



## DRY ICE BLASTING — FAST, ENVIRONMENTALLY FRIENDLY CLEANING

*By Pete Sawochka-Dalton*



Dry ice blasting, or dry ice cleaning, is a cleaning process that uses media blasting of dry ice pellets to remove contaminants from equipment, tools, surfaces, etc.

### **How dry ice blasting works**

Fundamentally, dry ice blasting works like other forms of media blasting (often referred to informally as “sandblasting”<sup>1</sup>). Media blasting propels a material at high-speed against a surface, typically using compressed air. In most media blasting, the material used to clean the surface is abrasive, scouring the surface clean of any contaminants. However, the material used in dry ice blasting — dry ice pellets — is virtually non-abrasive.

So how does dry ice blasting clean the surface? Through a combination of thermal shock and gas expansion.

A dry ice pellet is a form of solid carbon dioxide with a temperature of  $-109^{\circ}\text{F}$  ( $-78^{\circ}\text{C}$ ). When a dry ice pellet strikes a contaminant, rapid heat transfer occurs. This heat transfer causes the contaminant to contract and detach from the surface. This rapid heat transfer also causes the dry ice pellet to vaporize, changing the pellet from a solid to a gaseous state. This state change is accompanied by rapid expansion, knocking away the loosened debris.

## Advantages of dry ice blasting

- Fast cleaning — equipment can be cleaned without cooling completely, or in many cases disassembled, shortening shutdown times.
- Deep cleaning — the pressurized air stream can reach areas that are hard to reach using traditional cleaning methods.
- Simplified cleanup — because dry ice vaporizes to a gas it leaves behind no secondary waste. The only material to be cleaned up is the original contaminant.
- Environmentally responsible — dry ice pellets are pure carbon dioxide so don't leave behind any toxic residue. (Although the contaminants on the surfaces being cleaned may themselves be toxic.)
- Non-abrasive — because dry ice pellets are virtually non-abrasive, they won't damage the substrate of the surface being cleaned.
- Non-conductive — dry ice doesn't conduct electricity, making it suitable for cleaning electronic equipment.
- Dry cleaning method — because dry ice goes directly to a gaseous state from a solid one, dry ice blasting can be used when a dry cleaning method is required.
  - Microorganism decontamination — dry ice blasting can effectively remove Salmonella, E. coli and Listeria from surfaces such as stainless steel, ceramic tile and food grade plastics.<sup>2</sup>

## Disadvantages of dry ice blasting

Even though dry ice blasting is virtually non-abrasive, some painted surfaces can be damaged by the process.

## Dry ice cleaning applications

### Food & beverage processing

Several advantages of dry ice cleaning make it suitable for cleaning food production equipment, food packaging equipment, and the food production environment itself:

- Dry cleaning method
- Deep cleaning
- Microorganism decontamination
- Non-toxic cleaning material
  - The carbon dioxide used in dry ice cleaning is the same grade used in the food and beverage industry.<sup>3</sup>

### Semiconductor fabrication

Because dry ice is a non-conductive, non-abrasive material, dry ice blasting can be used in industries that rely heavily on semiconductors, like the electronics, aerospace, and medical device manufacturing industries.

### General manufacturing

Dry ice cleaning can be used in many manufacturing environments to clean production equipment (including printing presses), molds, tooling, and electronic equipment.

### Disaster remediation

Dry ice blasting is effective in remediating mold, smoke, fire, and water damage.

### Conservation & historical preservation

Because it produces no secondary waste, is non-abrasive, is environmentally responsible, and is a dry cleaning method, dry ice blasting is suitable for conservation and historical preservation projects.

## Applications not suitable for dry ice cleaning<sup>4</sup>

### Cleaning of soft surfaces

While dry ice cleaning is virtually non-abrasive, the material is still being propelled at 80 psi (5.5 bar) or higher, which can damage softer surfaces, like soft woods and soft plastics.

### Removing strongly bonded coatings

Because dry ice cleaning is virtually non-abrasive, coatings that have strong bonds with the underlying material, e.g. baked-on enamels and some primers, can't be removed by dry ice blasting.

### Cleaning soft contaminants

Some soft contaminants, like oil, can spatter under the pressures involved in dry ice cleaning, so either special collection systems or low-pressure cleaning methods may work better.

## Safety

As with any media blasting, you must take safety precautions when using dry ice blasting as a cleaning method:

- Wear protective clothing, including face shields and gloves, as protection from both the ultra-low temperatures of dry ice and debris from the surface being cleaned
- Wear hearing protection (ear muffs, ear plugs, etc.) to prevent noise-induced hearing loss
- Wear a breathing mask to keep from inhaling particulate knocked loose by the cleaning process

In addition, if cleaning indoors, the room must be well-ventilated. In a poorly-ventilated room, the cleaning process could cause a build-up of carbon dioxide and lead to asphyxiation.

<sup>1</sup> While media blasting is commonly referred to as "sandblasting", a variety of media can be used: sand, baking soda, glass, etc.

<sup>2</sup> Millar, Ian. (September 19, 2004). Final Technical Report: Cold Jet - a Novel Technique for Cleaning and Decontaminating Food Processing Areas, Equipment, Carcasses and Foods. [http://www.polarclean.com/wp-content/uploads/2015/07/Food\\_Standards\\_Agency.pdf](http://www.polarclean.com/wp-content/uploads/2015/07/Food_Standards_Agency.pdf) (accessed December 12, 2020)

<sup>3</sup> BNP Media Staff. (March 1, 2007). Harnessing the Cleaning Power of Dry Ice. <https://www.pcimag.com/articles/94587-harnessing-the-cleaning-power-of-dry-ice> (accessed December 12, 2020)

<sup>4</sup> Cryonomic. What kinds of applications are not suited for dry ice cleaning? <https://www.cryonomic.com/en/faq/221132/general-information/6> (accessed December 12, 2020)

## Sources

- Cold Jet. Dry Ice Blasting Solutions. <https://www.coldjet.com/dry-ice-blasting/> (accessed December 20, 2020)
- Cryonomic. Dry ice blasting: how does it work? <https://www.cryonomic.com/en/faq/21172/general-information/5-dry-ice-blasting-how-does-it-work> (accessed December 20, 2020)
- Manitoba Agriculture and Resource Development. Dry Ice Blast Cleaning for the Food Processing Industry. <https://www.gov.mb.ca/agriculture/food-safety/at-the-food-processor/print,dry-ice-blast-cleaning.html> (accessed December 20, 2020)
- BNP Media Staff. (March 1, 2007). Harnessing the Cleaning Power of Dry Ice. <https://www.pcimag.com/articles/94587-harnessing-the-cleaning-power-of-dry-ice> (accessed December 20, 2020)
- Rudawska, Anna. (2019). Dry Ice Blasting.Website. <https://www.sciencedirect.com/topics/engineering/dry-ice-blasting> (accessed December 20, 2020)