

DRY ICE CLEANING

BY

DanductClean®



AGENDA

Dry ice cleaning

- **Global Duct Cleaning Regulations**
- **Using dry ice - US companies**
- **What is dry ice**
- **ESG score**
- **Dry ice pellets**
- **How dry ice blasting works**
- **Partnership with White Lion**
- **Danduct dry ice robot**
- **What can be cleaned with dry ice**



REGULATIONS

The growing awareness of air quality and fire hazards is driving the demand for ongoing duct cleaning services. Over the coming years, this trend will likely accelerate as regulations tighten, technology advances, and industries push for safer, healthier environments.

- A selection of countries who already have laws & regulations:
 - United States
 - Occupational Safety and Health Administration - **OSHA (3)**
 - Fire hazard - **NFPA 96 (4)**
 - United Kingdom
 - Health and Safety Executive - **HSE**
 - Regulatory Reform (Fire Safety) - **TR19 (5)**
 - Australia
 - Workplace Health and Safety - **AS 1668.2-2012 (6)**



REGULATIONS

- Canada
 - workplace safety regulations - **CSA**
 - Fire hazard - **NFPA 96 (7)**
- Germany
 - Occupational Safety and Health or Trade Supervisory Office
 - Fire Safety - **DIN 1946-4 (8)**
- Sweden
 - Work environment act
 - Fire safety - **SBF (9)**
- United Arab Emirates (UAE)
 - General Duct Systems
 - Dubai Municipality Technical Guideline - **TG19 (10)**

Using dry ice - US companies



Kraft*Heinz*



Smithfield
Good food. Responsibly.®



Cargill



DanductClean

What is dry ice

- **Dry ice is solid carbon dioxide (CO_2)**
- **Compressed and cooled into pellets**
- **Temperature of -78.5°C**
- **Dry ice sublimates (into gas)**
- **Size: 1,7 mm/3 mm/6 mm/10 mm/16 mm**



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40% - Estimated for sanitation

60% - Water costs in the 30 largest US cities grew 60% from 2010 to 2019(1)



Eliminate downstream contamination

Reduce GHG scores (2)

Improve safety by removing solvents

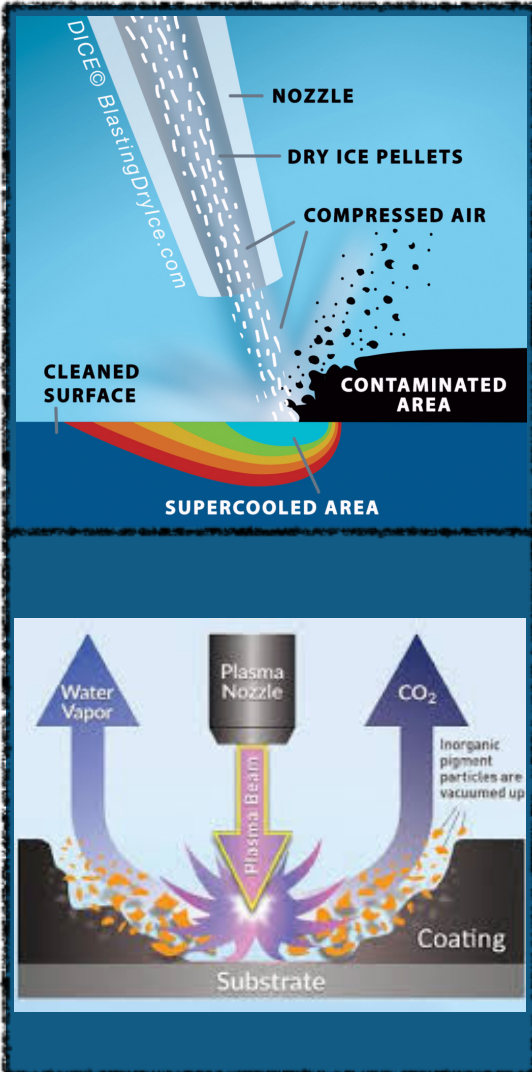


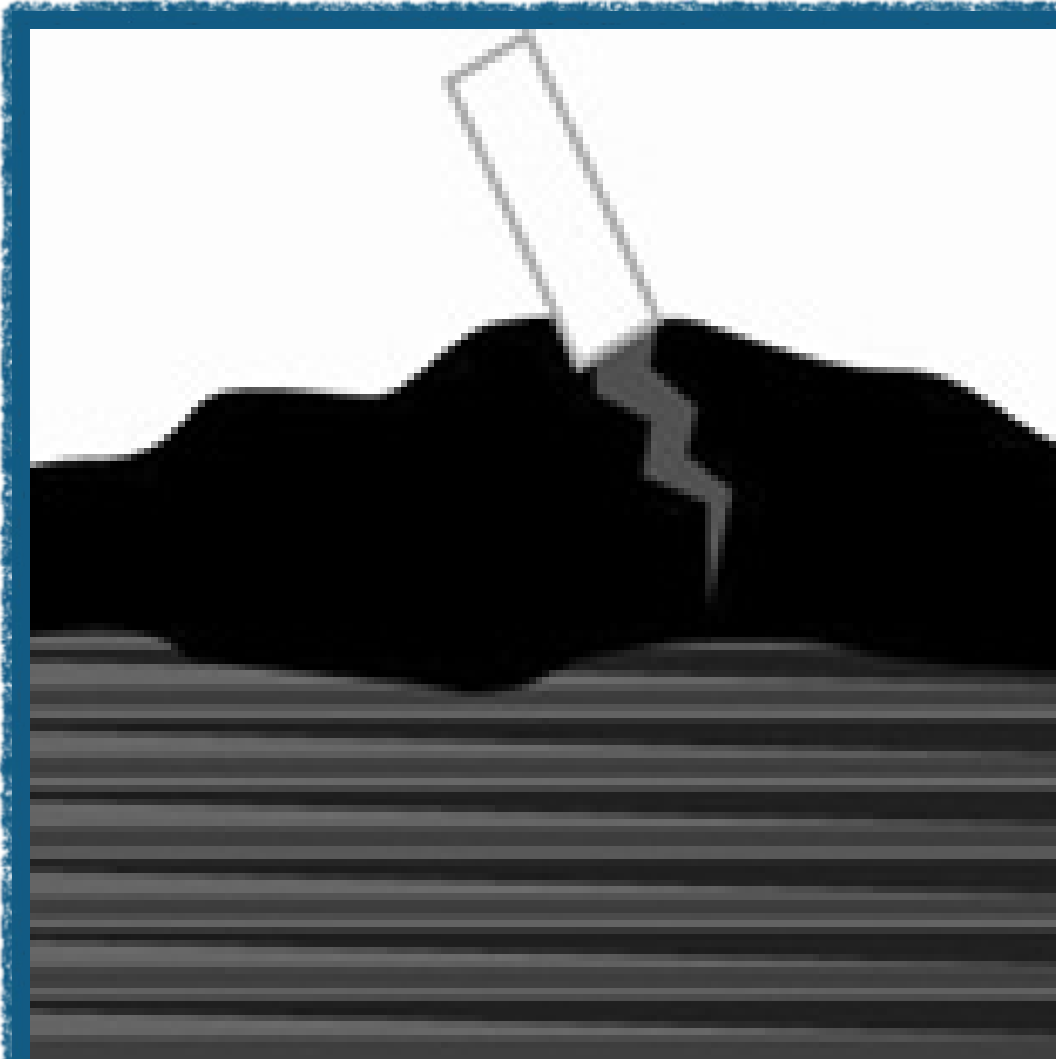
ESG score

- **No additional emission scoring**
- **CO² is accounted for at the producer level**
- **Dry ice is recycled CO²**
- **Giving CO² a second life**
- **Most sustainable solution on the market**

How dry ice blasting works

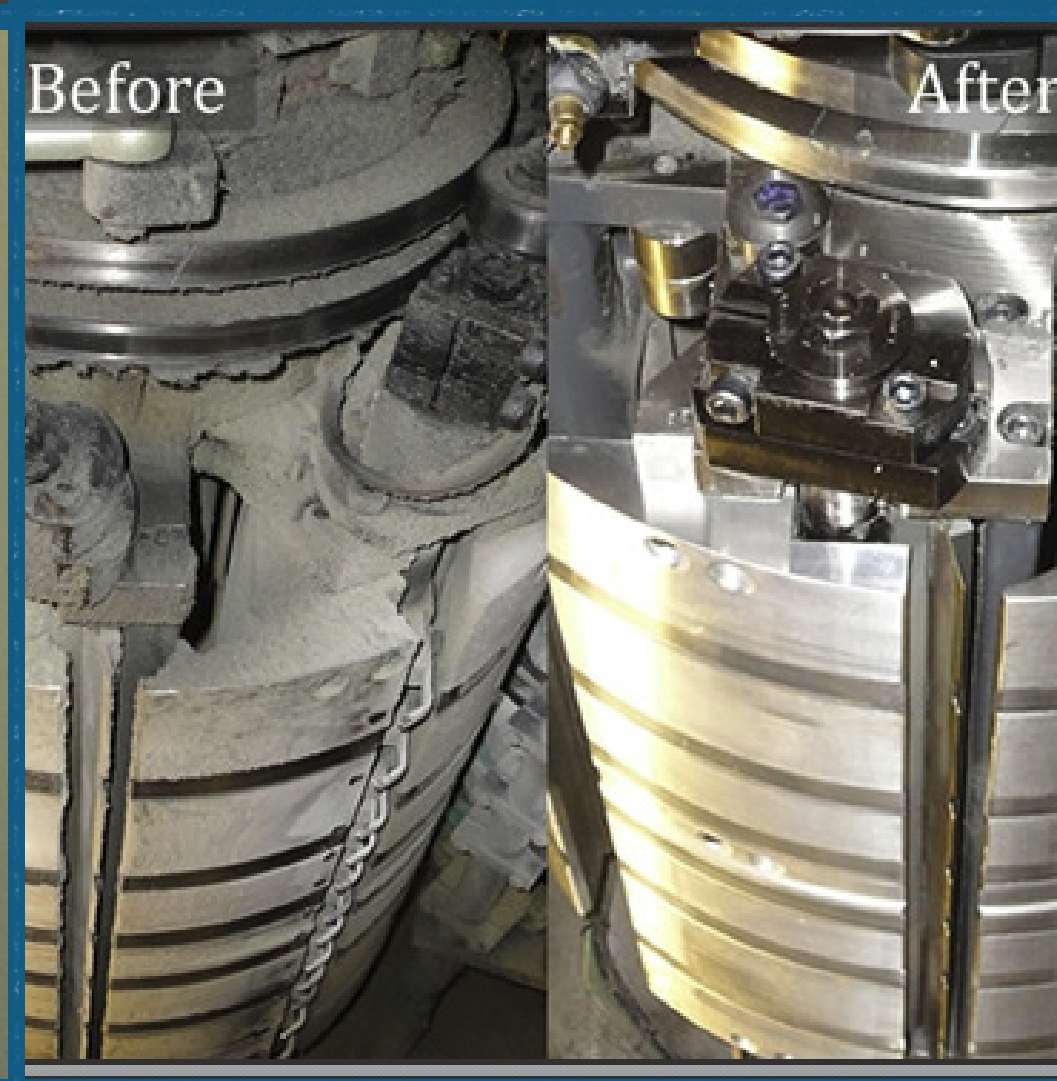
- Kinetic energy $E_{kin} = \frac{1}{2} \cdot m \cdot v^2$
- Sublimation $T >$
- Volume change times 800
- Thermal effect
- The combination of the 3 effects makes dry ice cleaning possible.





Example - Cleaning effect

- Hitting the surface with 300 m/s
- Volume increases 800 times
- This conversion creates an explosive effect, lifting the contaminant off the surface.





Partnership with White Lion

- **Made in Germany**
- **Dry ice technology saves time**
- **Prevention of secondary waste**

Made with passion.



DanductClean®

WL 1500



The compact solution for dry ice cleaning

- Internal compressed air pressure adjustment from 1 – 10 bar
- Dry ice pellet delivery volume continuously variable from 20 – 80 kg/h
- Digital display showing the dry ice pellet transport volume
- Emergency stop function with red LED signal lamp

WL 3000



The all-rounder among dry ice blasting systems.

- Internal compressed air pressure adjustment from 1 – 16 bar
- Dry ice pellet delivery volume continuously variable from 20 – 120 kg/h
- Digital display showing the dry ice pellet transport volume
- Emergency stop function with red LED signal lamp

WL 5000



The best choice for challenging dry ice cleaning jobs

- Quick nozzle replacement without tools
- Internal compressed air pressure adjustment from 1 – 16 bar
- Dry ice pellet delivery volume continuously variable from 20 – 140 kg/h
- Digital display showing the dry ice pellet transport volume
- Emergency stop function with red LED signal lamp



WHITE LION

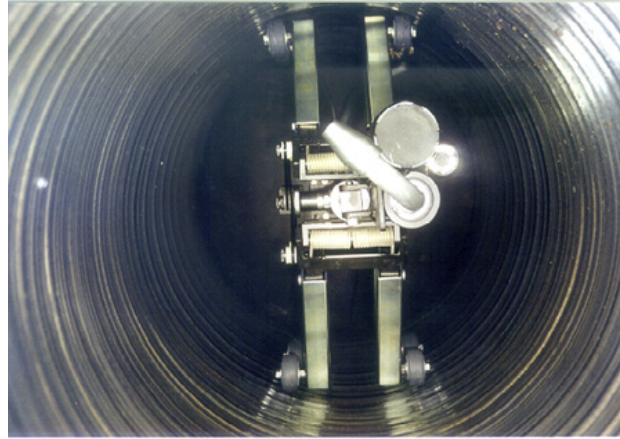
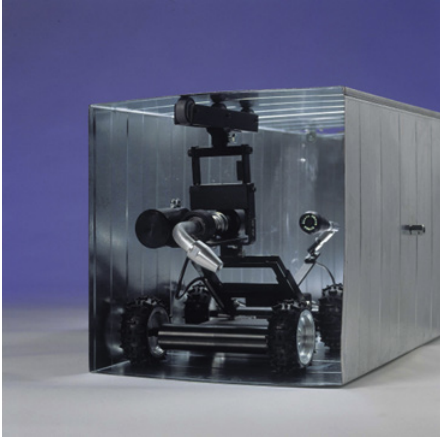
Dry Ice & Laser Cleaning Technology

- **Blasting Guns & LED Lights**
- **Flat Nozzles**
- **Round nozzles**
- **Ice splitters/Scramblers**
- **Extra hoses customized length**
- **Anular nozzles 45° to 90°**
- **Extensions up 150cm**

Danduct Dry Ice robot



Danduct Dry Ice Robot



Danduct ice robot

- For round & square vertical ducts
- Min. height in square ducts 200mm.
- Min. height in round ducts 400mm
- Cruise control (robot)

Steering kit

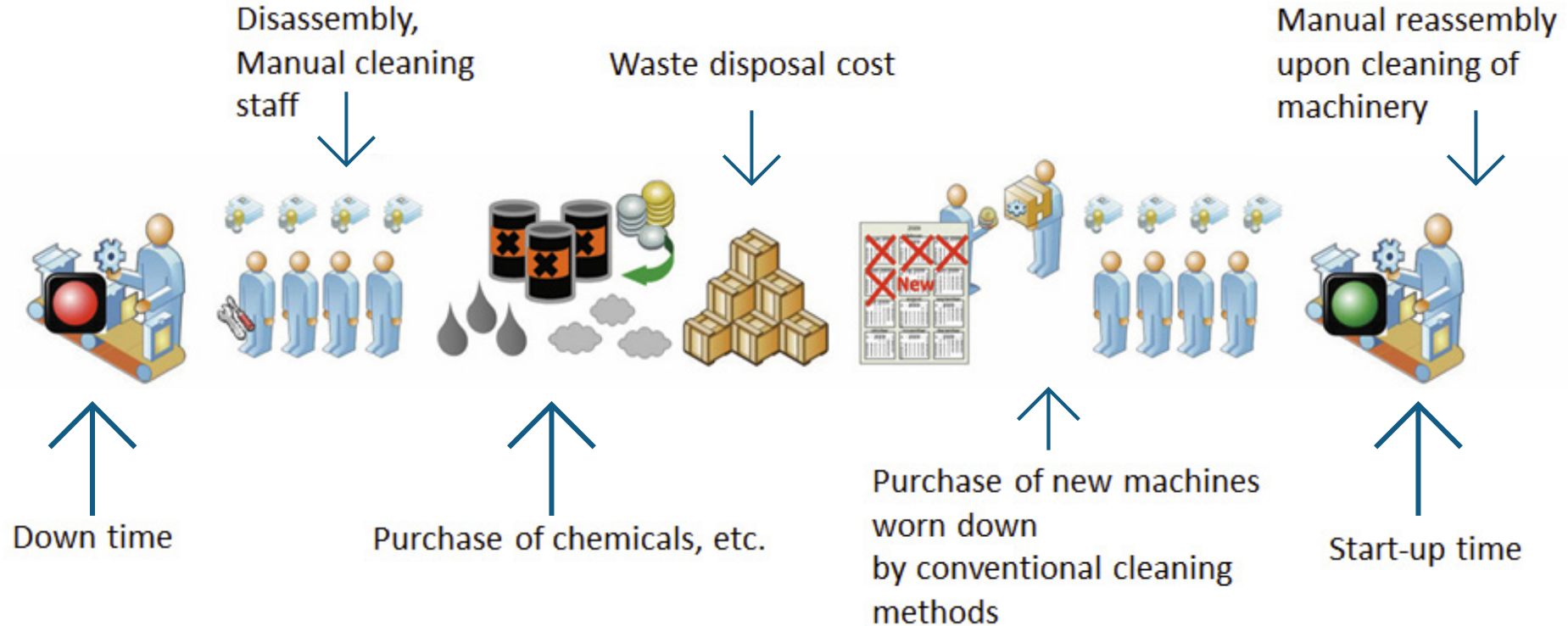
- For vertical ducts
- Min. height 200mm.
- For both round & square ducts
- From above & from below



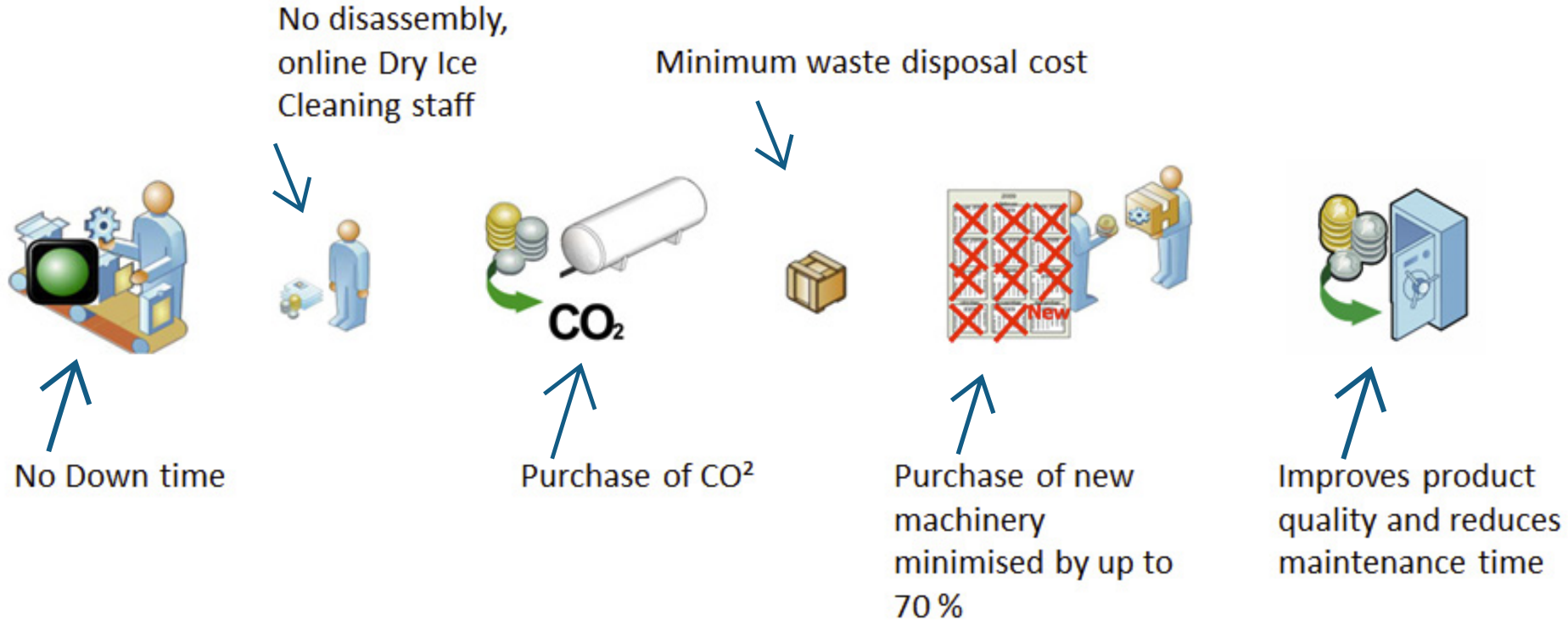
Benefits

- **The system produces no waste, with only removable coating left to be swept or vacuumed.**
- **Dry ice blasting is perfect for cleaning moulds and equipment without needing to cool or dismantle them.**
- **Dry ice blasting is non-toxic, uses no chemicals, and eliminates disposal costs for blasting media and solvents.**
- **These factors show the investment will pay off quickly.**

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Classical applications

Graphic industry:

- Removal of wet and dry ink, paper dust, glue.
- Cleaning Off-set presses, HOT MELT bookbinding machines, etc.

Wood Industry:

- Removal of glue, varnish, resins from production equipment, injectors, chain conveyors, drying ovens, grinding belts, etc.

Automotive Industry:

- Oil, grease and carbon residues on robotic equipment, jigs and fixtures at spot welding installations.
- Release agents and polyurethane residuals on moulds, (like, for example, at companies manufacturing car seats, bumpers, acoustic panels etc.
- Residual paint and varnish on fixtures at painting lines (cataphoresis).

Classical applications

Food Industry:

- Cleaning of glue at packaging lines
- Cleaning of hot melt glue at can labelling machines
- Cleaning of moulds, trays, ovens
- Cleaning electromechanical parts and transmissions in conveying lines

Plastic industry:

- Removal of release agents and other production residuals in moulds, extrusion screws, extrusion nozzles (especially within the manufacturing of nylon and polyethylene foils for flexible packaging).
- Rubber industry: cleaning of compression moulds for tyres, o-rings, seals and diverse rubber profiles

General:

- Cleaning of electromechanical components, electrical switchboards, hydraulic and pneumatic parts, transmissions, conveyors, chains



Townhall at Aachen, Germany

Use of Dry Ice blasting Asbestos /rusty iron construction.

- Surface: Rusty, asbestos covered roofconstruction
- Contamination: Asbestos fibers "stick" on rusty iron carriers
- Problem with sandblasting: The weight of eg. sand from sandblasting overloads the roof structure. Expensive to dispose the sand
- Procedure: Cover (air tight) with vacuum
Dry Ice blowing – finishing disposal of removed asbestos / rust
- Current cleaning method: Steel brush, hammer / chisel



Result with Dry Ice blasting asbestos/rusty iron construction

- The result of cleaning with dry ice blowing was extremely satisfactory:
 - Air pressure: 6 bar
 - Used nozzle: Flat nozzle 50mm
 - Dry Ice consumption: 40 kg/hour
 - Time consumption: 7 weeks
- Efficiency
 - One hour Dry ice blowing cleaned the same area, like 3 workers earlier could clean in 3 days



Dry Ice blasting for aggressive contamination of mold

- Reason: Extract system from kitchen, was not sent directly out, but instead let out inside the roof construction.
- Contamination: Moisture and impurities from the kitchen, resulted in an extensive mold/fungal attack to the building.
- Solution: The building was provided with a "tent" with constant vacuum to prevent the cleaned fungal / spores spread throughout the city.



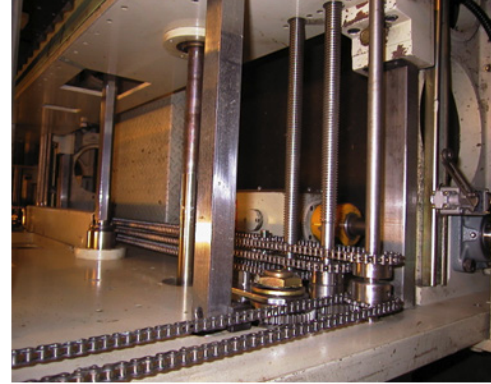
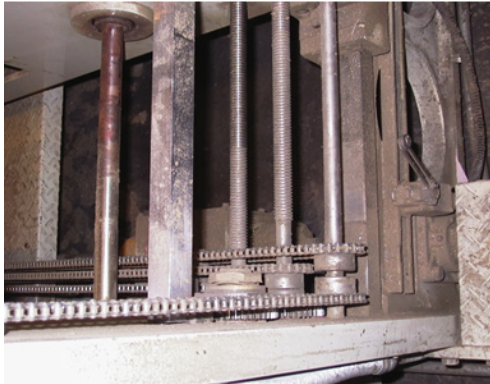
Dry Ice blasting for aggressive contamination of mold

- Result Dry Ice blasting - Wrong construction of kitchen extract duct work
 - Air pressure: 6 bar
 - Used nozzle: Flat nozzle 50mm - incl. icesplitter
 - Dry Ice consumption: 30 - 40 kg/hour
- Efficiency
 - 7 - 10m² /hour
- Savings
 - The roof required a complete renovation. The wooden structure was cleaned with dry ice and could be reused, so only the top sealing needed to be replaced.

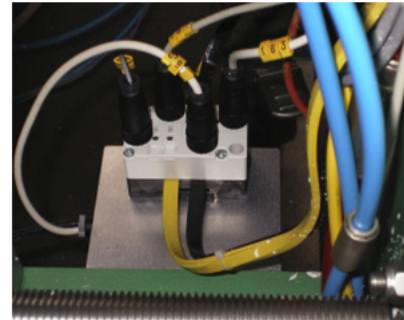
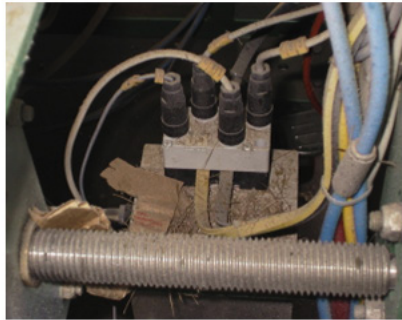
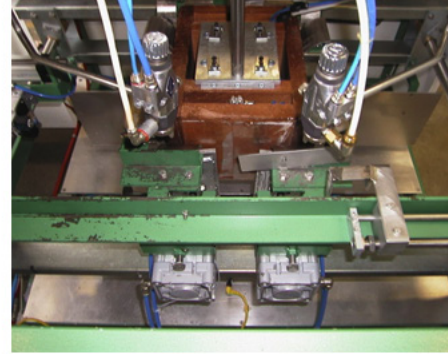
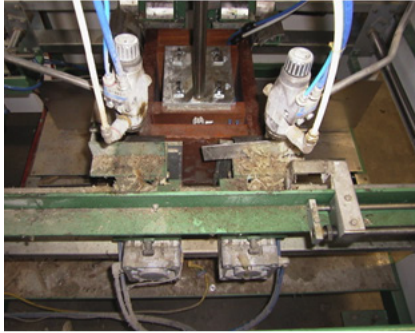
Various facade cleaning



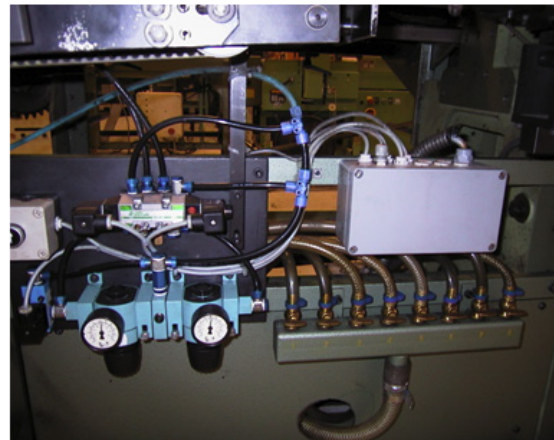
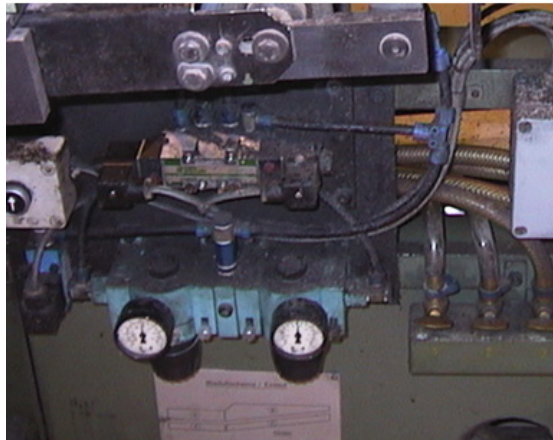
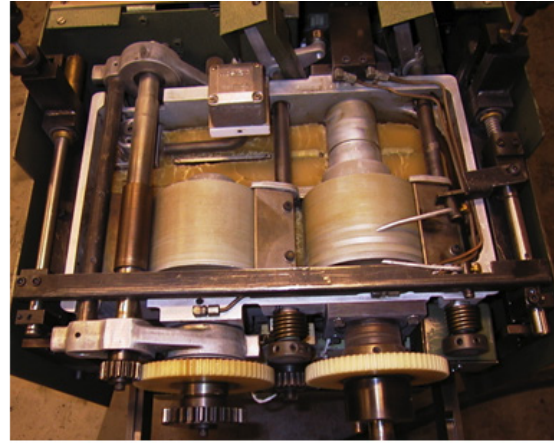
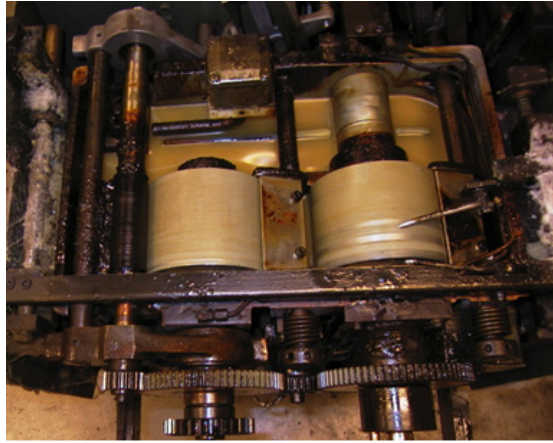
Before and after pictures



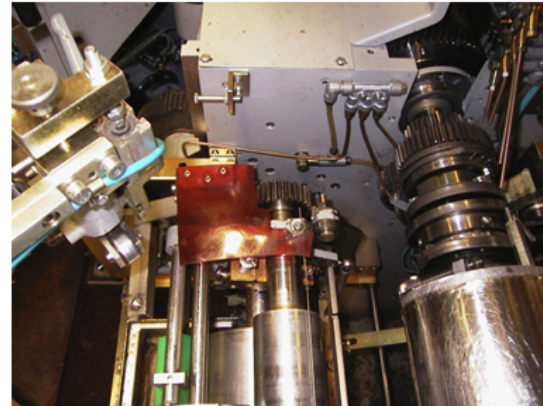
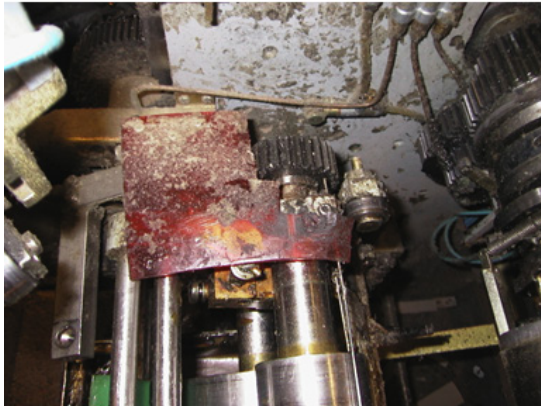
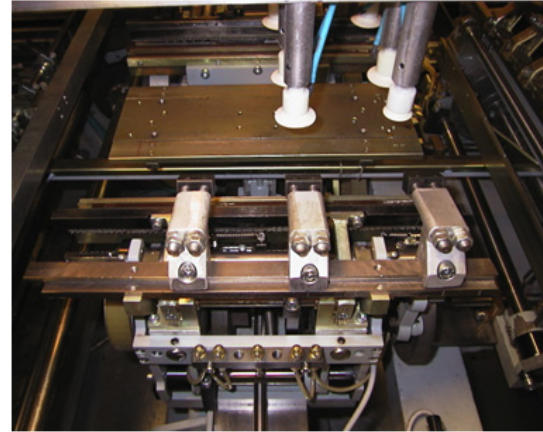
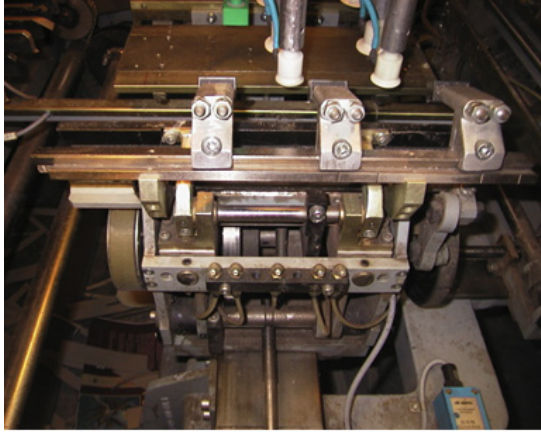
Before and after pictures



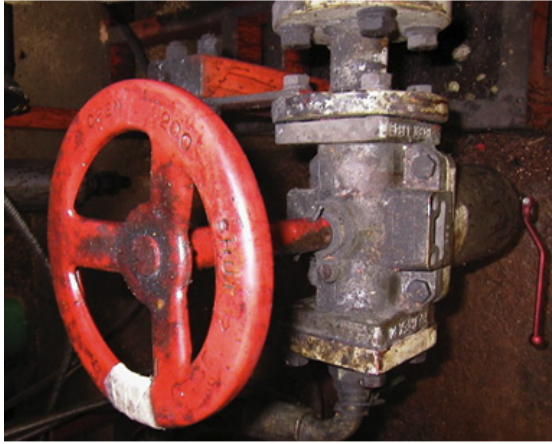
Before and after pictures



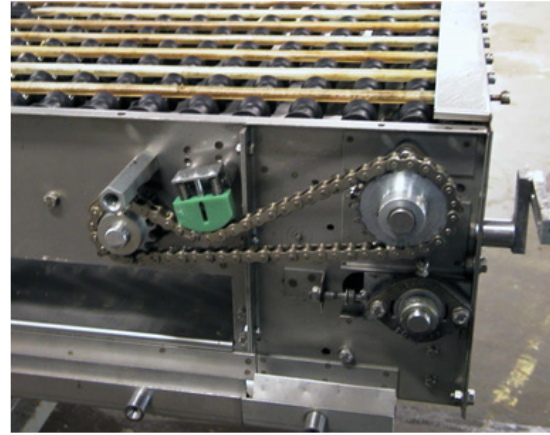
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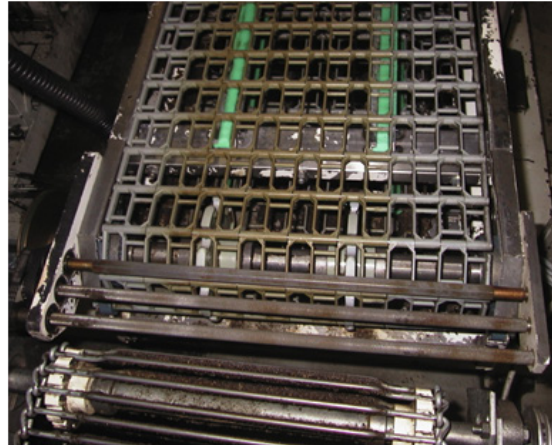
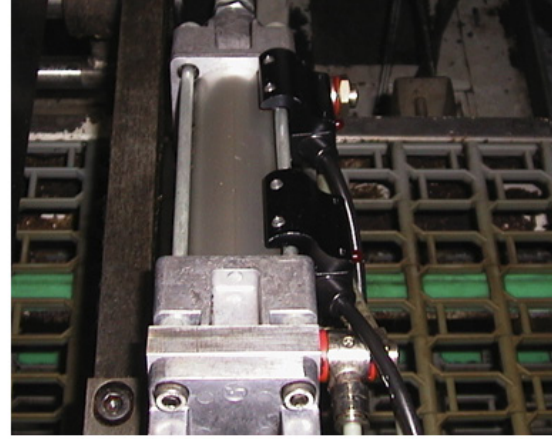
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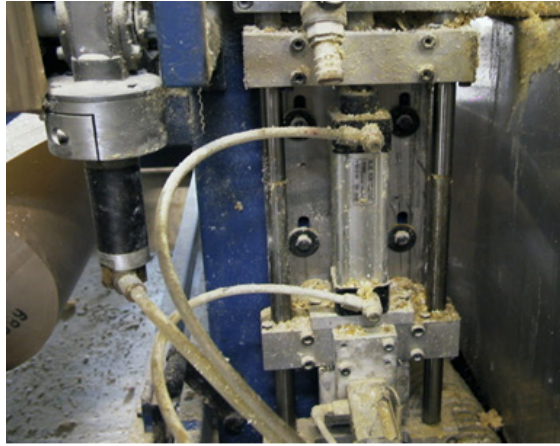
Before and after pictures



Before and after pictures



Before and after pictures



References

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- 2. Institute for Research and Technical Assistance. Alternative Low-VOC Release Agents and Mold Cleaners for Industrial Molding, Concrete Stamping and Asphalt Applications. www.irta.us. Retrieved 15 March 2022.**
- 3. Occupational Safety and Health Administration**
- 4. NFPA 96**
- 5. TR19 - LINK 1 & LINK 2**
- 6. Workplace Health and Safety**
- 7. NFPA 96**
- 8. DIN 1946-4**
- 9. SBF**
- 10. TG19**

References

11.

1. Tyson Foods

As one of the largest meat producers, Tyson Foods has utilized dry ice blasting to clean food processing equipment and machinery efficiently, maintaining hygiene standards.

2. General Mills

General Mills, known for products like Cheerios and Betty Crocker, has adopted dry ice blasting for cleaning production lines to ensure food safety and cleanliness.

3. Kraft Heinz

Kraft Heinz, a global leader in processed food, has used dry ice blasting in some of its manufacturing facilities to clean machines and remove food residues without chemicals.

4. PepsiCo

PepsiCo, which operates large-scale food and beverage manufacturing plants, uses dry ice blasting to clean production lines, especially for their snack food production.

5. Nestlé USA

Nestlé uses dry ice blasting in some of their food production facilities as part of their efforts to maintain food safety and avoid contamination from cleaning chemicals.

6. Hormel Foods

Hormel, known for products like Spam, uses dry ice blasting for cleaning purposes in their food production plants, particularly in areas where food residue and grease need to be removed without leaving contaminants.

7. Smithfield Foods

As one of the largest pork producers, Smithfield Foods uses dry ice blasting as part of its sanitation process, helping to clean hard-to-reach areas in food processing plants.

8. JBS USA

JBS USA, a major player in meat processing, has also implemented dry ice blasting to clean production equipment and facilities, ensuring hygiene standards are met.

9. Dole Food Company

Dole, which deals with fresh fruits and vegetables, uses dry ice blasting as part of its cleaning processes to ensure that the equipment is free from contaminants.

10. Cargill

Cargill, a multinational company involved in food production and agriculture, uses dry ice blasting for cleaning its processing equipment and maintaining cleanliness in facilities where food is produced.

Thank You

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