

CLEAN *surface*



Designers & Manufacturers of Dry Ice Blasting Equipment



The Power of DRY ICE

The safe way to remove surface deposits from moulding tools without chemical or solvent action, abrasion or damage to the surrounding environment.

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The power of dry ice

The Process

These are 3mm dry ice pellets rapidly subliming on the lid of a Clean Surface blast unit.

Dry ice, which is pure solid carbon dioxide, is made by decompressing liquid CO₂ to create CO₂ snow. The snow is then compacted and extruded through a die plate to form solid CO₂ pellets.

Dry ice is unstable above minus 78.6 °C, but instead of melting into CO₂ liquid it sublimates directly into CO₂ gas. It is this sublimation process that creates the cleaning effect when dry ice is used as a blasting medium.

During blasting the pellets are accelerated to speeds between 200 and 300 m/s with compressed air. They break up as they travel through the blaster system and arrive at the work surface as fast moving pinhead sized particles. The particles embed themselves in the pores of any surface deposits and very quickly sublime into a much larger volume of CO₂ gas. The expansion factor varies with temperature, but gas of at least 500 times the volume of the solid particle is generated within the surface deposit, which blows it apart and breaks its bond with the substrate material.

The Advantages

If the substrate is strong enough to resist the effect of the gas generation it will not be damaged. This means the cleaning of all metallic and most composite or plastic materials will be abrasion free.

CO₂ is chemically inert and causes no secondary reactions.

The blast media diffuses into the atmosphere after cleaning leaving no media debris to clear away.

There is no secondary impact that can cause damage to the surrounding area, which makes the process safe to use in an open environment, on complex machinery, pneumatic or hydraulic control systems, instrumentation or on tooling installed in a moulding machine.



An Aluminium rotational mould before & after cleaning.



Spalling of automotive bumper during paint removal.

The Disadvantages

If the substrate can be damaged by the gas generation within its pores the cleaning will not be abrasion free. This happens with some filled plastics, wood, plaster and similar friable substances.

If the solid dry ice particles find it difficult to penetrate the surface layer, cleaning will be very slow, e.g. enamels, sealants, etc.

Dry ice cleaning can be much slower than an abrasive process and cannot create any specific surface finish standard, e.g. rust will be removed, but the underlying steel surface will remain pitted.

The process is noisy and it is difficult to collect the small amount of debris created by the material removed.

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The Equipment and Operating Requirements

The Clean Surface System 2000 Dry Ice Blaster is a pneumatic low maintenance dual hose unit that can be fitted with a full range of blast nozzle configurations selected from either the TV or UV range. All nozzles operate with air pressures ranging from 4 to 10 bar, and for most applications 30-35 kg/h of 3mm diameter dry ice pellets will provide optimal cleaning. The equipment is supplied ready for immediate use with all necessary connecting hoses and ancillary equipment.

For general work requiring only short periods of cleaning, e.g. plastic moulding tools or hot aluminium diecasting dies, the compressed air can be taken from the factory ring main, typically fed from a standard 7 bar compressor. The system must be able to supply a minimum of 3 m³/min (105 cfm) dry air without pressure loss, but for tougher applications it may be necessary to use a higher volume of 7 bar air, or to upgrade to a high pressure/high volume system.

The most common nozzle sizes and operating conditions are listed in Table I overleaf together with cleaning times for a standard test plate. For applications requiring longer cleaning periods where times need to be kept to a minimum it is important to consider the high pressure option as the extra capital outlay for a compressor upgrade can often be justified by considerable savings in operator costs and downtime.

If the factory system cannot provide sufficient air volume a mobile diesel driven compressor can be used. Mobile compressors must always be fitted with an aftercooler and water separator or dryer package to prevent the formation of water ice in the system as this will first cause some abrasion and then block the dry ice flow.



System 2000 Blast Unit with TV750 Nozzle



New UV Nozzle in straight and 90° configuration. Just twist to change from straight to 90°



Gravity aluminium die coating removal at 300°C



Removing chipboard glue off an endless steel band



Rubber O-ring mould before & after cleaning

The Typical Applications

In-situ mould and tool cleaning for many products including metal castings, food, plastic, rubber, composites, etc. as well as maintenance of the moulding machine and surrounding area.

Removal of end of run deposits, process spillage, airborne deposits, grease etc. from production units or sensitive equipment.

Preparation for jointing processes to remove dirt or anti wetting films before soldering, brazing, welding or the application of adhesives. Also removal of spatter from the process jigs and surrounding equipment.

Removal of unwanted surface coatings including paints, glues, protective films etc, as well as flux removal from PCB assemblies.

Decontamination of components exposed to radiation.

Refurbishment of machinery prior to resale, especially complex printing equipment.

Renovation of old brickwork, hardwood beams, etc. and removal of smoke damage.

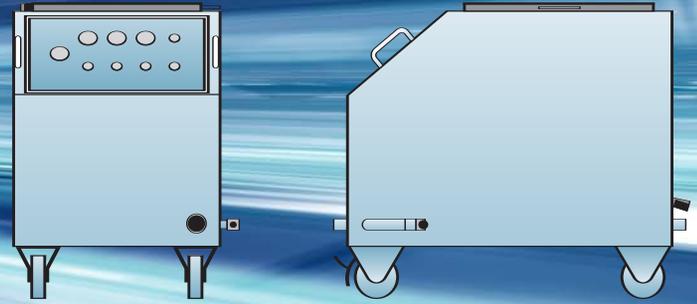


Table I: Nozzle Capacity & Performance

Nozzle type & size	Compressed air requirement					
	at 5.5 bar m ³ /min	CT sec	at 7.0 bar m ³ /min	CT sec	at 9.5 bar m ³ /min	CT sec
TV250	2.5	62	3.1	35	4.0	29
TV500	3.8	40	4.7	25	6.2	20
TV750	4.6	20	5.7	17	7.5	12
UV250	2.2	53	2.7	27	3.5	19
UV500	3.3	34	4.1	19	5.5	13
UV750	4.0	17	5.0	13	6.6	8

CT is the time taken to remove a 50 x 60 mm area of standard Polyester paint from a steel substrate. The cleaning times for the newly developed universal (UV) nozzle still have to be confirmed across the range but proving trials with the UV750 show faster times are achieved with less air, indicating an efficiency improvement of over 30% at 9.5 bar.

Noise levels measured 1m above and behind the nozzle exit range from 106 dB(A) at 5.5 bar for the TV250 to 125 dB(A) for the UV750 at 9.5 bar. The actual noise levels generated by the equipment in use will depend on many local factors and care must be taken to provide all exposed personnel with adequate protection. Our most important current R & D project is an extensive university linked programme to reduce the noise generated by the dry ice blasting process.



TV250/LR/45 long reach nozzle with diffuser angled at 45 degrees



TV250/TV500/TV750 standard interlocking straight nozzle

Why and Where to use Dry Ice Blasting

Why: Because it is currently the only environmentally friendly way to clean industrial surfaces without abrasion or the use of chemicals or solvents.

Because the list of chemicals and solvents that can not be used or disposed of without costly restrictions will increase.

Because production machinery and planning methods will improve the just in time capabilities of manufacturing plant and on-line cleaning will be the only way to avoid costly cleaning stoppages.

Where: On practically all surfaces that can resist the forces applied by the impingement of the compressed air and the dry ice particles, as well as the sublimation force of the dry ice.

Where conventional cleaning causes unwanted changes to dimensions and surface finish.

Where conventional cleaning introduces unwanted moisture, chemical attack or is a safety hazard.

If in doubt about an application please arrange for us to conduct a test in our Leicester R&D facility.

Table II: Technical Specification

Blast Unit:	
Dimensions L X W X H	770 x 490 x 700 mm
Dry ice hopper capacity	20 kg
Dry ice feed rate	20 - 60 kg/h
Compressed air connection	1" BSP
Weight empty	55 kg
Standard Hoses:	
Air supply hose	25 mm NB x 10 m
Blast hose assembly with:	
Air hose and	25 mm NB x 5 m
Ice hose sheathed together	19 mm NB x 5 m
Maximum Working Pressures:	
Compressed air hoses	16 bar
Dry ice hose	3.5 bar
Blast unit	15 bar

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