER SQUARE FOOT: 3 - 5 minutes

Heat haze on glass surfaces is a faint but discernible imperfection, often encountered in the aftermath of an improperly calibrated tempering process. This form of haze resembles surface oxidation and typically arises when the tempering oven's settings are not accurately tuned to the current atmospheric conditions. The result is a slight but noticeable alteration in the glass's surface appearance, which may affect both its aesthetic and optical qualities.



Fig. 5200A



Fig. 5200B

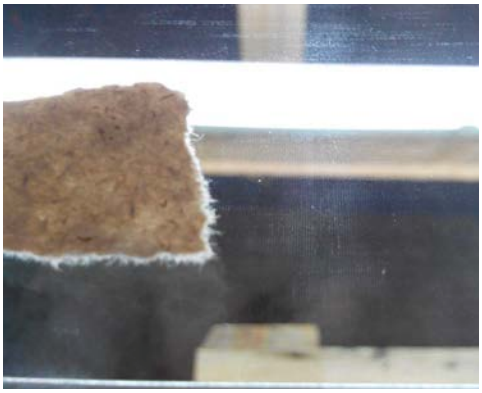


Fig. 5200C

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 5200D

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Foam Finishing Disk(s)
- ☐ Cutting Compound
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

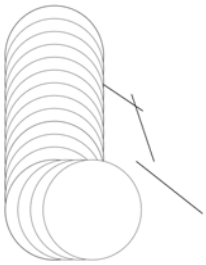


Fig. 5210A



Fig. 5210B

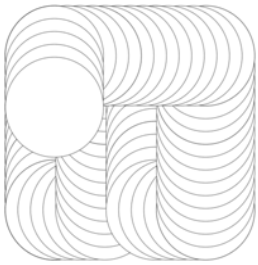


Fig. 5210C



Fig. 5210D

C 5.2.1.0 - Step One: Cutting utilizes a Foam Finishing Disk to quickly remove target damage.

1. Secure a Foam Finishing Disk to the designated backing pad.
2. apply 1/4 - 1/2 oz. of Cutting Compound to the surface of the Foam Finishing Disk.
3. Adjust the polisher to operate at a rotational speed of 600 RPM.
4. Align the Foam Finishing Disk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Engage the polisher's power trigger, and trigger lock.
6. Employ a systematic cutting approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue cutting until all damage has been removed.
7. Disengage the Foam Finishing Disk from the glass pane.
8. Disengage the polisher's power trigger. Ensure the disk is stationary.
9. Detach the Foam Finishing Disk.
10. Continue to [Step Two: Polish].

NOTE: Over the course of cutting, it may be necessary to reapply Cutting Compound to the Foam Finishing Disk. If the Cutting Compound has been fully worked into the glass, or if the Cutting Compound becomes dry on the pane:

- **Disengage the polisher, ensuring the disk is stationary.**
- **apply 1/4 - 1/2 oz. of Cutting Compound to the surface of the Foam Finishing Disk.**



Fig. 5210E



Fig. 5210F



Fig. 5210G

Notes:

C 5.2.2.0 - Step Two: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

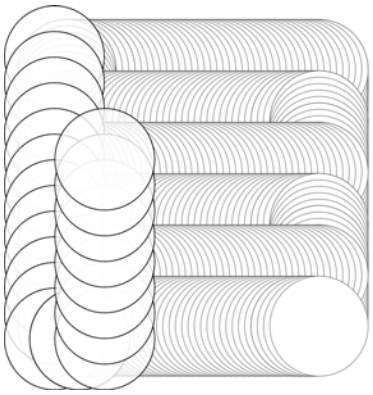


Fig. 5220A

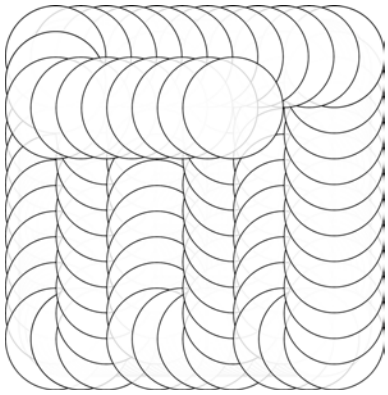


Fig. 5220B

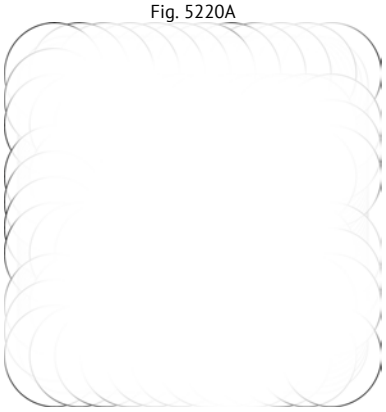


Fig. 5220C

Fig. 5220D



Fig. 5220E



Fig. 5220F

Notes:

C 5.3.0.0 - Hard Water Deposits [CAT-1]

APPROXIMATE TIME PER SQUARE FOOT: 4 - 7 minutes

Light hard water deposits are characterized by the accumulation of salt residues lightly adhered to glass surfaces. These deposits predominantly consist of alkaline minerals and are the direct result of the glass's exposure to water with a high Total Dissolved Solids (TDS) content. Typically, water with a TDS exceeding 20 parts per million is prone to leaving behind these mineral traces as it evaporates. In the initial stages, these deposits rest on the glass surface, beginning the process of forming ionic bonds with the trace elements found in the glass's outermost layers. This early stage of deposit formation is crucial for restoration efforts, as the bonds have not yet fully solidified, making the deposits easier to remove.



Fig. 5300A



Fig. 5300B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 5300C

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Foam Finishing Disk(s)
- ☐ Cutting Compound
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

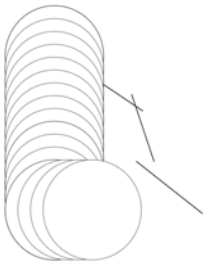


Fig. 5310A



Fig. 5310B

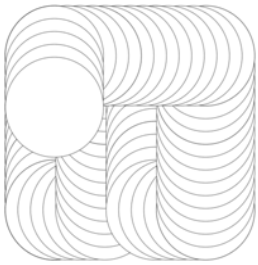


Fig. 5310C



Fig. 5310D

C 5.3.1.0 - Step One: Cutting utilizes a Foam Finishing Disk to quickly remove target damage.

1. Secure a Foam Finishing Disk to the designated backing pad.
2. apply 1/4 - 1/2 oz. of Cutting Compound to the surface of the Foam Finishing Disk.
3. Adjust the polisher to operate at a rotational speed of 600 RPM.
4. Align the Foam Finishing Disk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Engage the polisher's power trigger, and trigger lock.
6. Employ a systematic cutting approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue cutting until all damage has been removed.
7. Disengage the Foam Finishing Disk from the glass pane.
8. Disengage the polisher's power trigger. Ensure the disk is stationary.Detach the Foam Finishing Disk.
9. Continue to [Step Two: Polish].

NOTE: Over the course of cutting, it may be necessary to reapply Cutting Compound to the Foam Finishing Disk. If the Cutting Compound has been fully worked into the glass, or if the Cutting Compound becomes dry on the pane:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Apply 1/4 - 1/2 oz. of Cutting Compound to the surface of the Foam Finishing Disk.**



Fig. 5310E



Fig. 5310F



Fig. 5310G

Notes:

C 5.3.2.0 - Step Two: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

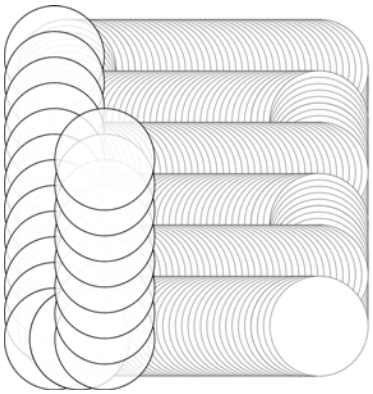


Fig. 5320A

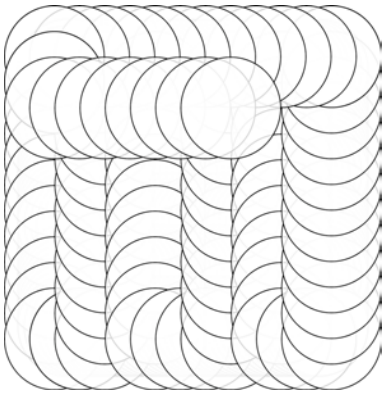


Fig. 5320B

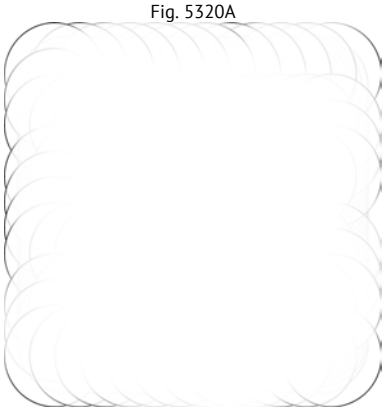


Fig. 5320C

Fig. 5320D



Fig. 5320E



Fig. 5320F

Notes:

C 5.4.0.0 - Hard Water Staining [CAT-1]

APPROXIMATE TIME PER SQUARE FOOT: 7 - 12 minutes

Light hard water staining is a subtle yet persistent issue that arises when dissolved minerals in water achieve prolonged contact with glass surfaces. This prolonged exposure, particularly at certain concentrations, leads to the encapsulation of the underlying glass by these deposits. As a result, a robust chemical bonding occurs between the trace minerals within the glass and the residual dissolved minerals on its surface.

The hallmark of light staining is its appearance as a darker shadow or "stain" on the glass surface, which becomes evident after the surface deposits have been removed. This staining subtly permeates the outer layer of the glass, marking a change in its visual clarity. However, in cases of light staining, technicians can still observe areas of clear, unstained glass amidst the spots of deposit. This distinguishing feature is key to identifying the extent of the staining and formulating an appropriate restoration strategy. Addressing light hard water staining involves techniques that target both the removal of surface deposits and the mitigation of the underlying stains, to restore the glass to its original clarity.



Fig. 5400A



Fig. 5400B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 5400C

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Foam Finishing Disk(s)
- ☐ Cutting Compound
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

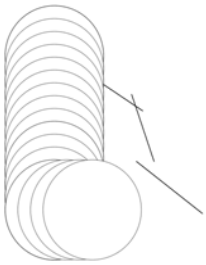


Fig. 5410A



Fig. 5410B

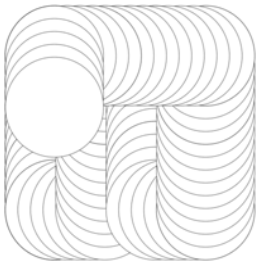


Fig. 5410C



Fig. 5410D

C 5.4.1.0 - Step One: Cutting utilizes a Foam Finishing Disk to quickly remove target damage.

1. Secure a Foam Finishing Disk to the designated backing pad.
2. apply 1/4 - 1/2 oz. of Cutting Compound to the surface of the Foam Finishing Disk.
3. Adjust the polisher to operate at a rotational speed of 600 RPM.
4. Align the Foam Finishing Disk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Engage the polisher's power trigger, and trigger lock.
6. Employ a systematic cutting approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue cutting until all damage has been removed.
7. Disengage the Foam Finishing Disk from the glass pane.
8. Disengage the polisher's power trigger. Ensure the disk is stationary.
9. Detach the Foam Finishing Disk.
10. Continue to [Step Two: Polish].

NOTE: Over the course of cutting, it may be necessary to reapply Cutting Compound to the Foam Finishing Disk. If the Cutting Compound has been fully worked into the glass, or if the Cutting Compound becomes dry on the pane:

- **Disengage the polisher, ensuring the disk is stationary.**
- **apply 1/4 - 1/2 oz. of Cutting Compound to the surface of the Foam Finishing Disk.**



Fig. 5410E



Fig. 5410F



Fig. 5410G

Notes:

C 5.4.2.0 - Step Two: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

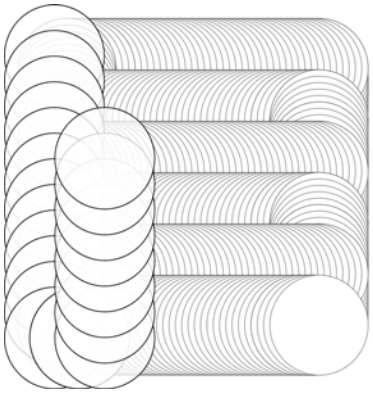


Fig. 5420A

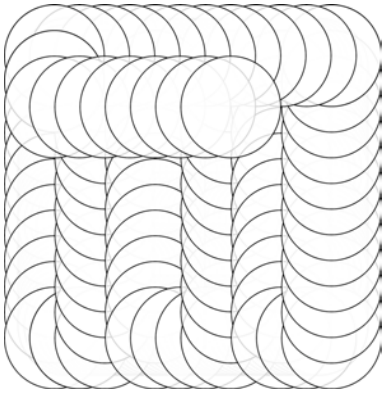


Fig. 5420B

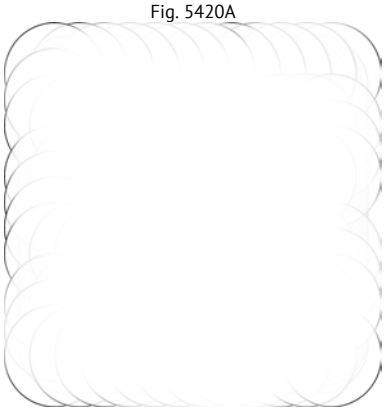


Fig. 5420C

Fig. 5420D



Fig. 5420E



Fig. 5420F

Notes:

C 5.5.0.0 - Hard Water Etching [CAT-2]

APPROXIMATE TIME PER SQUARE FOOT: 12 - 15 minutes

Light hard water etching is a more advanced stage of glass surface deterioration that evolves from persistent hard water staining, especially in environments where the glass continues to be exposed to water with high levels of dissolved solids. The transition from staining to etching is marked by the point at which the dissolved minerals begin to covalently bond with the trace minerals and oxides in the outer layer of the glass pane. This chemical interaction leads to the active erosion of the glass's surface, causing noticeable surface modeling and morphological alterations to its structure.

Typically, this kind of damage is indicative of long-term neglect; however, in areas where the water supply has extremely high levels of dissolved solids, such etching can manifest relatively quickly, potentially within a 12-18 month timeframe. Light hard water etching presents a significant challenge in glass restoration, as it moves beyond mere surface discoloration to actual physical changes in the glass. Restoration at this stage requires not only removing the visible signs of etching but also addressing the subtle yet fundamental changes to the glass's surface structure to restore its original clarity and integrity.

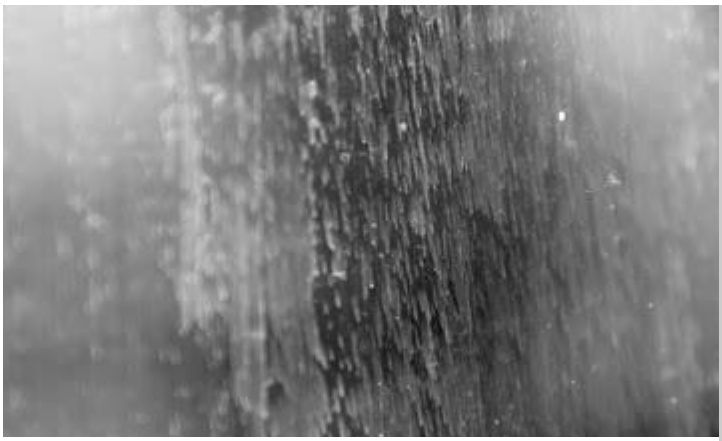


Fig. 5500A



Fig. 5500B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80℉ Δ	N/A
Tempered	+120℉ Δ	N/A
Laminate- Annealed	+80℉ Δ	145℉
Laminate- Tempered	+120℉ Δ	145℉
Mirrored	+80℉ Δ	N/A

Fig. 5500C

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Black RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

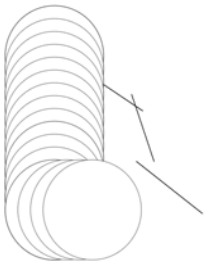


Fig. 5510A



Fig. 5510B



Fig. 5510C



Fig. 5510D

C 5.5.1.0 - Step One: Abrasion utilizes a Black RenuDisk to quickly remove target damage.

1. Secure a Black RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Black RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**

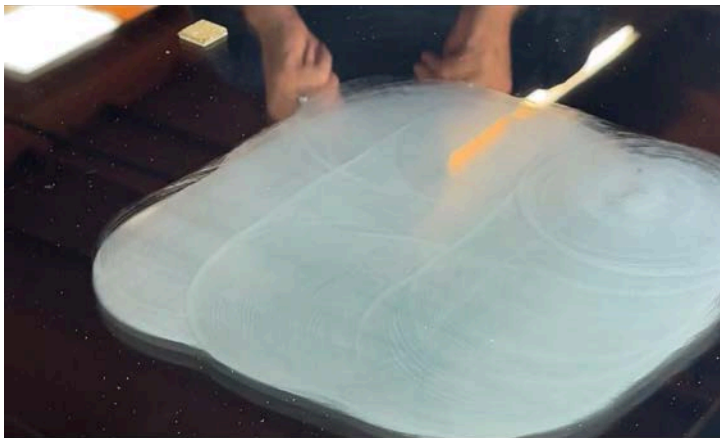


Fig. 5510E



Fig. 5510F

Notes:

C 5.5.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

C 5.5.2.1 - MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

C 5.5.2.2 - High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.

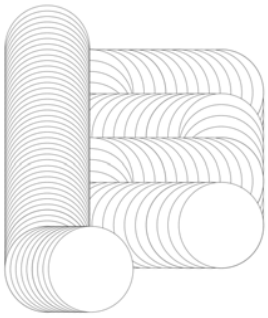


Fig. 5520A

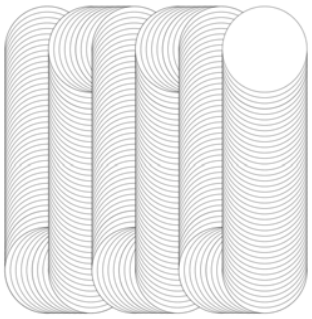


Fig. 5520B

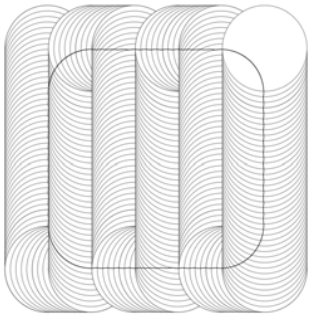


Fig. 5520C

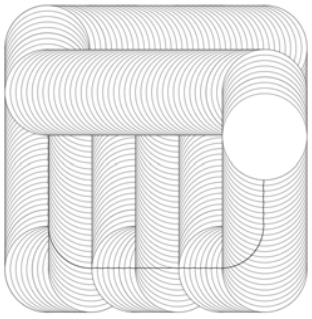


Fig. 5520D



Fig. 5520E

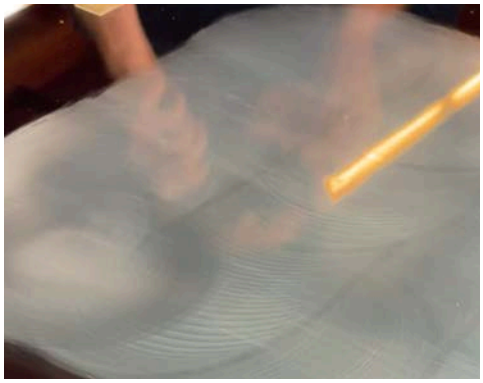


Fig. 5520F

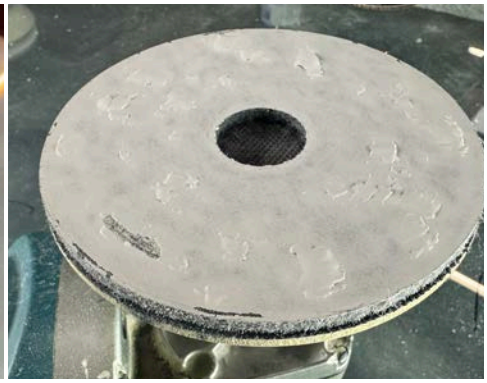


Fig. 5520G

C 5.5.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

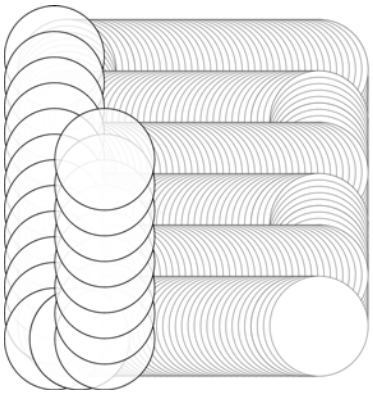


Fig. 5530A

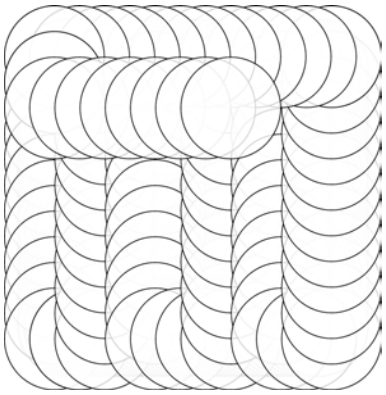


Fig. 5530B

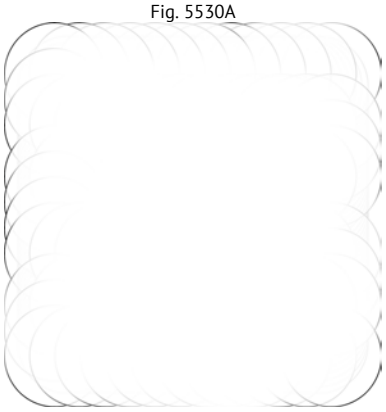


Fig. 5530C

Fig. 5530D



Fig. 5530E



Fig. 5530F

Notes:

C 5.6.0.0 - Fines and Ticks [CAT-2]

APPROXIMATE TIME PER SQUARE FOOT: 15 - 20 minutes

Fines and ticks are specific types of surface damage characterized by fine, localized scratches on glass. This form of damage typically occurs when micro-crystals, protruding slightly from the glass surface, become dislodged and are subsequently dragged across it. Historically referred to as 'fabrication debris,' these defects are now more commonly known as fines and ticks.

The characteristic manifestation of this damage is a prominent single point scratch, often trailed by a finer, hairline drag mark. These marks are typically the result of cleaning or handling tools, such as razor blades or other instruments, which inadvertently dislodge, trap, and then drag the micro-crystal across the glass surface. The nature of fines and ticks suggests a delicate surface interaction, where even minimal contact can result in noticeable scratching.

Addressing fines and ticks in glass restoration involves a meticulous process. The approach needs to carefully remove the micro-crystals and mitigate the scratches while preserving the overall integrity of the glass. Given the subtlety of such scratches, the restoration process must be precise and controlled to effectively restore the glass to its original state without exacerbating the existing damage.

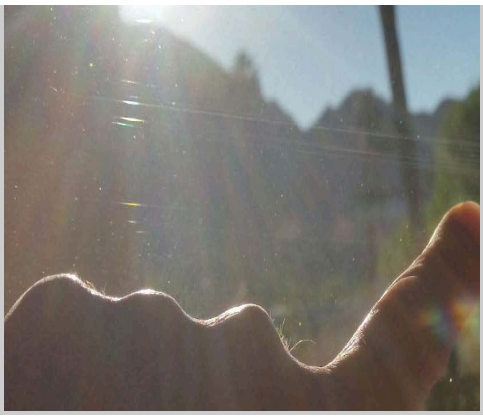


Fig. 5600A

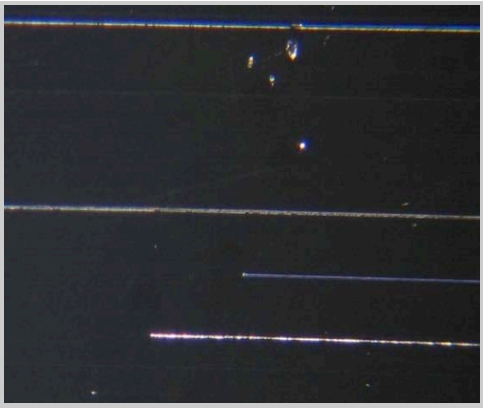


Fig. 5600B



Fig. 5600C

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 5600

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Black RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

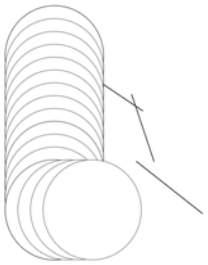


Fig. 5610A



Fig. 5610B



Fig. 5610C



Fig. 5610D

C 5.6.1.0 - Step One: Abrasion utilizes a Black RenuDisk to quickly remove target damage.

1. Secure a Black RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Black RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 5610E



Fig. 5610F

Notes:

C 5.6.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

C 5.6.2.2 - MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

C 5.6.2.3 - High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.

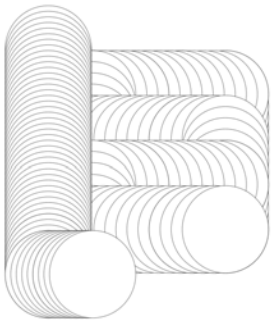


Fig. 5620A

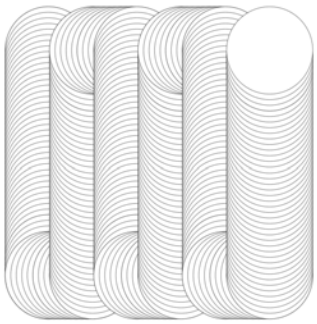


Fig. 5620B

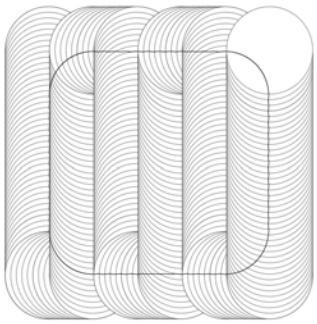


Fig. 5620C

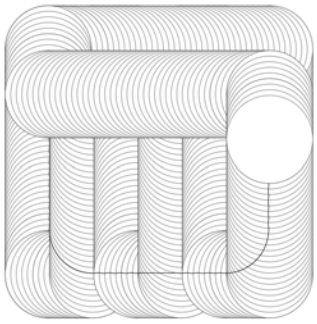


Fig. 5620D



Fig. 5620E

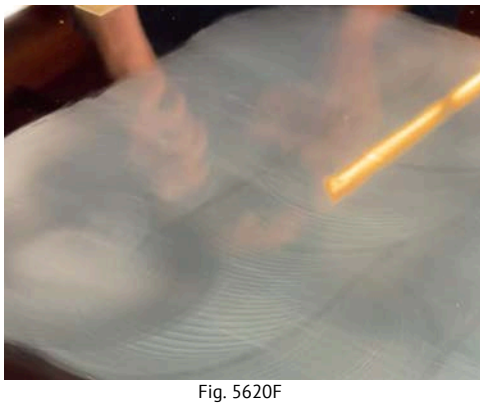


Fig. 5620F

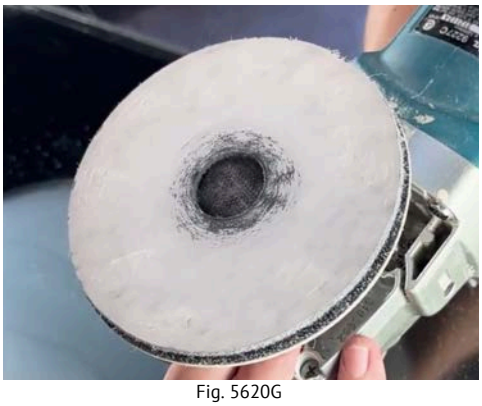


Fig. 5620G

C 5.6.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

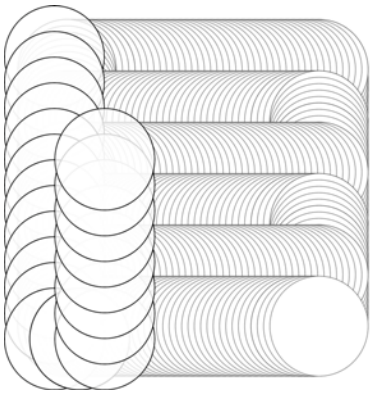


Fig. 5630A

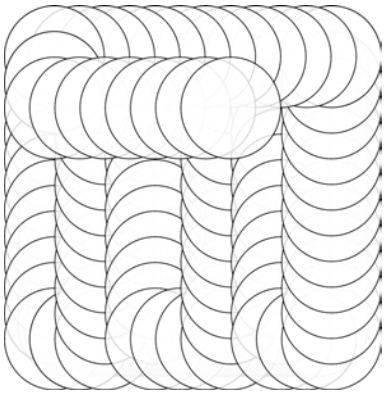


Fig. 5630B

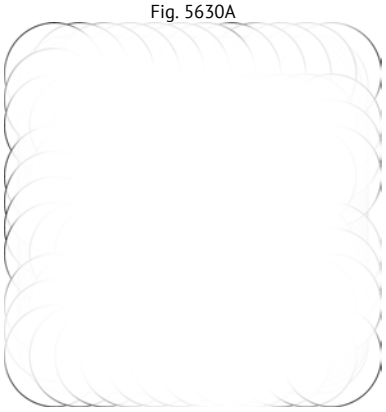


Fig. 5630C

Fig. 5630D



Fig. 5630E



Fig. 5630F

Notes:

C 5.7.0.0 - Cleaning Abrasives [CAT-2]

APPROXIMATE TIME PER SQUARE FOOT: 15 - 20 minutes

Damage caused by cleaning abrasives is a common issue in glass care, often resulting from the use of abrasive sponge materials or steel wool during cleaning processes. Notably, while white abrasive sponge materials are generally safe for glass, the green and blue variants can frequently cause scratches. These abrasive-induced scratches typically manifest as spider web-like patterns, characterized by swirls or omnidirectional marks. Although these scratches may not be detectable by a fingernail, they often become more pronounced and visible under direct sunlight.

In professional window cleaning, steel wool of grade 0000 is frequently employed to remove organic materials that have adhered to glass surfaces. While this fine grade of steel wool usually does not scratch glass surfaces under dry conditions, its interaction with water can lead to rapid oxidation, forming iron oxide (FeO2). Iron oxide is notably harder than glass, which can result in scratches similar to those caused by scrub sponges.

In the restoration of glass surfaces damaged by cleaning abrasives, the approach must be twofold: removing the superficial scratches and ensuring the complete eradication of any residual abrasive particles. This process requires a careful balance of techniques to effectively diminish the appearance of the scratches while maintaining the structural integrity of the glass, especially when dealing with the microscopic abrasions that are less perceptible to touch but visually apparent.



Fig. 5700A



Fig. 5700B



Fig. 5700C

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 5700D

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Black RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

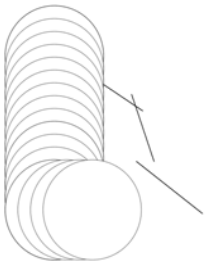


Fig. 5710A



Fig. 5710B



Fig. 5710C



Fig. 5710D

C 5.7.1.0 - Step One: Abrasion utilizes a Black RenuDisk to quickly remove target damage.

1. Secure a Black RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Black RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**

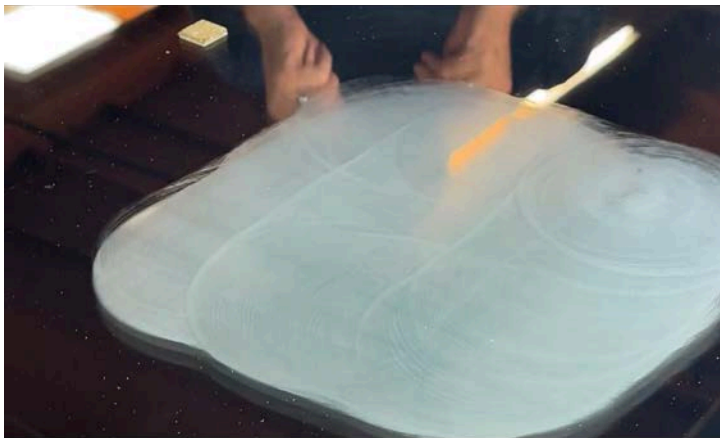


Fig. 5710E



Fig. 5710F

Notes:

C 5.7.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

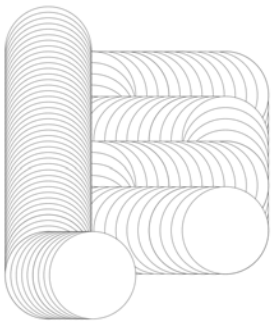
NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

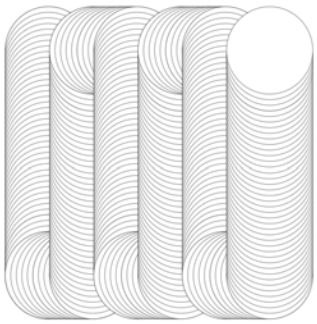
- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

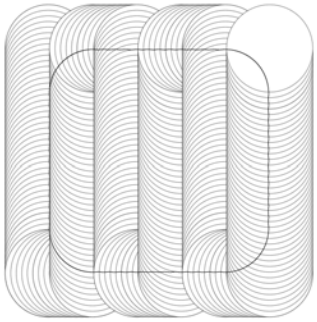
High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.


Fig. 5720A


Fig. 5720B


Fig. 5720C

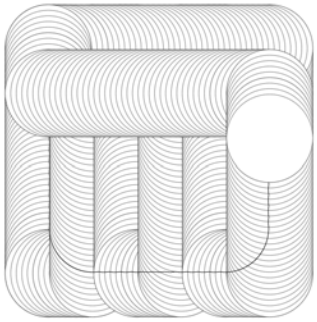
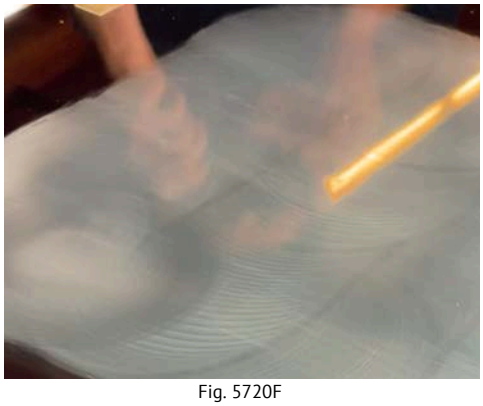
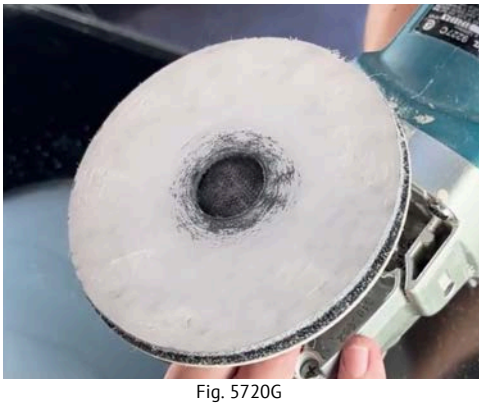

Fig. 5720D


Fig. 5720E


Fig. 5720F


Fig. 5720G

C 5.7.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

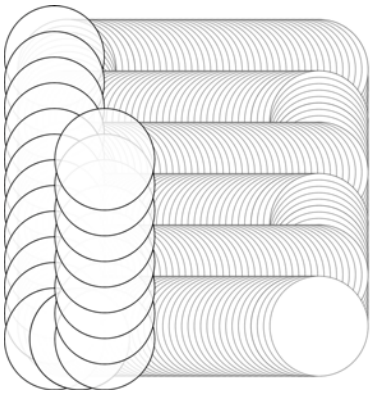


Fig. 5730A

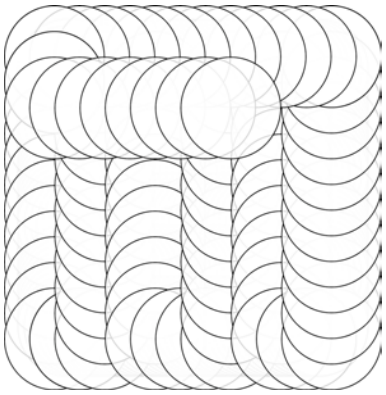


Fig. 5730B

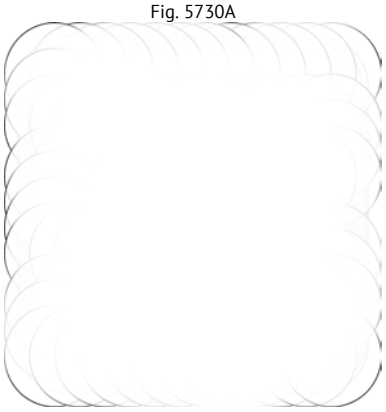


Fig. 5730C

Fig. 5730D



Fig. 5730E



Fig. 5730F

Notes:

C 5.8.0.0 - Metallic Rub [CAT-2]

APPROXIMATE TIME PER SQUARE FOOT: 12 - 15 minutes

Metallic rub damage on glass typically arises when soft metals, such as aluminum or iron, come into contact with and are dragged across the glass surface. While these marks may initially appear to be scratches etched into the glass, they are often more accurately described as micro-deposits of metal that have become embedded within the surface structure of the glass. This kind of damage is especially common in environments where aluminum ladders are frequently used or where decorative ironwork is installed near glass surfaces.

The visual appearance of metallic rub damage can be deceptive; what seems like a scratch might actually be a thin layer of metal transferred to the glass. Addressing this type of damage requires a careful approach that focuses on removing the metallic deposits without causing additional scratches to the glass surface. The restoration process often involves the use of specialized compounds designed to lift and dissolve these metal deposits, thereby restoring the clarity and integrity of the glass without compromising its structural strength.



Fig. 5800A



Fig. 5800B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 5800C

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Black RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

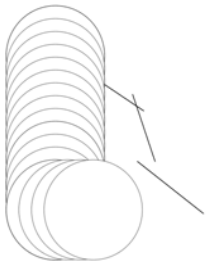


Fig. 5810A



Fig. 5810B

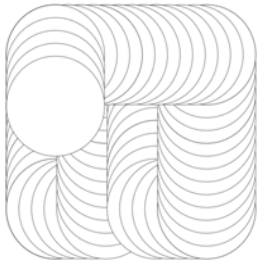


Fig. 5810C



Fig. 5810D

C 5.8.1.0 - Step One: Abrasion utilizes a Black RenuDisk to quickly remove target damage.

1. Secure a Black RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Black RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 5810E



Fig. 5810F

Notes:

C 5.8.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.

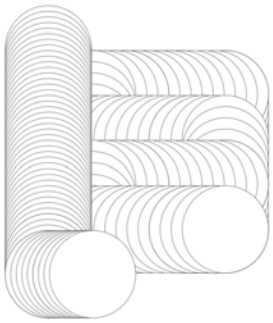


Fig. 5820A

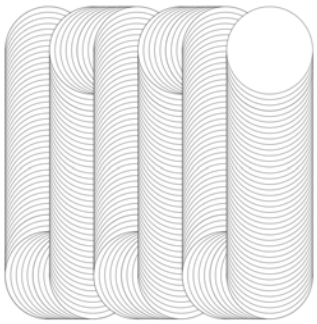


Fig. 5820B

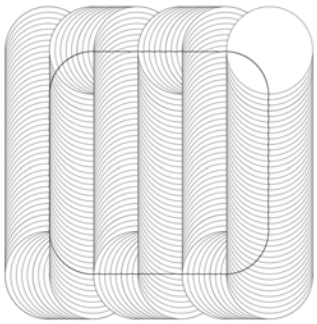


Fig. 5820C

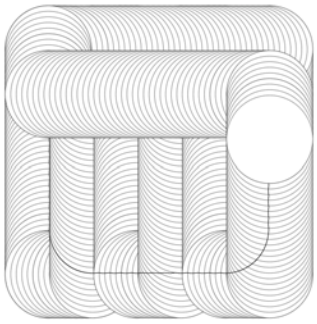


Fig. 5820D



Fig. 5820E

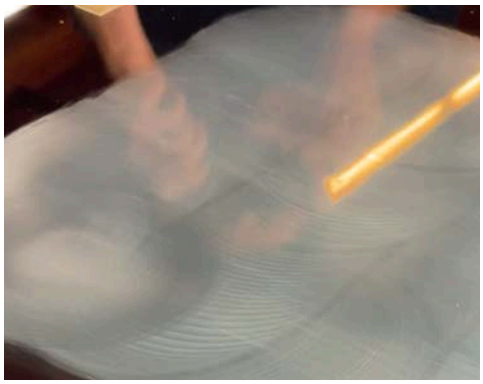


Fig. 5820F

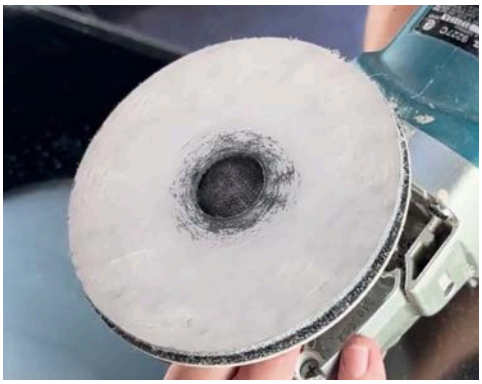


Fig. 5820G

C 5.8.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

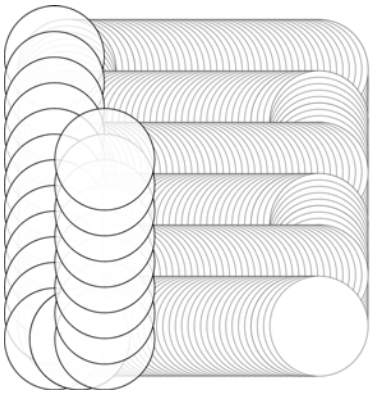


Fig. 5830A

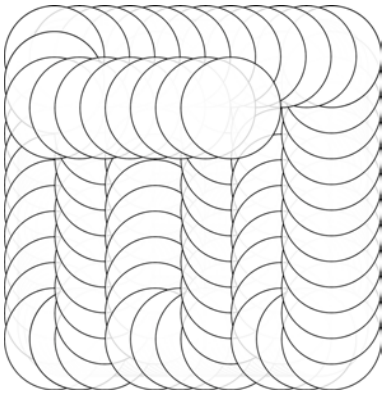


Fig. 5830B

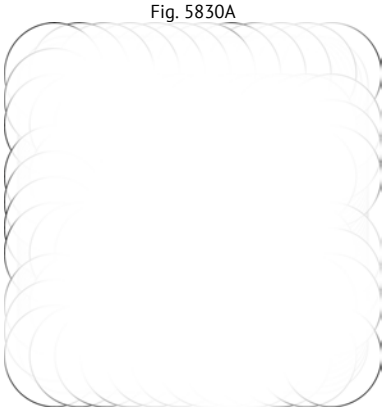


Fig. 5830C

Fig. 5830D



Fig. 5830E



Fig. 5830F

Notes:

C 5.9.0.0 - Glass on Glass [CAT-2]

APPROXIMATE TIME PER SQUARE FOOT: 15 - 20 minutes

Glass on glass damage is a specific type of impairment that occurs when two glass surfaces come into contact and are rubbed or dragged against each other. This interaction typically leaves a tactile scratch on the surface, distinguishable by its texture, which can be felt with a fingernail. Visually, these scratches often appear as “dusty” white lines, marking the points of friction between the glass surfaces.

This form of damage is most commonly seen during the construction phase or in the manufacturing process of glass panels. It can occur on job sites or within assembly houses where multiple glass panels are handled or transported in close proximity to one another. The likelihood of such damage underscores the need for careful handling and adequate protective measures during the movement and installation of glass panels.

Restoration of glass on glass damage requires a nuanced approach, focusing on gently smoothing out the tactile scratches and restoring the uniformity of the glass surface. This process often involves the use of fine abrasives and polishing compounds, carefully applied to remove the superficial layer of damage while maintaining the integrity of the glass. Precision and care are key in ensuring the glass is restored to its original clarity without introducing further damage.

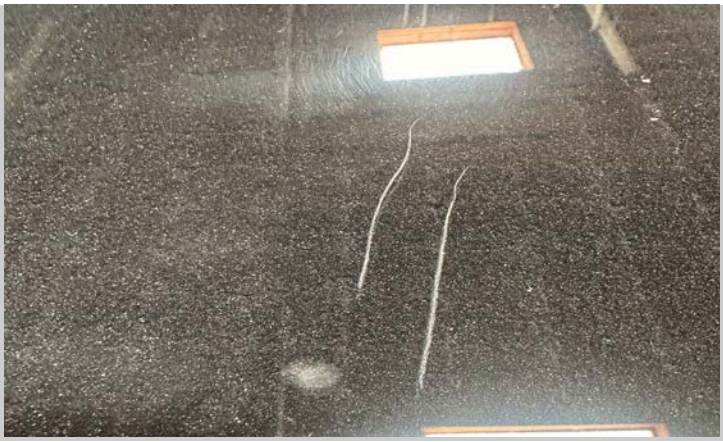


Fig. 5900A



Fig. 5900B

IMPORTANT NOTE: During the glass restoration process, it’s crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80˚F Δ	N/A
Tempered	+120˚F Δ	N/A
Laminate- Annealed	+80˚F Δ	145˚F
Laminate- Tempered	+120˚F Δ	145˚F
Mirrored	+80˚F Δ	N/A

Fig. 5900C

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Black RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

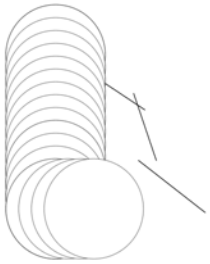


Fig. 5910A



Fig. 5910B

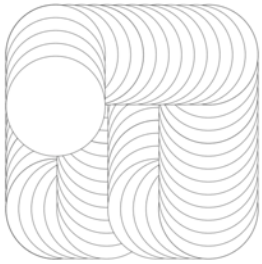


Fig. 5910C

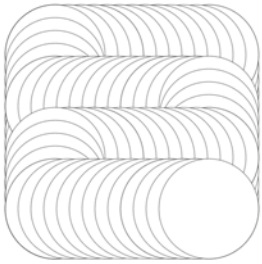


Fig. 5910D

C 5.9.1.0 - Step One: Abrasion utilizes a Black RenuDisk to quickly remove target damage.

1. Secure a Black RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Black RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 5910F



Fig. 5910G

Notes:

C 5.9.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
3. Engage the polisher's power trigger, and trigger lock.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.

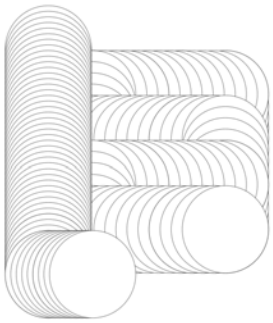


Fig. 5920A

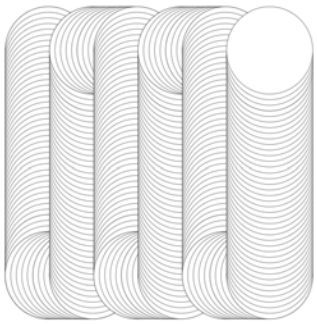


Fig. 5920B

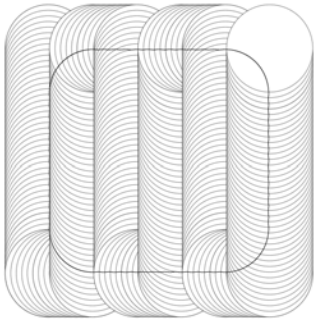


Fig. 5920C

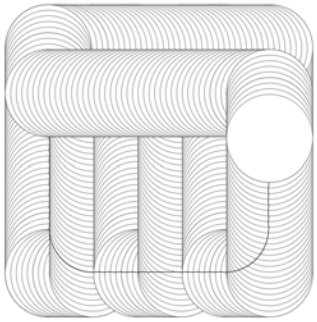


Fig. 5920D



Fig. 5920E

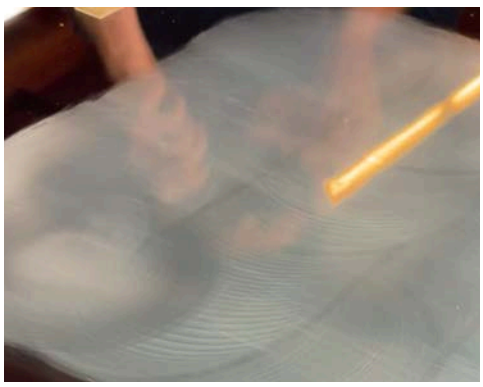


Fig. 5920F

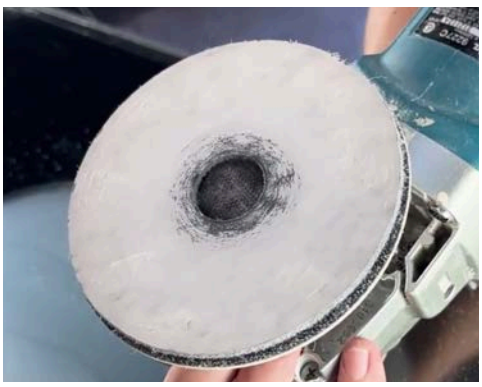


Fig. 5920G

C 5.9.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

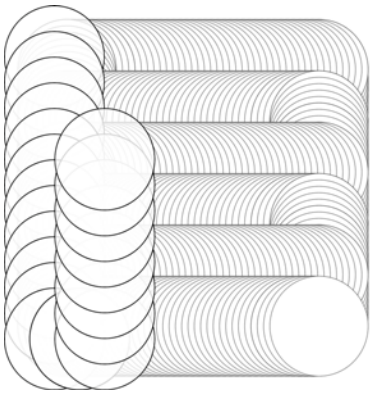


Fig. 5930A

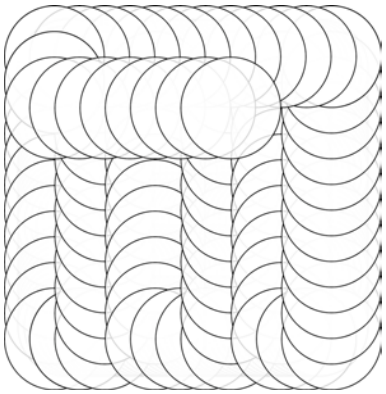


Fig. 5930B

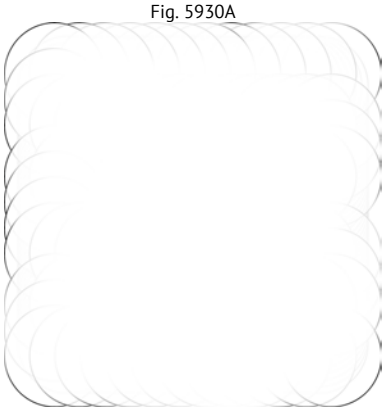


Fig. 5930C

Fig. 5930D



Fig. 5930E



Fig. 5930F

Notes:

C 5.10.0.0 - Razor Blade [CAT-3]

APPROXIMATE TIME PER SQUARE FOOT: 15 - 25 minutes

Razor blade damage on glass is a diverse category of surface impairment, ranging from the finest scratches, similar to those caused by fines and ticks (as detailed in section 5.11.0.0), to deeper gouges typically resulting from the use of older, possibly rusty steel blades. This type of damage is often a consequence of post-construction cleaning processes, where razor blades are employed to remove accumulated debris from the glass surface.

The appearance of razor blade damage can vary considerably. It might manifest as ultra-fine scratches that are difficult to detect by touch, or as more conspicuous scratches that are easily felt with a fingernail. Prior to any restoration efforts, a comprehensive evaluation of the glass surface is critical. This assessment aims to identify the full extent and depth of the damage, ensuring that any subsequent restoration steps are appropriately tailored to address the specific nature of the scratches present on the glass.



Fig. 51000A



Fig. 51000B

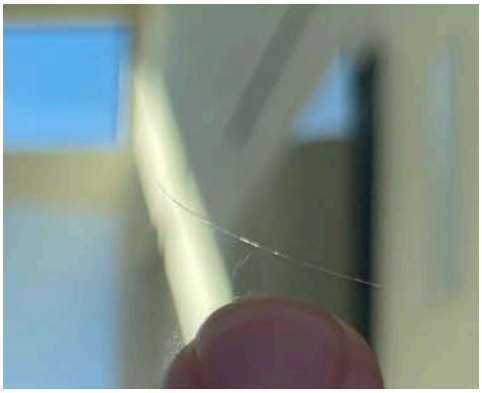


Fig. 51000C

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 51000D

Tool Checklist

- [ ] Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- [ ] Backing Pad
- [ ] Black RenuDisk(s)
- [ ] Grey RenuDisk(s)
- [ ] Polishing Felt
- [ ] Polishing Compound
- [ ] Rasp
- [ ] IR Thermometer

Workspace Checklist

- [ ] Power Access
- [ ] Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- [ ] Masking Tools
- [ ] Drop Clothes/ Tarps/ Waste Receptacles
- [ ] Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- [ ] Confirm Glass Type
- [ ] Confirm Damage Type
- [ ] Inspect Glass System Integrity (Framing, Glazing, Etc.)
- [ ] Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- [ ] Identify Damage Location(s)

Notes:

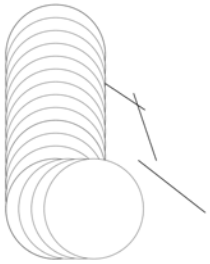


Fig. 51010A



Fig. 51010B

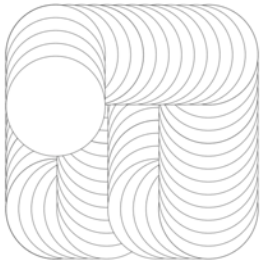


Fig. 51010C

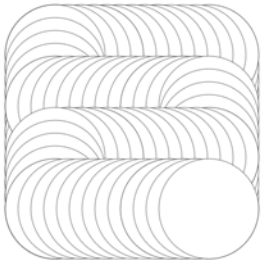


Fig. 51010D

C 5.10.1.0 - Step One: Abrasion utilizes a Black RenuDisk to quickly remove target damage.

1. Secure a Black RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Black RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 51010E



Fig. 51010F

Notes:

C 5.10.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

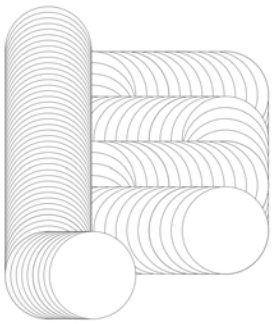


Fig. 51020A

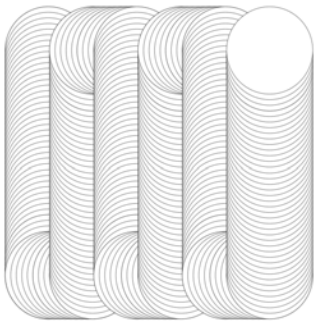


Fig. 51020B

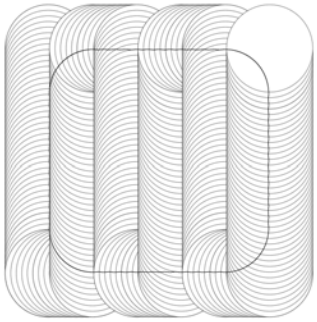


Fig. 51020C

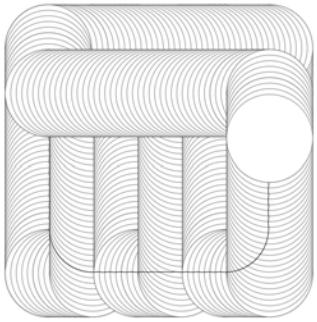


Fig. 51020D

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.



Fig. 51020E

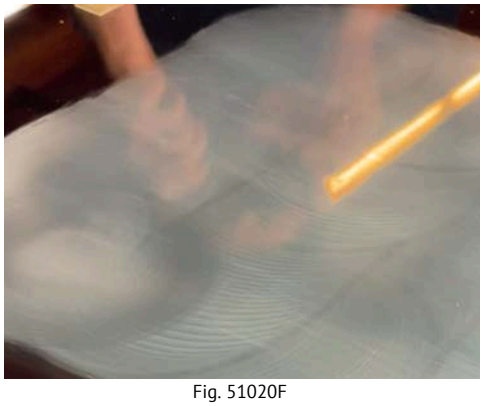


Fig. 51020F

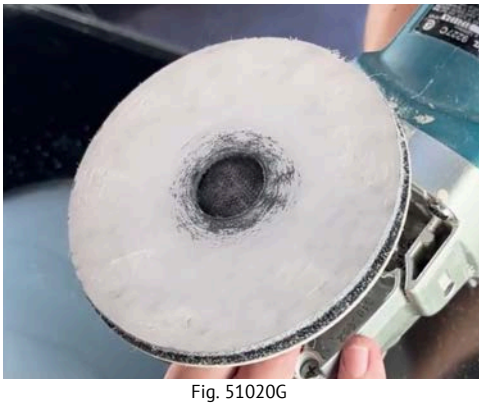


Fig. 51020G

C 5.10.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

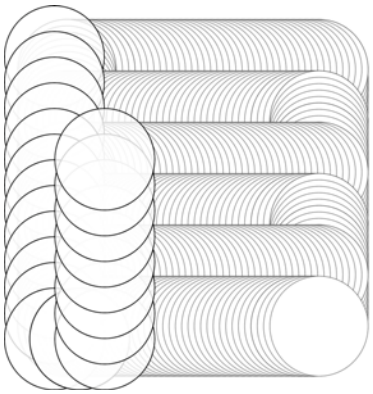


Fig. 51030A

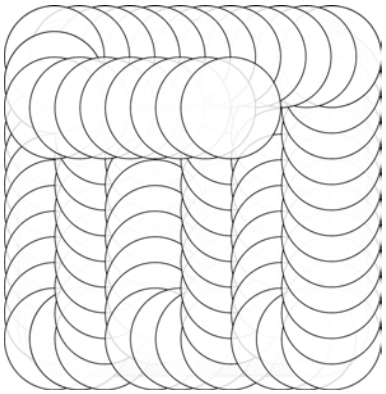


Fig. 51030B

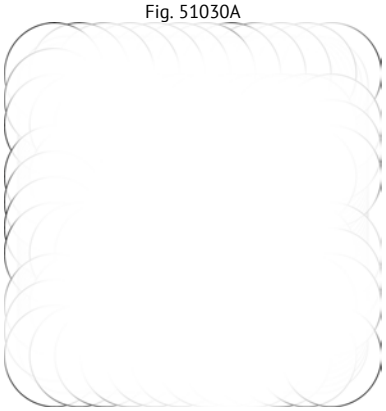


Fig. 51030C

Fig. 51030D



Fig. 51030E



Fig. 51030F

Notes:

C 5.11.0.0 - Rock/ Masonry [CAT-3]

APPROXIMATE TIME PER SQUARE FOOT: 20 - 30 minutes

Rock and masonry damage on glass surfaces typically occurs during construction phases, especially when materials like mortar or other binding agents used for Securing exterior façade components inadvertently come into contact with the glass. The interaction of these substances with the glass, particularly if they are scrubbed or scraped off, can lead to a range of scratch patterns. These may vary from very fine, almost imperceptible scratches, to deep, pronounced gouges that significantly mar the glass surface.

In addition to the physical scratches, the chemical components of these construction materials, often including elements like lye and lime, can also pose a risk. Prolonged contact with these substances can result in minor acid burns or stains on the glass, adding another layer of complexity to the damage.

For technicians preparing to address rock and masonry damage, it's crucial to thoroughly assess the extent of the damage. This involves determining not only the severity of the scratches but also identifying any areas of chemical etching or staining. The restoration plan should be meticulously formulated based on this comprehensive evaluation, ensuring that it effectively addresses the most severe aspects of the damage to restore the glass to its optimal condition.

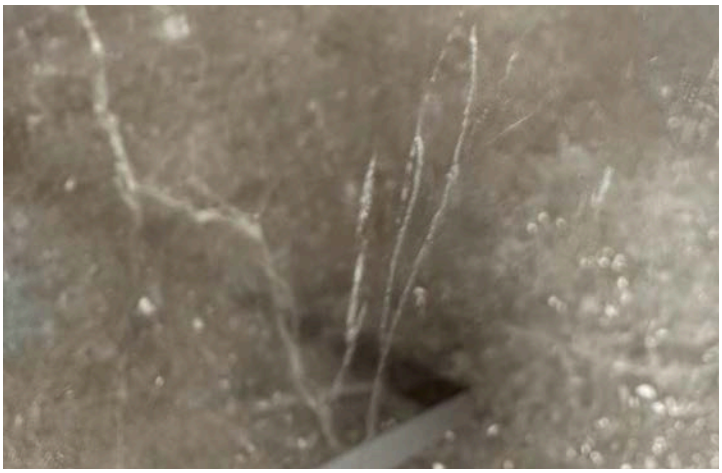


Fig. 51100A



Fig. 51100B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 51100C

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Black RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

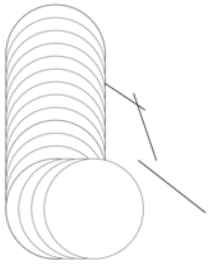


Fig. 51110A



Fig. 51110B

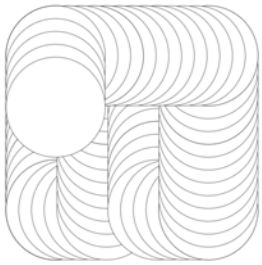


Fig. 51110C

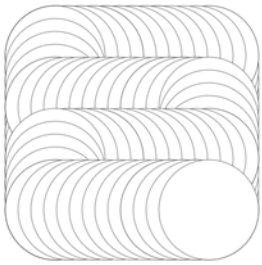


Fig. 51110D

C 5.11.1.0 - Step One: Abrasion utilizes a Black RenuDisk to quickly remove target damage.

1. Secure a Black RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Black RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 51110E



Fig. 51110F

Notes:

C 5.11.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

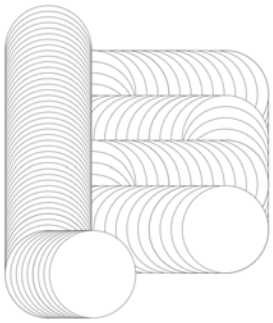
NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

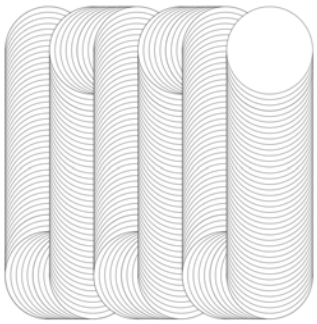
- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

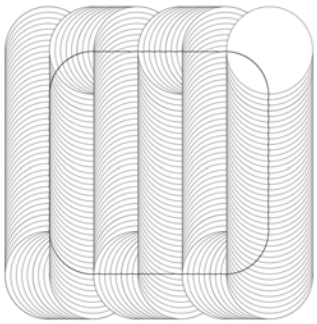
High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.


Fig. 51120A


Fig. 51120B


Fig. 51120C

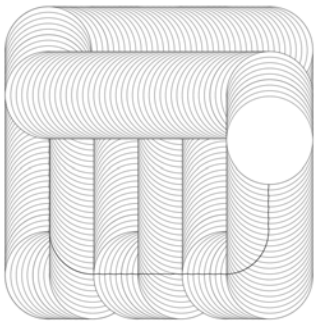
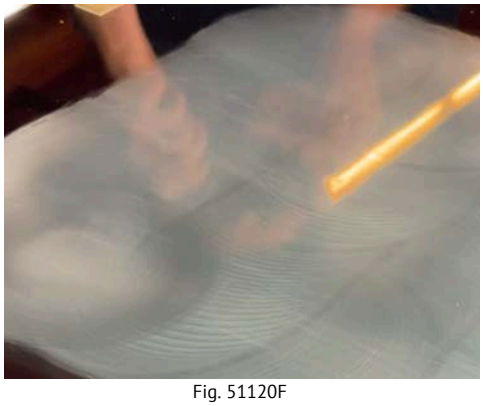
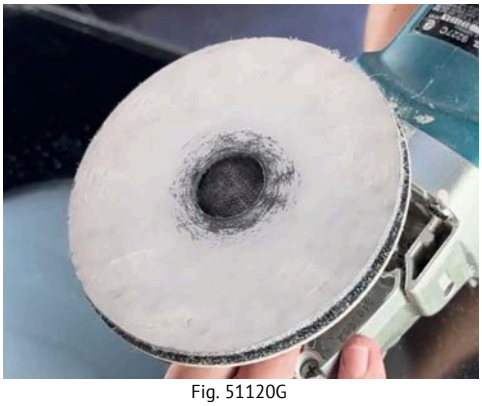

Fig. 51120D


Fig. 51120E


Fig. 51120F


Fig. 51120G

C 5.11.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

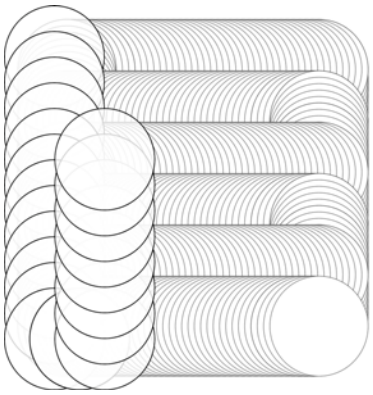


Fig. 51130A

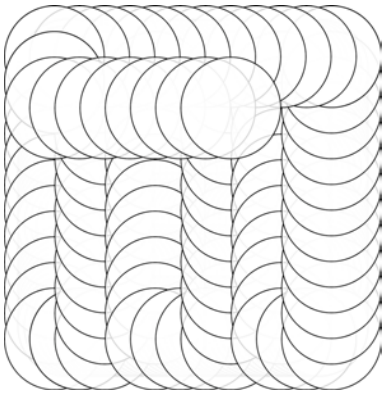


Fig. 51130B

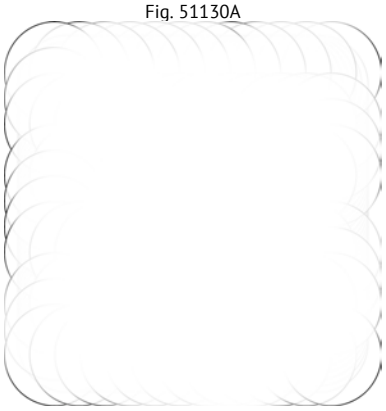


Fig. 51130C

Fig. 51130D



Fig. 51130E



Fig. 51130F

Notes:

C 5.12.0.0 - Acid (Light) [CAT-3]

APPROXIMATE TIME PER SQUARE FOOT: 15 - 30 minutes

Light acid damage on glass is best understood as an intensified variant of heavy hard water etching, often arising from the use of inappropriate solvents during cleaning or restoration activities involving materials near glass surfaces. This type of damage can also result from certain types of graffiti activities, though it is important to note that most graffiti-related acid damage tends to be more severe than this category.

Characteristically, light acid damage presents as a "fogged" appearance on the glass, with a distinctly blotchy and streaky visual effect. This fogging is not merely a surface residue; it is a chemical alteration of the glass itself and, as such, cannot be removed by conventional cleaning methods, regardless of their intensity or nature.

When encountering light acid damage, it's important for technicians to recognize the limitations of standard cleaning practices and to understand that this type of damage marks the beginning of deeper, more permanent alterations to the glass's structure. This initial assessment stage is critical in determining the scope and approach for any potential restoration efforts.



Fig. 51200A



Fig. 51200B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80℉ Δ	N/A
Tempered	+120℉ Δ	N/A
Laminate- Annealed	+80℉ Δ	145℉
Laminate- Tempered	+120℉ Δ	145℉
Mirrored	+80℉ Δ	N/A

Fig. 51200C

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Black RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

Acid (Light)
C 5.12.1.0 - Step One: Abrade

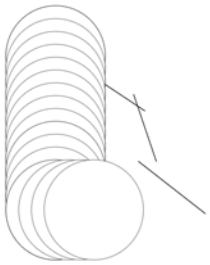


Fig. 51210A



Fig. 51210B

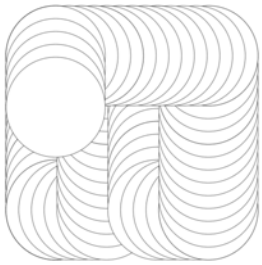


Fig. 51210C

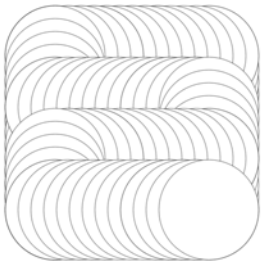


Fig. 51210D

C 5.12.1.0 - Step One: Abrasion utilizes a Black RenuDisk to quickly remove target damage.

1. Secure a Black RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Black RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**

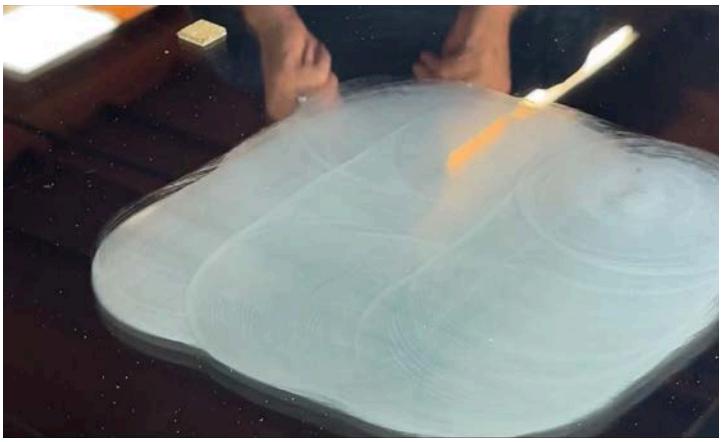


Fig. 51210E



Fig. 51210F

Notes:

C 5.12.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

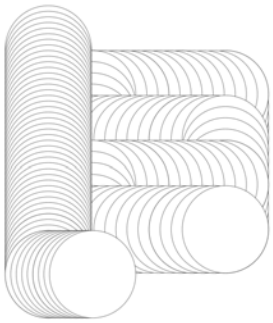
NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

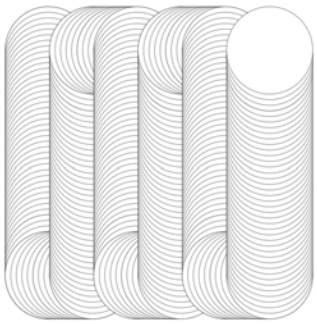
- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

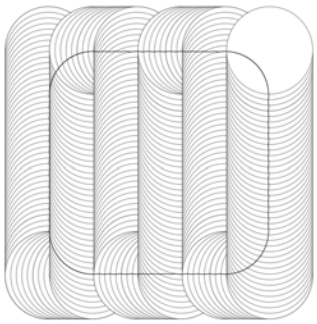
High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.


Fig. 51220A


Fig. 51220B


Fig. 51220C

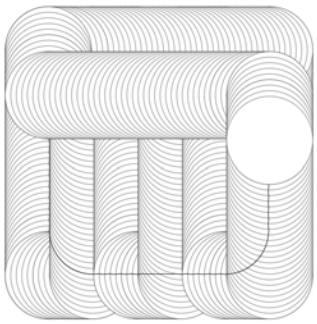
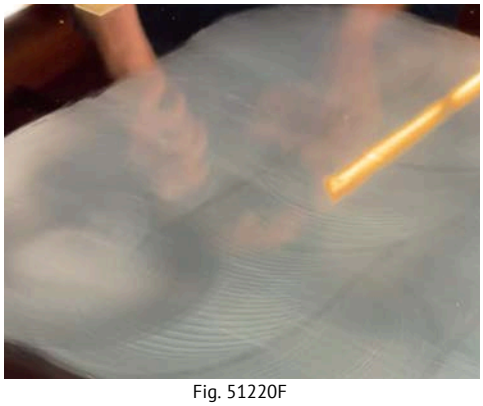
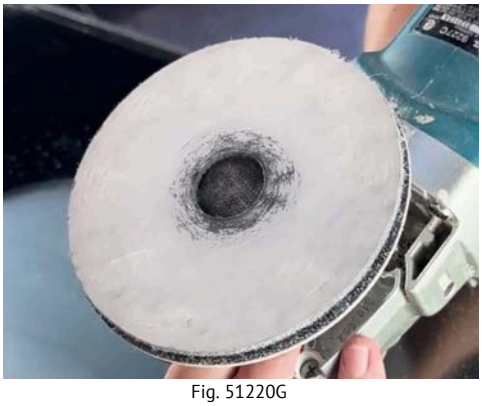

Fig. 51220D


Fig. 51220E


Fig. 51220F


Fig. 51220G

C 5.12.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

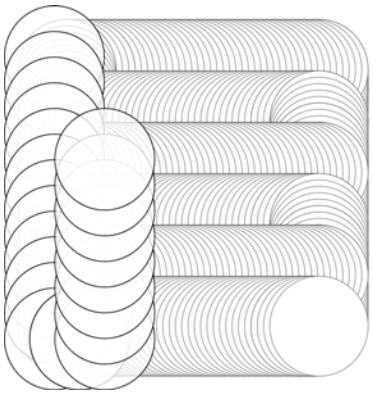


Fig. 51230A

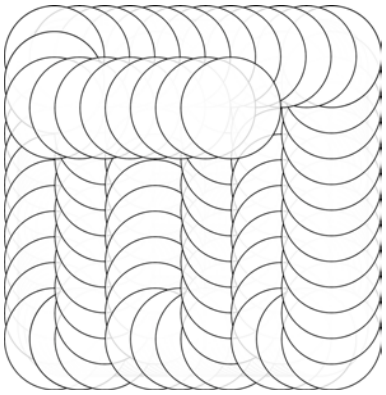


Fig. 51230B

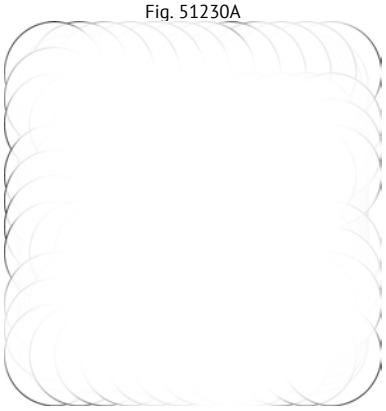


Fig. 51230C

Fig. 51230D



Fig. 51230E



Fig. 51230F

Notes:

C 5.13.0.0 - Acid (Medium) [CAT-3]

APPROXIMATE TIME PER SQUARE FOOT: 15 - 30 minutes

Medium acid damage on glass surfaces often results from the extended exposure to acid-based solvents, particularly those used for the removal of hard water deposits. When these solvents are allowed to dwell on the glass for longer than recommended, they can cause significant and more aggressive etching. This form of damage is sometimes referred to as "Tin-Etch Haze," indicative of a layer of tin oxide (SnO_2) that develops on the glass. This etching may appear as either a white or brown discoloration, embedded within the surface of the glass.

Typically, medium acid damage is characterized by a consistent, uniform etch across the glass surface. This widespread etching signifies a more profound alteration of the glass's surface compared to lighter acid damage. Recognizing the extent of this damage is crucial for technicians as it often necessitates a more comprehensive and intensive approach during restoration. The restoration process for medium acid damage may involve greater abrasion techniques to effectively mitigate the etching and return the glass to its original state.



Fig. 51300A



Fig. 51300B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 51300C

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Black RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

Acid (Medium)
C 5.13.1.0 - Step One: Abrade

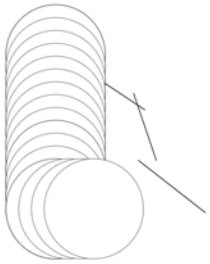


Fig. 51310A



Fig. 51310B

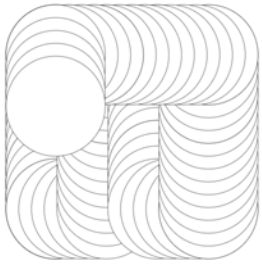


Fig. 51310C

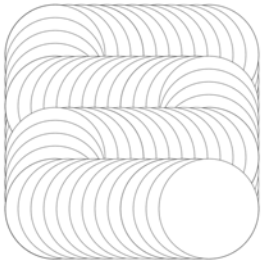


Fig. 51310D

C 5.13.1.0 - Step One: Abrasion utilizes a Black RenuDisk to quickly remove target damage.

1. Secure a Black RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Black RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 51310E



Fig. 51310F

Notes:

C 5.13.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.

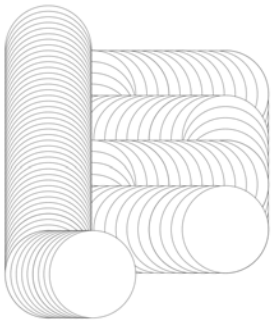


Fig. 51320A

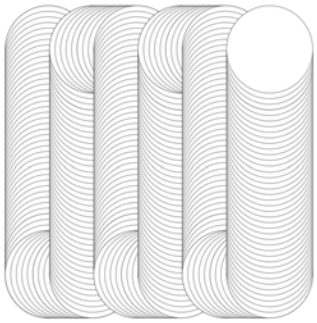


Fig. 51320B

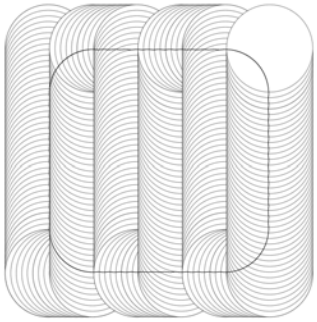


Fig. 51320C

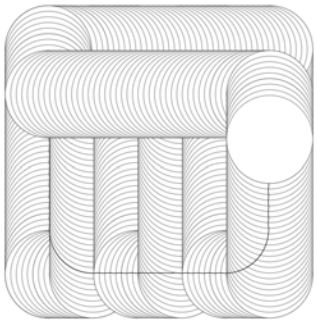


Fig. 51320D



Fig. 51320E

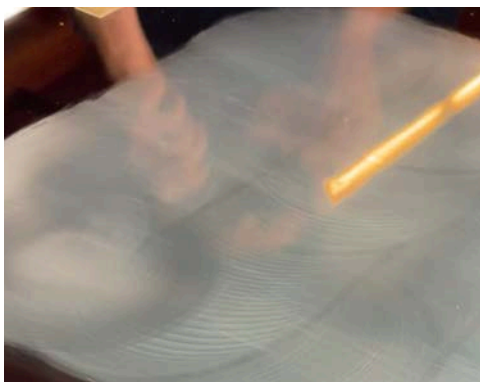


Fig. 51320F

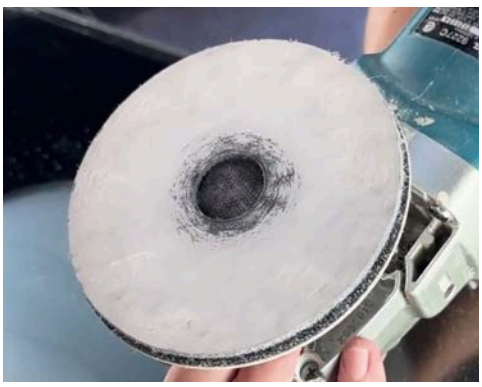


Fig. 51320G

C 5.13.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

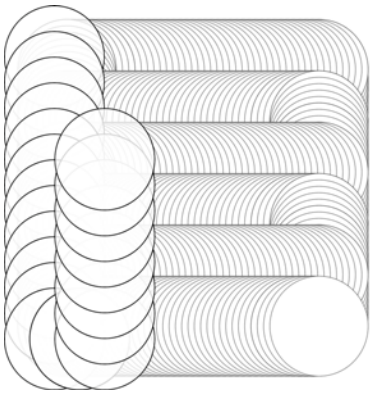


Fig. 51330A

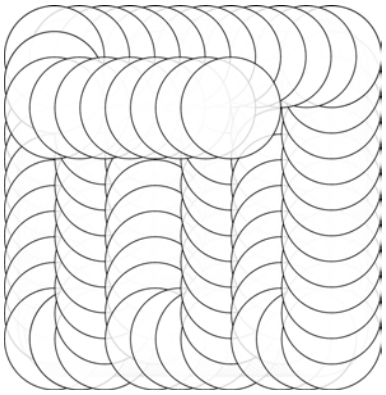


Fig. 51330B

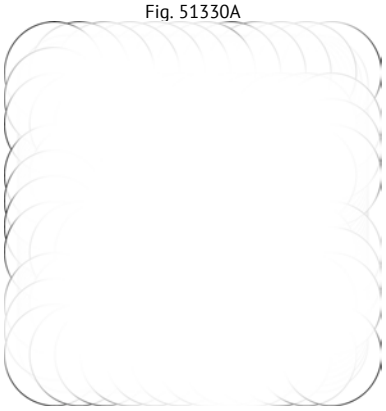


Fig. 51330C

Fig. 51330D



Fig. 51330E



Fig. 51330F

Notes:

C 5.14.0.0 - Graffiti Scratch (Light) [CAT-3]

APPROXIMATE TIME PER SQUARE FOOT: 20 - 30 minutes

Light graffiti scratches are surface-level abrasions typically caused by sharp objects or tools used in acts of vandalism. These scratches, while visible, do not penetrate deeply into the glass and generally affect only the outermost layer. The damage appears as thin, shallow lines or marks that scatter light and create a visible distortion across the surface. Though unsightly, light graffiti scratches do not compromise the structural integrity of the glass and can usually be restored without introducing significant optical distortion or surface modeling.



Fig. 51400A



Fig. 51400B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80˚F Δ	N/A
Tempered	+120˚F Δ	N/A
Laminate- Annealed	+80˚F Δ	145˚F
Laminate- Tempered	+120˚F Δ	145˚F
Mirrored	+80˚F Δ	N/A

Fig. 51400C

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Black RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

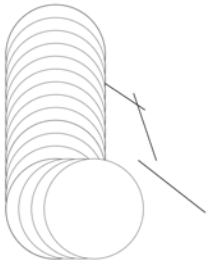


Fig. 51410A



Fig. 51410B

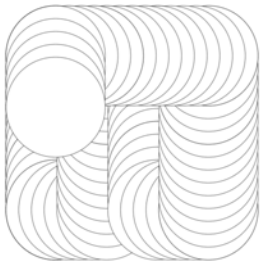


Fig. 51410C

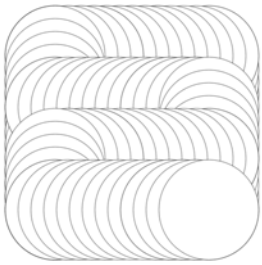


Fig. 51410D

C 5.14.1.0 - Step One: Abrasion utilizes a Black RenuDisk to quickly remove target damage.

1. Secure a Black RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Black RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 51410F



Fig. 51410G

Notes:

C 5.14.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

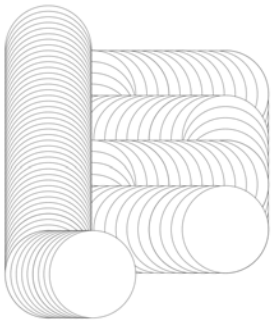
NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

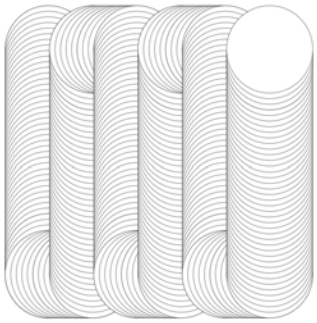
- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

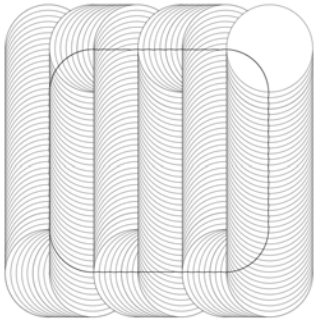
High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.


Fig. 51420A


Fig. 51420B


Fig. 51420C

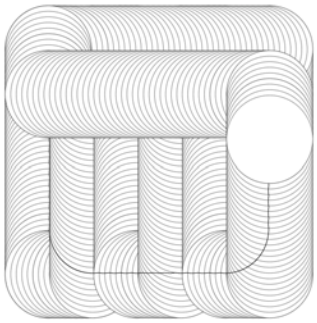
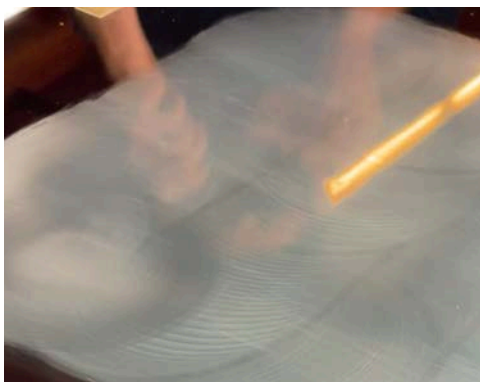
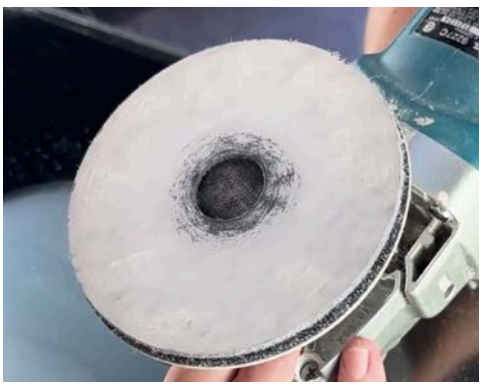

Fig. 51420D


Fig. 514420E


Fig. 514420F


Fig. 514420G

C 5.14.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

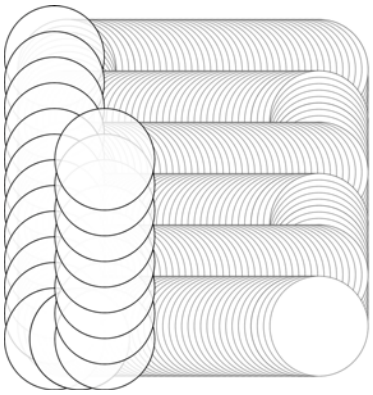


Fig. 51430A

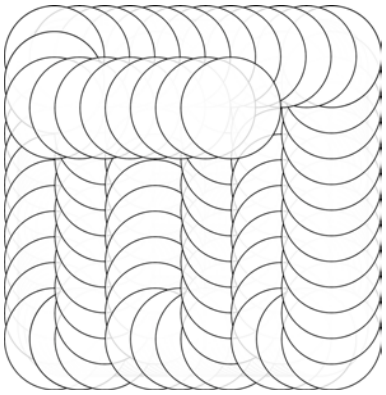


Fig. 51430B

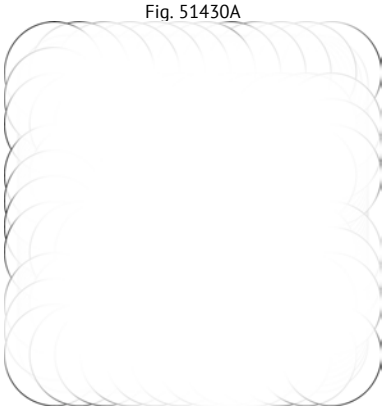


Fig. 51430C

Fig. 51430D



Fig. 51430E



Fig. 51430F

Notes:

C 5.15.0.0 - Acid (Heavy) [CAT-3]

APPROXIMATE TIME PER SQUARE FOOT: 60+ minutes

Heavy acid damage on glass is predominantly an act of intentional vandalism, often manifesting as graffiti. In the vast majority of cases, this type of damage involves the use of hydrofluoric acid (HF), one of the few acids potent enough to etch glass effectively. Graffiti perpetrators typically employ hobbyist-grade acid, specifically formulated for rapid and efficient glass etching, to inscribe or deface the surface.

The severity of the etching caused by HF can vary significantly, ranging from medium to extreme depths, depending on the concentration of the acid used. This variability necessitates a comprehensive assessment of the entire affected area to accurately gauge the depth and extent of the damage. Heavy acid damage is usually visually identifiable as white, frosted lettering or designs, often accompanied by elongated drip tails stemming from the lower edges of letters or design elements.

Understanding the depth and pattern of the etching is crucial in planning any restoration efforts. This evaluation helps in determining the scope of the damage and in formulating an appropriate strategy for addressing the etching while considering the overall integrity and clarity of the glass.



Fig. 51500A



Fig. 51500B



Fig. 51500C

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 51500G

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Black RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

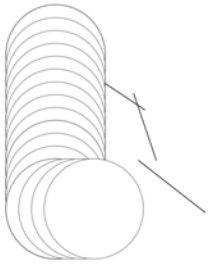


Fig. 51510A



Fig. 51510B

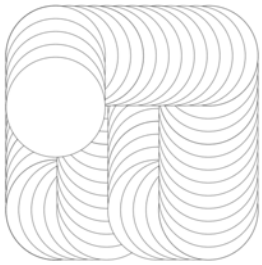


Fig. 51510C

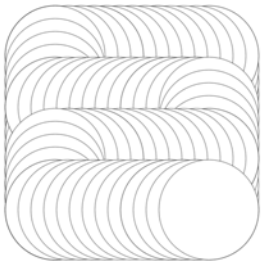


Fig. 51510D

C 5.15.1.0 - Step One: Abrasion utilizes a Black RenuDisk to quickly remove target damage.

1. Secure a Black RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Black RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 51510F



Fig. 51510G

Notes:

C 5.15.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.

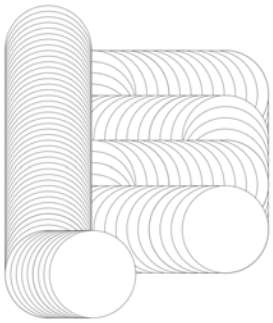


Fig. 51520A

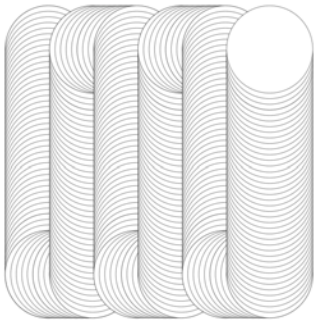


Fig. 51520B

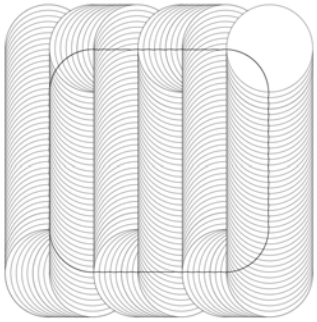


Fig. 51520C

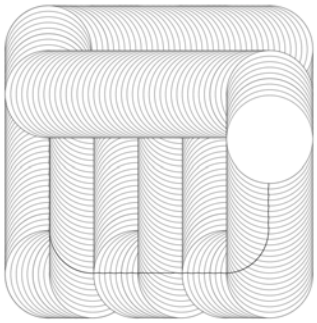


Fig. 51520D



Fig. 51520E

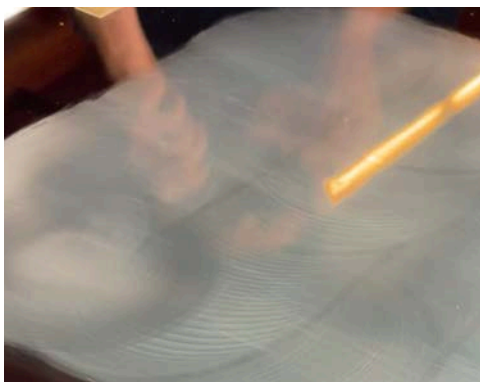


Fig. 51520F

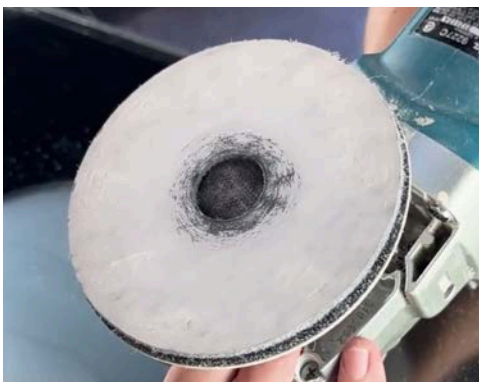


Fig. 51520G

C 5.15.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

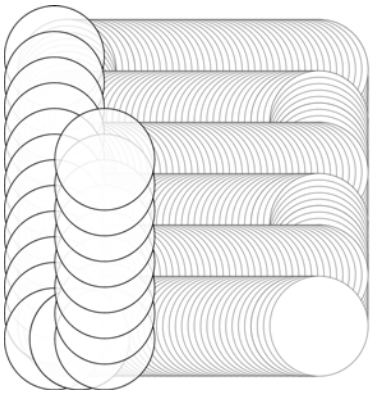


Fig. 51530A

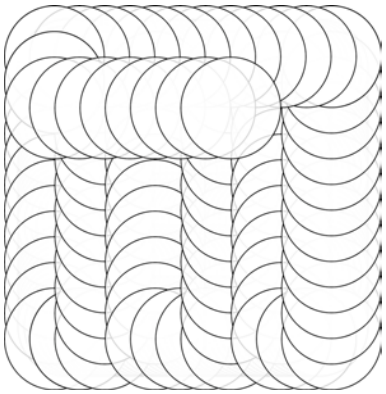


Fig. 51530B

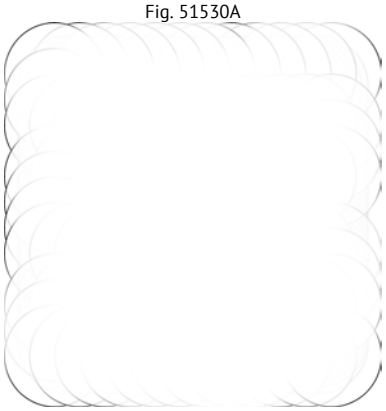


Fig. 51530C

Fig. 51530D



Fig. 51530E



Fig. 51530F

Notes:

C 5.16.0.0 - Severe Scratches [CAT-4]

APPROXIMATE TIME PER SQUARE FOOT: 25+ minutes

Severe scratches on glass represent a high level of damage that goes beyond mere visibility or the ability to catch a fingernail. These scratches are characterized by the presence of chipping or small flecks of glass that are missing along the edges of the scratch, indicating a deeper impact on the glass surface. Such damage is not only visually apparent but also tactilely perceptible and can significantly affect both the aesthetic and structural integrity of the glass.

This type of damage is categorized as extreme due to the depth and severity of the scratches. It is crucial for technicians to meticulously assess and identify the deepest points of these scratches before commencing any restoration work. This careful evaluation is essential in ensuring that the restoration plan developed is comprehensive enough to effectively address the extent of the damage. The presence of chipping and glass flecks requires a nuanced approach in restoration, as these factors can complicate the process, necessitating precision and care to restore the glass effectively while avoiding further damage.



Fig. 51600A



Fig. 51600B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 51600C

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Red RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

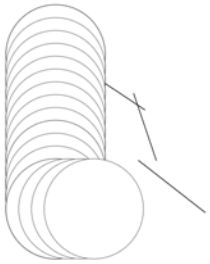


Fig. 51610A



Fig. 51610B

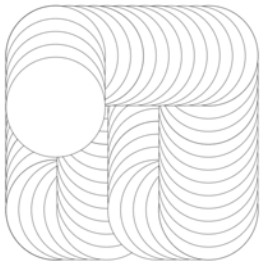


Fig. 51610C

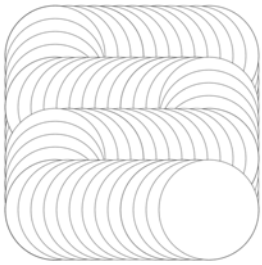


Fig. 51610D

C 5.16.1.0 - Step One: Abrasion utilizes a Red RenuDisk to quickly remove target damage.

1. Secure a Red RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Red RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 51610F



Fig. 51610G

Notes:

C 5.16.2.0 - Step Two: Pre-Polishis broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

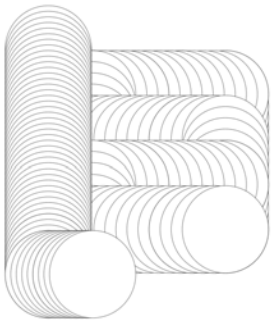


Fig. 51620A

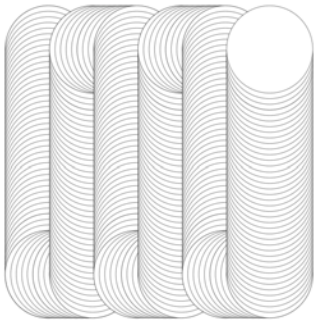


Fig. 51620B

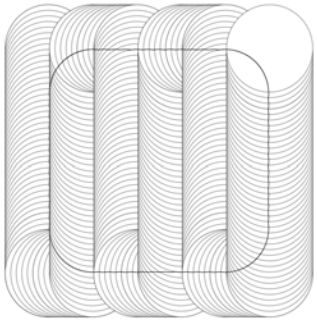


Fig. 51620C

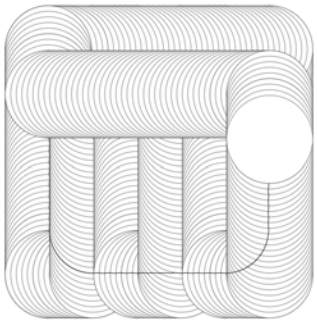


Fig. 51620D

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.



Fig. 51620E

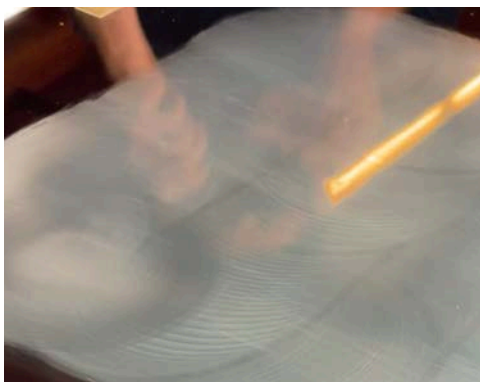


Fig. 51620F

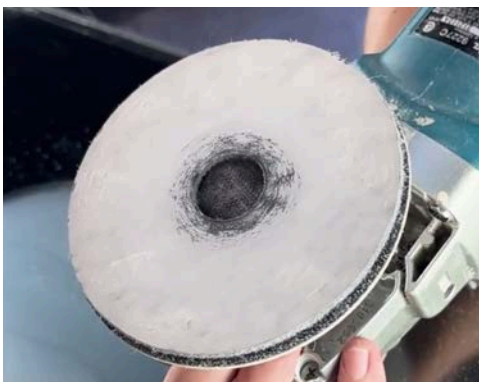


Fig. 51620G

C. 5.22.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

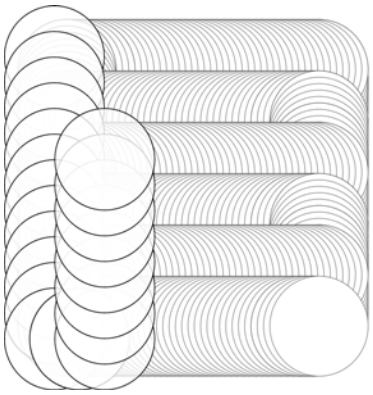


Fig. 51630A

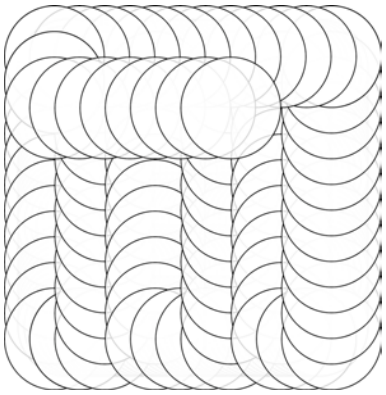


Fig. 51630B

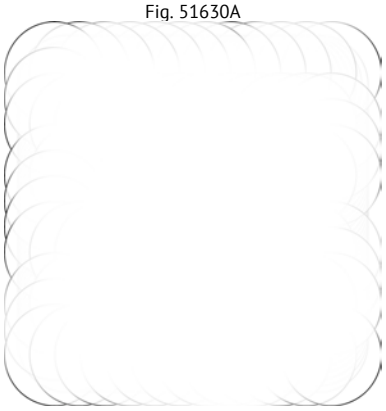


Fig. 51630C

Fig. 51630D



Fig. 51630E



Fig. 51630F

Notes:

C 5.17.0.0 - Graffiti Scratch (Heavy) [CAT-4]

APPROXIMATE TIME PER SQUARE FOOT: 25+ minutes

Heavy graffiti scratches on glass are comparable in severity to severe scratches (refer to section 5.21.0.0), typically manifesting as deeply incised and extensive markings on the glass surface. These scratches are often inflicted using highly durable and hard tools, such as carbide-tipped scribes or scratch awls, which can penetrate deeply into the glass structure.

This type of vandalism not only affects the glass aesthetically but also poses a risk to its structural integrity. The depth and nature of these scratches necessitate extreme caution during any restoration or handling, especially when applying force to the damaged areas. Factors such as the overall thickness of the glass, whether it is tempered or annealed, and the location of the damage on the pane are critical considerations.

Given the potential for these scratches to induce additional stress on the glass surface, technicians may need to adopt a phased approach to restoration. This involves gradually removing the damage in controlled stages, which helps in reducing surface stress and preventing further compromise to the glass's integrity. Such a careful and strategic approach is essential to effectively address the damage while maintaining the safety and stability of the glass pane.



Fig. 51700A



Fig. 51700B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 51700D

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Red RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

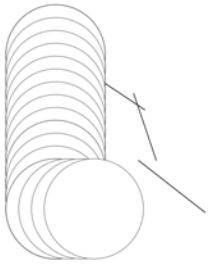


Fig. 51710A



Fig. 51710B

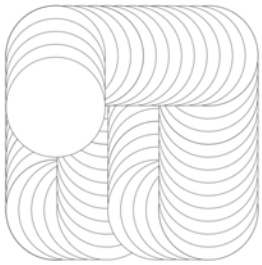


Fig. 51710C

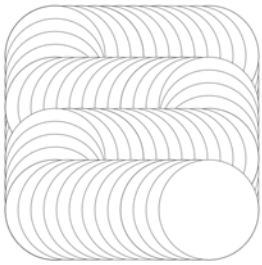


Fig. 51710D

C 5.17.1.0 - Step One: Abrasion utilizes a Red RenuDisk to quickly remove target damage.

1. Secure a Red RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Red RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 51710F



Fig. 51710G

Notes:

C 5.17.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.

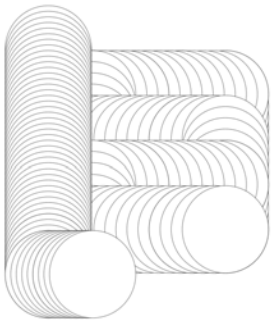


Fig. 51720A

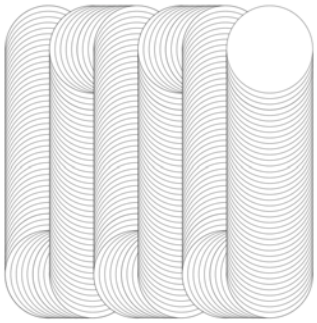


Fig. 51720B

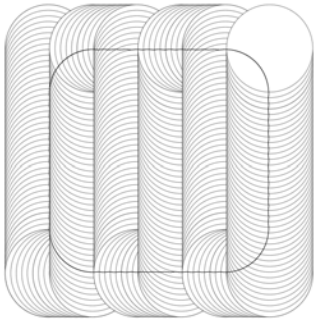


Fig. 51720C

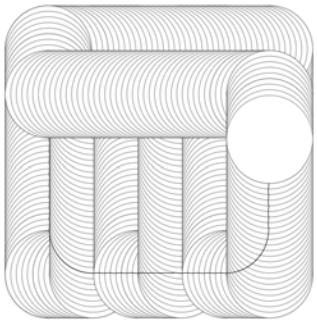


Fig. 51720D



Fig. 51720E

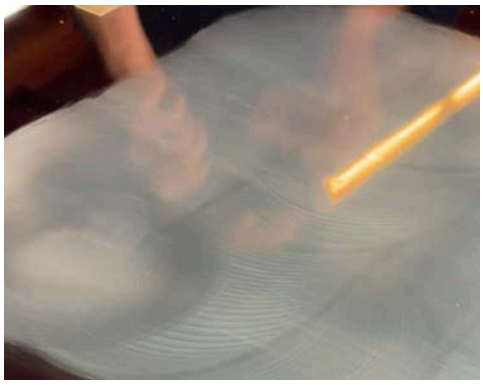


Fig. 51720F

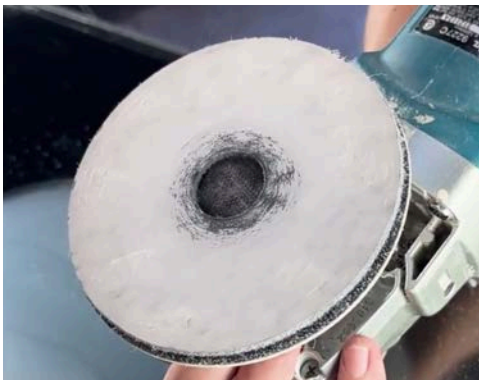


Fig. 51720G

C 5.17.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

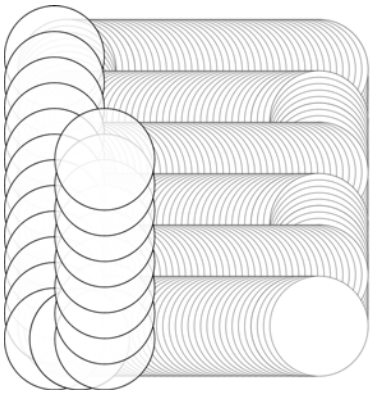


Fig. 51730A

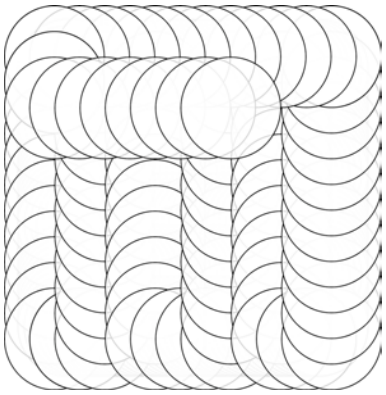


Fig. 51730B

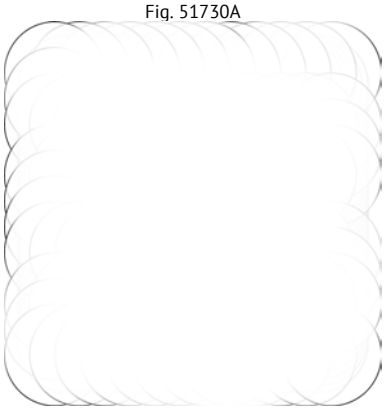


Fig. 51730C

Fig. 51730D



Fig. 51730E



Fig. 51730F

Notes:

C 5.18.0.0 - Metal Grinding Debris Damage [CAT-4]

APPROXIMATE TIME PER SQUARE FOOT: 35+ minutes

Metal Grinding Debris Damage commonly arises when construction activities, such as cutting rebar or metal framing studs, occur near glass surfaces. During these operations, hot, nearly molten metal shards are ejected, effectively being 'sprayed' to the glass. These hot metal fragments have the potential to embed themselves into the glass surface, creating deep and often severe damage. The result is not just surface scratching but the actual encapsulation of small metal particles within the glass.

Before embarking on any restoration, it is crucial to attempt to remove as much of the embedded metal from the glass as possible. This preliminary step is essential to prevent further damage during the restoration process. An additional consideration is the relation between the depth of the impact marks – or 'poc' marks – left by these hot metal shards and the overall thickness of the glass, particularly its tempering envelope.

A key threshold in evaluating the damage is whether the depth of the burrows exceeds 10% of the total thickness of the glass. If the damage remains within this limit, the tempering envelope of the glass is generally considered to remain intact. However, in instances where the damage penetrates deeper, a thorough evaluation of the glass's safety and operational integrity becomes imperative. Understanding this relationship is crucial for technicians to determine the appropriate course of action, balancing the restoration of the glass with maintaining its structural safety.

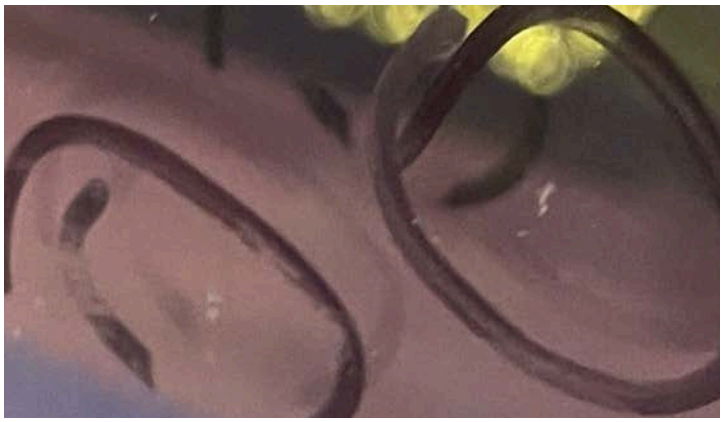


Fig. 51800A



Fig. 51800B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 51800C

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Red RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

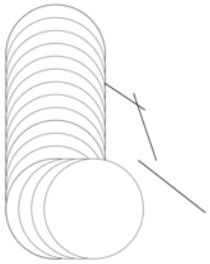


Fig. 51810A



Fig. 51810B

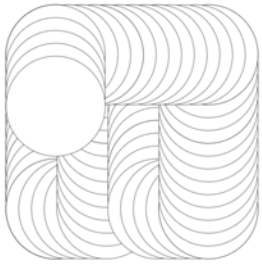


Fig. 51810C

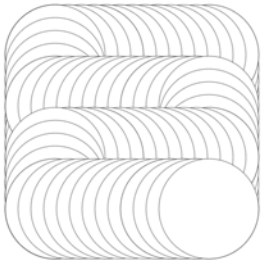


Fig. 51810D

C 5.18.1.0 - Step One: Abrasion utilizes a Red RenuDisk to quickly remove target damage.

1. Secure a Red RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
4. Engage the polisher's power trigger, and trigger lock.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Red RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 51810F



Fig. 51810G

Notes:

C 5.18.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.

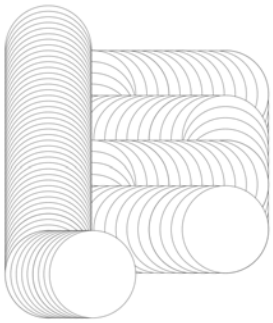


Fig. 51820A

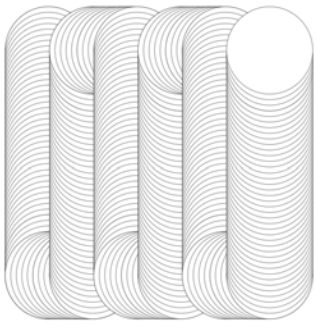


Fig. 51820B

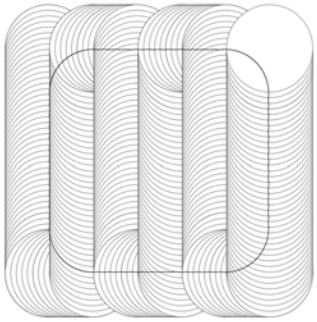


Fig. 51820C

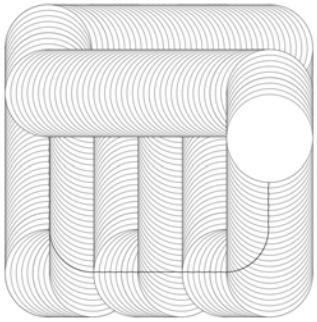


Fig. 51820D



Fig. 51820E

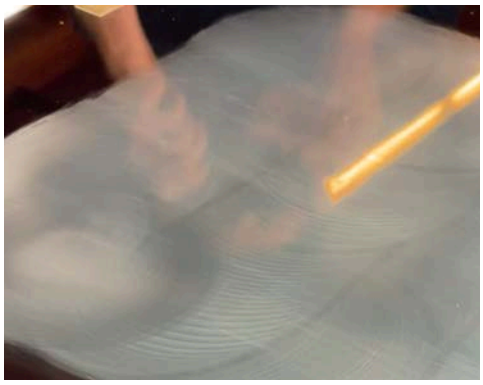


Fig. 51820F

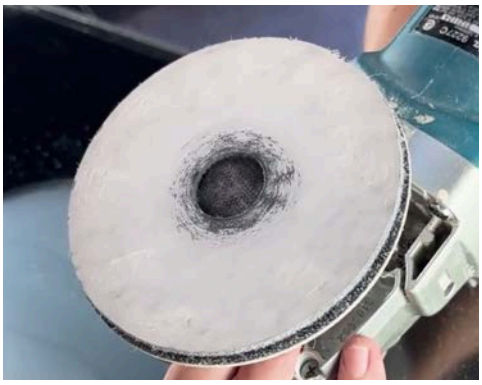


Fig. 51820G

Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

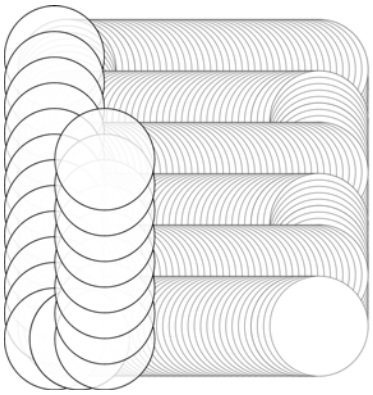


Fig. 51830A

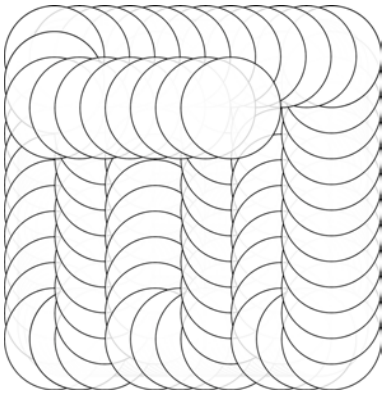


Fig. 51830B

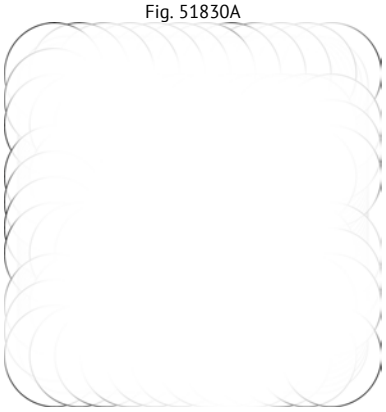


Fig. 51830C

Fig. 51830D



Fig. 51830E



Fig. 51830F

Notes:

C 5.19.0.0 - Media Blast [CAT-4]

APPROXIMATE TIME PER SQUARE FOOT: 40+ minutes

Media blast damage represents one of the most severe forms of damage that glass surfaces can endure. The extent of this damage is such that media blasting is actually a technique used by glass artisans for decorative etching and design work. However, when media blast damage occurs unintentionally, it often results from nearby masonry restoration activities where abrasive media used for blasting inadvertently impacts the glass.

Due to the extreme nature of this damage, the restoration process can be exceptionally time-consuming and labor-intensive. Undertaking such restoration is typically advised only in scenarios where glass replacement is not feasible or would incur prohibitively high costs. It's important to acknowledge that repairing media blast damage often involves resurfacing the entire pane of glass. This process can be up to four to five times more time-consuming than addressing other types of glass damage.

Given the complexity and the extent of the work involved, restoration of media blast damaged glass should be approached with a clear understanding of the time and resources required. Technicians embarking on such projects need to be prepared for a meticulous and prolonged restoration process, often demanding a high level of skill and patience.



Fig. 51900A



Fig. 51900B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 51900C

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Red RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

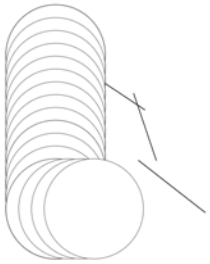


Fig. 51910A



Fig. 51910B

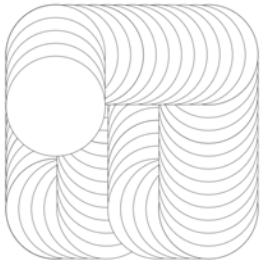


Fig. 51910C

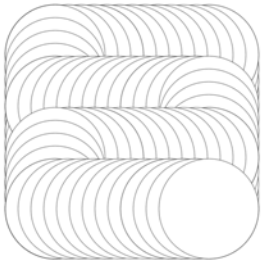


Fig. 51910D

C 5.19.1.0 -Step One: Abrasion utilizes a Red RenuDisk to quickly remove target damage.

1. Secure a Red RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Red RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 51910F



Fig. 51910G

Notes:

C 5.20.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

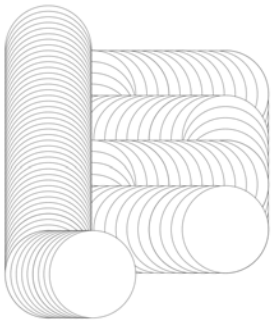
NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

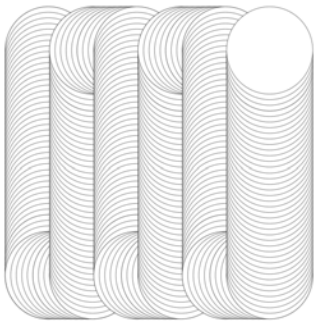
- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

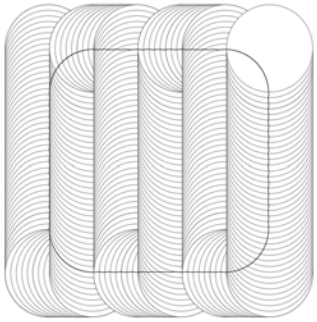
High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.


Fig. 51920A


Fig. 51920B


Fig. 51920C

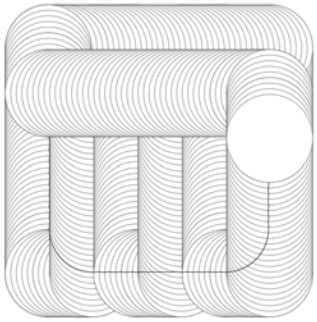
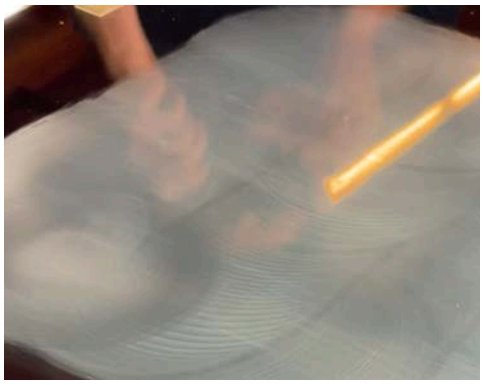
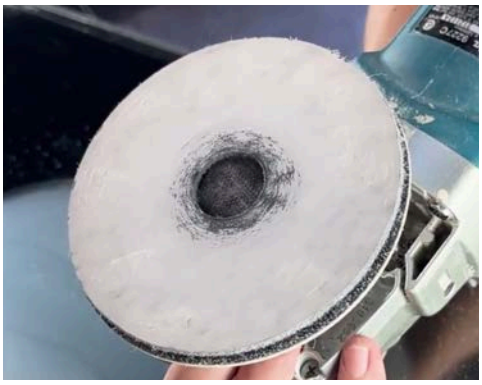

Fig. 51920D


Fig. 51920E


Fig. 51920F


Fig. 51920G

C 5.19.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

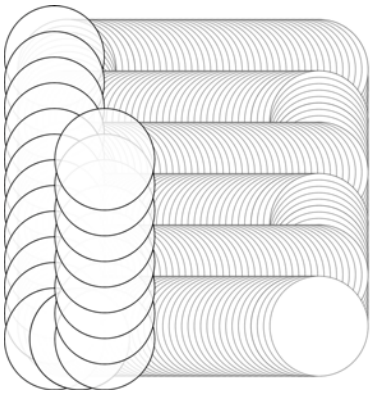


Fig. 51930A

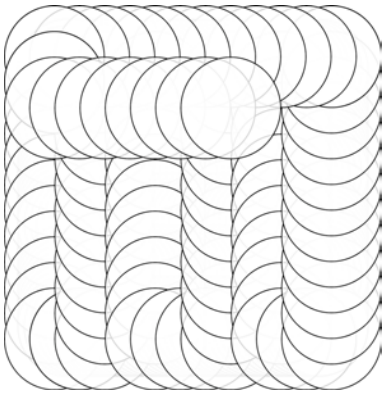


Fig. 51930B

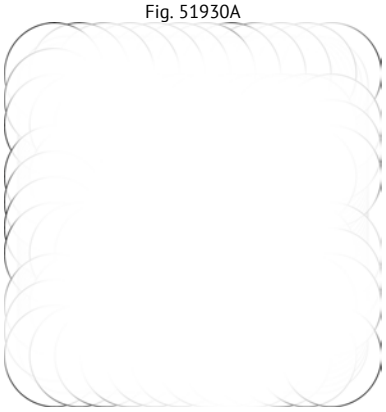


Fig. 51930C

Fig. 51930D



Fig. 51930E



Fig. 51930F

Notes:

C 5.20.0.0 - Welding Slag [CAT-4]

APPROXIMATE TIME PER SQUARE FOOT: 45+ minutes

Welding Slag Damage, commonly referred to as welding drips, represents a particularly challenging and labor-intensive type of glass restoration. This damage typically occurs when molten material from welding activities inadvertently lands on glass surfaces, leading to significant damage. Due to the complexity and difficulty of the restoration process, it is generally advisable to undertake such projects only in cases where the glass is exceedingly expensive or challenging to replace.

A crucial aspect to consider in the restoration of glass damaged by welding slag is the safety implications, especially regarding the location and severity of the damage. In instances where the glass is a component of a building's safety system, particularly if it is tempered, restoration efforts could potentially compromise its structural integrity. Welding slag often penetrates the tempering envelope of tempered glass (and almost invariably shatters annealed glass), which could affect the glass's ability to function safely as intended.

Furthermore, welding slag damage frequently involves encapsulated metal within the glass. Prior to any restoration attempts, it is important to remove as much of this metal as possible. The reason for this is that the metal can act as a heat sink during the restoration process, drawing excess heat into the center of the glass and potentially causing rapid thermal expansion. This can lead to additional challenges and risks, making the careful planning and execution of the restoration process even more essential.

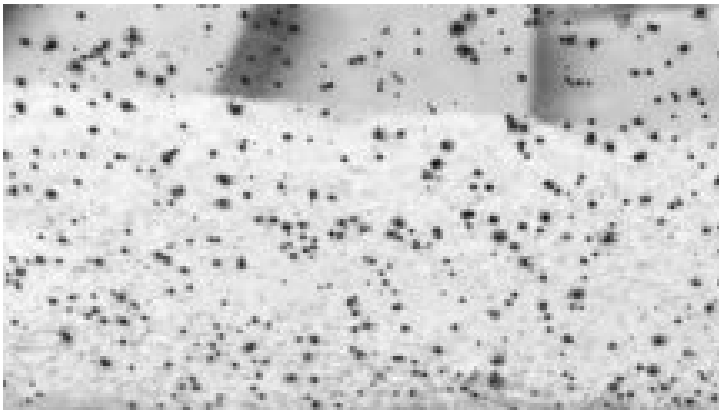


Fig. 52000A



Fig. 52000B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80°F Δ	N/A
Tempered	+120°F Δ	N/A
Laminate- Annealed	+80°F Δ	145°F
Laminate- Tempered	+120°F Δ	145°F
Mirrored	+80°F Δ	N/A

Fig. 52000C

Tool Checklist

- ☐ Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- ☐ Backing Pad
- ☐ Red RenuDisk(s)
- ☐ Grey RenuDisk(s)
- ☐ Polishing Felt
- ☐ Polishing Compound
- ☐ Rasp
- ☐ IR Thermometer

Workspace Checklist

- ☐ Power Access
- ☐ Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- ☐ Masking Tools
- ☐ Drop Clothes/ Tarps/ Waste Receptacles
- ☐ Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- ☐ Confirm Glass Type
- ☐ Confirm Damage Type
- ☐ Inspect Glass System Integrity (Framing, Glazing, Etc.)
- ☐ Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- ☐ Identify Damage Location(s)

Notes:

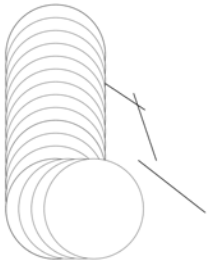


Fig. 52010A



Fig. 52010B

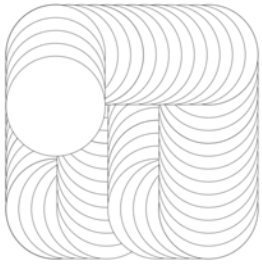


Fig. 52010C

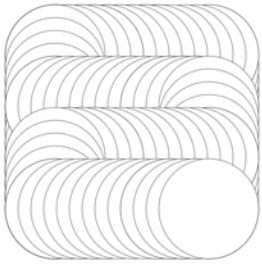


Fig. 52010D

C 5.20.1.0 - Step One: Abrasion utilizes a Red RenuDisk to quickly remove target damage.

1. Secure a Red RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Red RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 52010F



Fig. 52010G

Notes:

C 5.20.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.

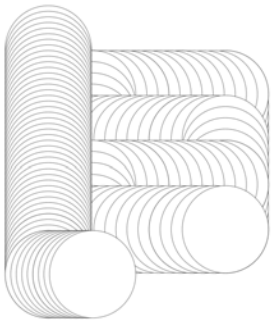


Fig. 52020A

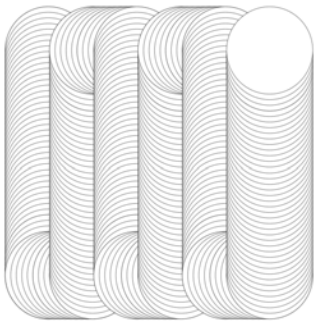


Fig. 52020B

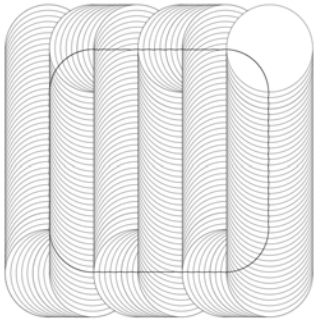


Fig. 52020C

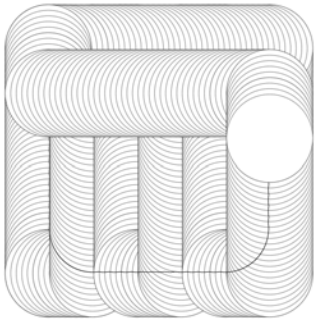


Fig. 52020D



Fig. 52020E

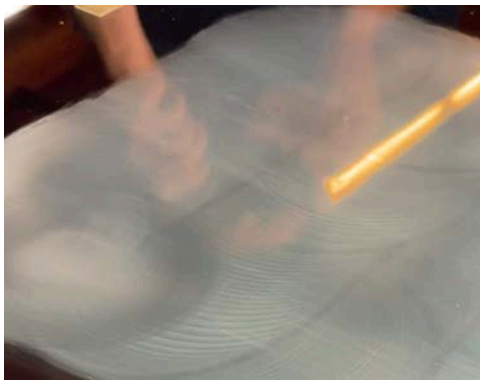


Fig. 52020F

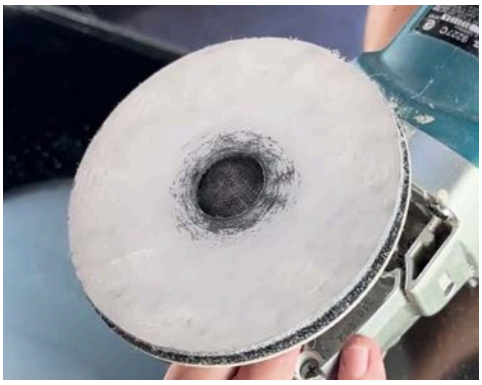


Fig. 52020G

C 5.20.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

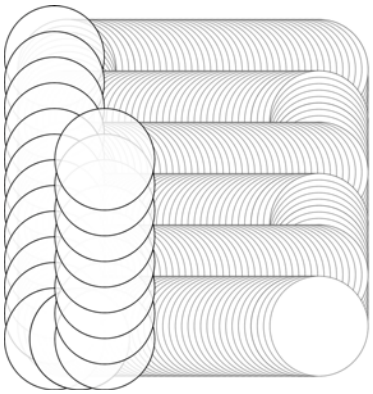


Fig. 52030A

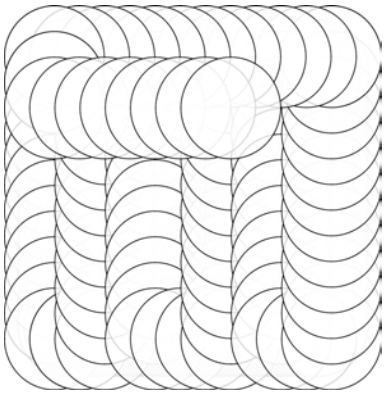


Fig. 52030B

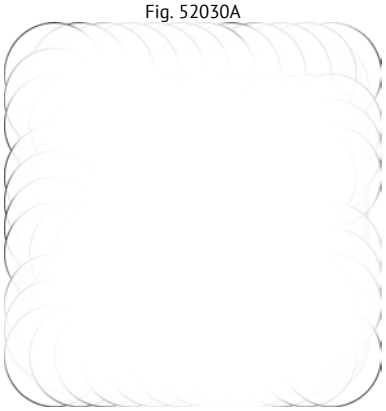


Fig. 52030C

Fig. 52030D



Fig. 52030E



Fig. 52030F

Notes:

C 5.21.0.0 - Chip [CAT-4]

APPROXIMATE TIME PER SQUARE FOOT: 120+ minutes

Chips in glass represent significant structural weak points and, depending on their size and location, are often deemed non-restorable due to the inherent risks they pose to the glass's integrity. However, there are certain instances where the removal or blending of chips can be cautiously considered within reasonable limits. This is particularly applicable to cases involving large, shallow chips located near the edges of the glass, where they can potentially be softened or blended into the surrounding area.

It is important to note that any restoration attempt aiming to address chips in glass will likely introduce some degree of optical distortion and can be exceedingly time-consuming. Rather than complete removal, a more feasible approach for restoration technicians might be to minimize the visibility of the damage and carefully remove stress points along the chip. This strategy can help prevent further structural degradation of the glass.

Given the complexities and risks involved, chip restoration in glass should only be undertaken by experienced technicians. This type of repair is a delicate process and should be considered a last resort, reserved for situations where no other viable options are available.



Fig. 52100A



Fig. 52100B

IMPORTANT NOTE: During the glass restoration process, it's crucial to closely monitor the temperature of the glass pane. The heat generated from grinding or polishing can increase the risk of thermal stress, potentially leading to cracks or breakage. To effectively manage this risk, it is recommended to use a non-contact thermometer, a tool available at most hardware stores. This allows for accurate and safe temperature measurements without interrupting the workflow.

Regular monitoring of the temperature differential between the repair area and the rest of the pane is key to preventing thermal damage. Should the temperature in the work area rise significantly, pause the restoration and allow the glass to cool. Immediate cessation of work and allowing the pane to return to a normal temperature range is necessary if overheating occurs. For specific temperature guidelines and detailed procedures on managing thermal expansion, please refer to section C 3.1.1.0 - Thermal Expansion.

TEMPERATURE ADVISORY	Delta	Maximum Temperature
Annealed	+80℉ Δ	N/A
Tempered	+120℉ Δ	N/A
Laminate- Annealed	+80℉ Δ	145℉
Laminate- Tempered	+120℉ Δ	145℉
Mirrored	+80℉ Δ	N/A

Fig. 52100C

Tool Checklist

- [ ] Corded, Variable Speed, Rotary Polisher (600-3000 RPM MINIMUM, ⅝-11 threaded spindle)
- [ ] Backing Pad
- [ ] Red RenuDisk(s)
- [ ] Grey RenuDisk(s)
- [ ] Polishing Felt
- [ ] Polishing Compound
- [ ] Rasp
- [ ] IR Thermometer

Workspace Checklist

- [ ] Power Access
- [ ] Workbenches, ladders, scaffolding, lifts, etc. (If Applicable)
- [ ] Masking Tools
- [ ] Drop Clothes/ Tarps/ Waste Receptacles
- [ ] Temperature Control Tools (If Applicable)

Damage Assessment Checklist

- [ ] Confirm Glass Type
- [ ] Confirm Damage Type
- [ ] Inspect Glass System Integrity (Framing, Glazing, Etc.)
- [ ] Inspect Glass Pane Integrity (Cracks, Chips, etc.)
- [ ] Identify Damage Location(s)

Notes:

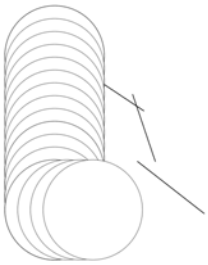


Fig. 52110A



Fig. 52110B



Fig. 52110C



Fig. 52110D

C 5.2.7.1.0 - Step One: Abrasion utilizes a Red RenuDisk to quickly remove target damage.

1. Secure a Red RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface directly above the glass's damaged area, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths across the damaged area. This action should form a precise cross-hatch pattern. Maintaining uniform pressure, continue abrading until all damage has been removed.
6. Disengage the RenuDisk from the glass pane.
7. Disengage the polisher's power trigger. Ensure the disk is stationary.
8. Detach the Red RenuDisk.
9. Continue to [Step Two: Pre-Polish].

NOTE: Over the course of the abrasion, glass stock will accumulate on the RenuDisk surface. It may be necessary to periodically unclog the disk surface to maintain optimal performance. To do this:

- **Disengage the polisher, ensuring the disk is stationary.**
- **Utilize the flat, non-aggressive face of the rasp file or wire brush.**
- **Gentle tapping motions on the RenuDisk surface will dislodge glass stock that has accumulated during operation. Refrain from brushing.**



Fig. 52110F



Fig. 52110G

Notes:

C 5.20.2.0 - Step Two: Pre-Polish is broken down into two distinct sub-steps: Mid Speed, and High Speed Pre-Polish. Each sub-section utilizes the same Grey Renudisk to refine, feather, and expand the established work area.

MID SPEED PRE-POLISH

1. Attach a new Grey RenuDisk to the designated backing pad.
2. Adjust the polisher to operate at a rotational speed of 1800 RPM.
3. Engage the polisher's power trigger, and trigger lock.
4. Align the RenuDisk surface to overlap the top left corner of the established work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
5. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
6. When the work area has been fully refined, expanded, and made uniform edge to edge, cease cleaning the Grey RenuDisk. At the end of the Mid Speed Pre-Polish subsection, it is necessary to allow the glass stock being removed from the pane to accumulate on the surface of the Grey RenuDisk.
7. Disengage the RenuDisk from the glass pane.
8. Disengage the polisher's power trigger.
9. Ensure the Grey RenuDisk surface is completely coated in glass stock.
10. Continue to High Speed Pre-Polish.

NOTE: Over the course of the Mid Speed Pre-Polish, glass stock will accumulate on the RenuDisk surface. If the RenuDisk is clogged, and further refinement/ expansion of the established work area is required, it may be necessary to clean the Grey RenuDisk and continue the Mid Speed Pre-Polish. To maintain optimal performance of the Grey RenuDisk:

- **Disengage the polisher's power trigger. Ensure the disk is stationary.**
- **Utilize the non-aggressive face of the rasp file or wire brush.**
- **Administer gentle tapping motions on the RenuDisk surface. Refrain from brushing.**

High Speed Pre-Polish

1. Adjust the polisher to operate at a rotational speed of 3000 RPM.
2. Engage the polisher's power trigger, and trigger lock.
3. Align the RenuDisk surface to overlap the top left corner of the established work work area by approximately ½ the diameter of the RenuDisk, ensuring that the disk remains parallel to the glass pane.
4. Employ a systematic abrasion approach by guiding the RenuDisk in alternating horizontal and vertical paths, expanding the established work area created in Step One by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure.
5. Disengage the RenuDisk from the glass pane.
6. Disengage the polisher's power trigger. Ensure the disk is stationary.
7. Remove the Grey RenuDisk.
8. Continue to: [Step Three: Polish].

NOTE: The Grey RenuDisk surface should maintain full glass stock accumulation during the entirety of the High Speed Pre-Polish subsection. No disk maintenance should be required.

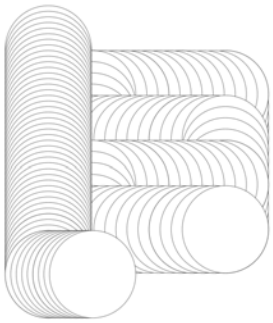


Fig. 52120A

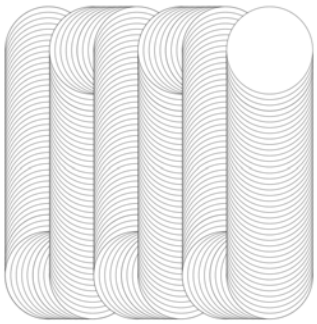


Fig. 52120B

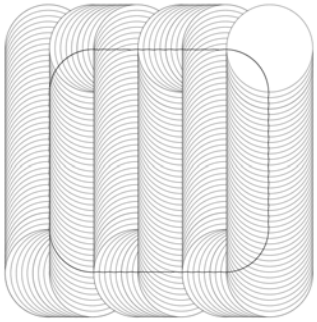


Fig. 52120C

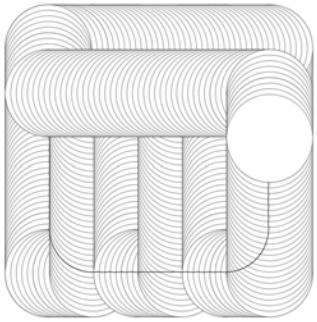


Fig. 52120D



Fig. 52120E

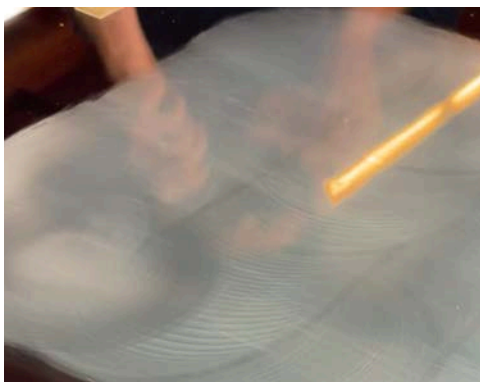


Fig. 52120F

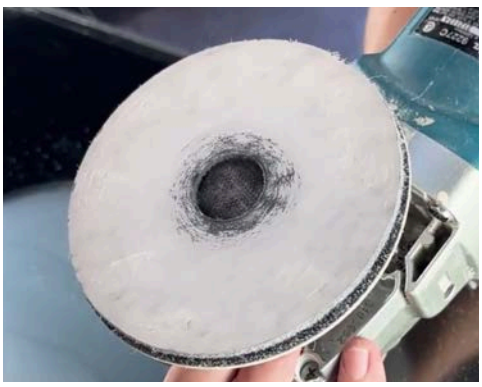


Fig. 52120G

C 5.21.3.0 - Step Three: Polish utilizes the Polishing Felt and Polishing Compound to restore glass to full luster.

1. Secure the polishing felt to the designated backing pad.
2. Using the rasp file, abrade the polishing felt surface gently. This helps elevate the natural fibers of the felt for enhanced polishing ease and efficiency.
3. Vigorously agitate the bottle prior to each application to ensure homogeneous distribution of the polishing compound. Apply Polish Compound directly to the felt's surface.
4. Adjust the polisher to operate at a rotational speed of 600 RPM.
5. Align the polishing felt surface to overlap the top left corner of the established work area by approximately ½ the diameter of the polishing felt, ensuring that the disk remains parallel to the glass pane.
6. Engage the polisher's power trigger, and trigger lock.
7. Disperse the polish uniformly across the entirety of the work area.
8. Employ a systematic polishing approach by guiding the polishing felt in alternating horizontal and vertical paths, expanding the established work area created in Step Two by approximately ½ the diameter of the RenuDisk. This action should form a precise cross-hatch pattern. Maintain uniform pressure. Continue the polishing process until all of the Polishing Compound has been worked into the glass.
9. Inspect the entire work area, checking for any remnants of haze from multiple angles. Pay particular attention to the edges and corners of the work area. If any remnants remain, begin Step Three again.
10. When the pane has been adequately restored, clean the glass using any standard glass cleaning technique to remove excess Polishing Compound.

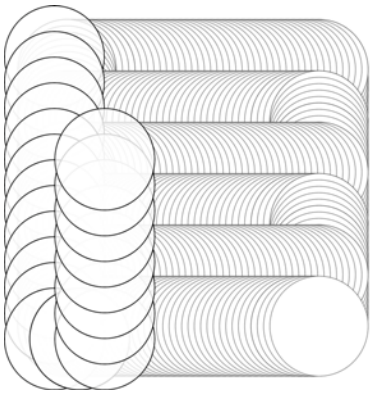


Fig. 52130A

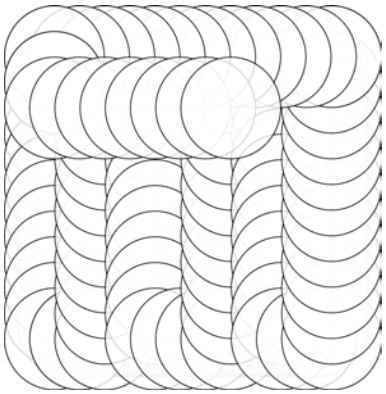


Fig. 52130B

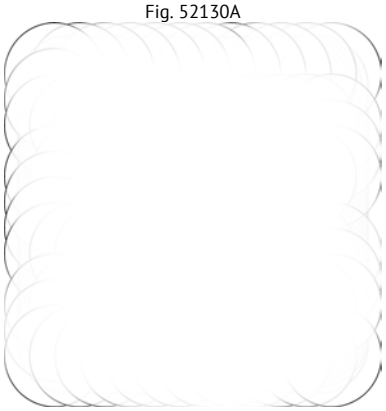


Fig. 52130C

Fig. 52130D



Fig. 52130E



Fig. 52130F

Notes: