CO2 Snow Cleaning for Art

CO2 Snow Jet Cleaning uses a carbon dioxide snow plume to remove contaminati9n from surface including particles, dirt, wax, polishing residues, fingerprints, and more.

Nondestructive, Nonabrasive, Residue-free, Nonchemical Waste

Examples for Art and Artifact Cleaning

Example 1 - Polishing Residue Removal - Polishing residue removal from a brass candlestick. The image on the left was typical before cleaning. The image on the right was typical after cleaning. Cleaning was less than 3 seconds with a high flow nozzle and we only focused on the grooves. A hot air gun was used to minimize moisture condensation. This example is shown with permission from the Biltmore's Conservation Department. Images can be magnified. We have other examples.

Example 2 - Wax Removal - Wax removal from the same candlestick. The image on the left was typical of the wax before cleaning. The image on the right was typical after cleaning. We used a hot air gun to melt the wax, and then blew it away totally. Cleaning was within 5 seconds for that area. The brass candlestick is shown with permission of the Biltmore Estate Conservation Department.

Before CO2 cleaning **After CO2 cleaning**

Example 3 - Dirt Removal - These plastic fake food items were partially cleaned with CO2 snow. A hot air gun was used to keep away moisture condensation. The center area was cleaned well in one pass, less than 3 seconds. The outside areas need more work. This example is shown with permission from the Biltmore's Conservation

Example 4 - Soot Removal - This glass was exposed to a candle flame leading to soot deposits. With a hot air gun aimed at the glass, soot was removed within seconds, and no moisture seen. Even with these images, soot removal requires care and attention to any moisture condensation. Images can be magnified.

Before CO2 cleaning **After CO2 cleaning**

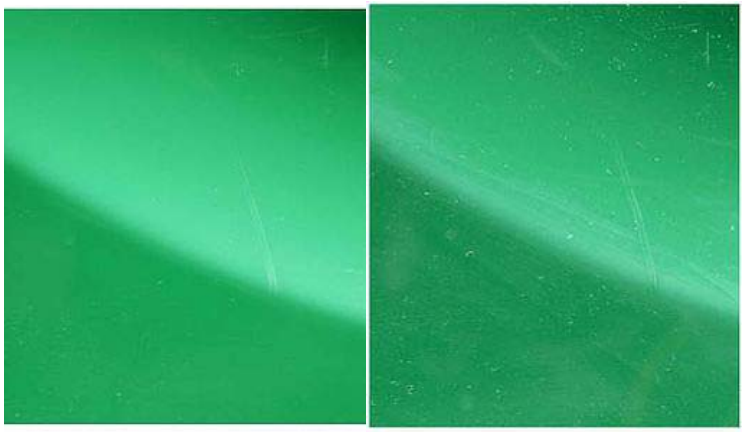
Example 5 - Facial Grease A plate galss sample had facial grease smeared all over its surface and we marked an 'x' on the surface. Half the sample was cleaned using a hot .

Fingerprint Removal - Note the five fingerprints on the glass surface before cleaning above the 'X'. CO2 snow cleaning removed the middle fingerprints

Before CO2 cleaning **After CO2 cleaning**

Example 6 - Hugh Shockey on R. Morris's "Model" This polymer sculpture had an unknown haze on its surface as shown in the 'Before' image below. CO2 snow cleaning removed the haze, which was likely an unknown organic as shown in the 'after' image. Images can be magnified.

Before CO2 cleaning **After CO2 cleaning**



Example 7 - Cleaning Woven Baskets - The image on the left shows the samples Nancy Odegaard tested CO2 snow cleaning to characterize dust and dirt removal. The table below shows the relative percentages of dirt removed for brushing, brushing and vacuuming, and CO_2 snow cleaning for both woven baskets with and without textiles. The bottom image presents the data as a bar graph. Overall, CO_2 snow cleaning removed from 30 to 50% more dirt in the same time than brushing or brushing and vacuuming. Images can be magnified.

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The CO2 Snow Cleaning process removes particles of all sizes, from visible down to 3 - 5 nanometers. At the same time, hydrocarbon-based contamination and organic residues can be removed. Carbon dioxide snow cleaning is nondestructive, nonabrasive, residue-free, and environmentally friendly - there is no chemical waste. The cleaning process is based upon the controlled expansion of either liquid or gaseous carbon dioxide. This expansion leads to the nucleation of small dry ice particles and a high velocity carrier gas stream. Upon impact with a surface, the dry ice removes particles of all sizes by momentum transfer, and hydrocarbons and organics via a transient solvent or a freeze fracture mechanism. The high-velocity gas blows the contaminants away. Additionally, nozzle design changes can be made for cleaning large telescope mirrors.

New Equipment

We put efforts into making units dedicated for large telescope mirror cleaning and for cleaning art as in restoration and conversation. Please see those respective pages, **Telescopes** and **Art Conservation**. We also added a leak valve option.

Portable Units - We have two units with a small CO2 canister attached to the hand gun or solenoid. These canisters are less and 1/2 KG of CO2. They are totally portable, hand carried. The solenoid version can be equipped with batteries.

Dual Gas Units: We make a teflon insert that can fit over the nozzle and then nitrogen or dry compressed air passes over and about the cold CO2 stream. This design is based upon the ideas of Hoenig, 1986. This does not eliminate the moisture problems, but reduces it. The Dual Gas Unit (K6-10DG-A) uses 2 solenoid valves, one for the CO2 and another for the nitrogen flow. Solenoid controls can be footpetals or just 24VDC signals. The K6-10DG-B uses a valve in place of the second solenoid. A dry compressed air heater can be attached.

New Nozzles: We developed a few new nozzles with reduced consumption, flow and velocity, yet they still perform organic thin film and particle removal. By still having oganic removal, submicron particle removal will occur. The polymer nozzle is still available for existing customers at reduced prices. We also introduced a leak valve for reduced flow.

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