CLEAN surface

Designers & Manufacturers of Dry Ice Cleaning Equipment

The safe way to clean or remove surface deposits without any media debris, solvent action or damage to the surrounding environment.

CLEAN surface
Designers & Manufacturers of Dry Ice Cleaning Equipment

14 Highmeres Road,
Leicester,
LE4 9LZ,
United Kingdom

Tel: +44 116 224 0072
Fax: +44 116 224 0074
E: sales@cleansurface.co.uk
W: www.cleansurface.co.uk

CLEAN surface

Designers & Manufacturers of Dry Ice Cleaning Equipment

The Power of Dry Ice

This photograph shows 3mm dry ice pellets releasing their cleaning power while rapidly subliming on the top of a Clean Surface blast unit.

Dry ice pellets, which are pure solid carbon dioxide, are made by decompressing liquid CO_2 to create CO_2 snow. The snow is then compacted and extruded through a die plate to form solid CO_2 pellets.

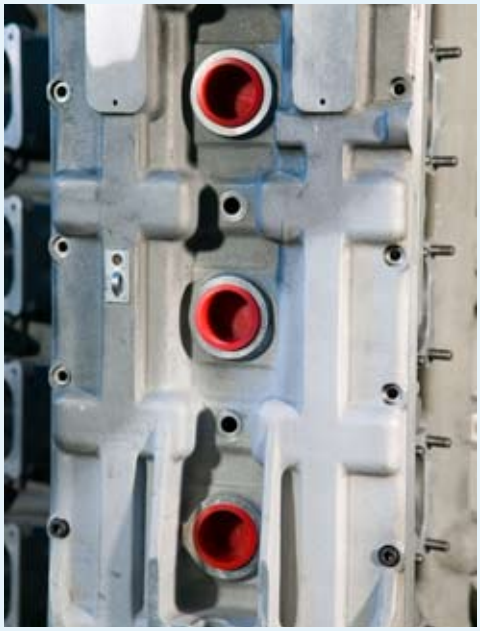
Dry ice is unstable above minus 78.6 °C, but instead of melting into CO_2 liquid when it warms up, it sublimes directly into CO_2 gas. It is this sublimation process that creates the cleaning effect when dry ice is used as a blast medium.

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 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 CO_2 gas. This rapid generation of gas within an enclosed space breaks up the surface deposit, releases its bond with the substrate and blows it away. The CO_2 then diffuses into the atmosphere leaving no debris other than the material removed, which is usually found as a fine dust.

What can be cleaned or removed with Dry Ice?

If the substrate is strong enough to resist the effect of the gas generation it will not be damaged or abraded and, because CO_2 is chemically inert, there will be no chemical reactions to alter the substrate's surface finish. Also, as sublimation takes place on first impact, there is no secondary impact to cause undesirable effects to the surrounding area or localised equipment, all of which makes the process safe and ideal for use in an open environment, and as an in-situ tool cleaner.

Alumina based die coating removal at 300°C



Cleaning a V10 Le Mans racing engine

What cannot be cleaned or removed with Dry Ice?

If the substrate is porous so that gas generation can also occur within its pores the cleaning may not be abrasion free. With porous substrates the deciding factor is the strength of the material. A porous sintered metal will withstand the gas generation, but a friable material like soft wood or plaster will not. Also, composite materials will show differing effects. For example the talc will be leached out of the surface of talc filled plastic leaving the surface roughened, whilst the same plastic without the talc, will clean without damage.

If the solid dry ice particles find it difficult to penetrate the layer that should be removed, cleaning will be very slow or impossible. Typical materials that are hard to penetrate are oven cured paints or enamels and elastic materials commonly used as sealants. Dry ice cleaning is slower than an abrasive process on many materials and cannot create any specific surface finish standard, e.g. rust will be removed, but the underlying steel surface will remain pitted.

CLEAN surface

Designers & Manufacturers of Dry Ice Cleaning Equipment

Some typical Customer applications and work done by Clean Surface on site and in the test facility:

Cleaning:

Aircraft wing paint booths
Aircraft components
Automotive welding robots and jigs
Automotive interior cladding formers
Before NDT
Boiler membrane walls
Braking systems on cars, planes and trains
Can lacquer lines and printers
Chemical plant
Chocolate moulds and process machinery
Cigarette manufacturing machinery
Classic car components
Curing ovens
Dirt and grease from machinery
Electric train conductors and control gear
Film casting bands and equipment
Food contact surfaces
Food processing machinery
Generating equipment
Heat exchangers and radiators
Hot and cold core boxes
Injection moulding tools
Laminate flooring machinery
Latex formers
High performance racing engines
Metallising ovens
Packaging machinery
Pattern boxes
Petrochemical heater tubes
Plastic sheet and film extrusion dies
Plastic casting tools
Rotational moulding tools
Rubber moulding tools
Sluice gate chains
Turbine blades

Removing:

Ageing deposits from brickwork and hardwood
Alumina based die coatings from LP casting dies
Antifouling coatings from boat hulls
Anti-wetting films prior to brazing or welding
Baking residues from baking bands
Coatings from high value complex parts
Carbon (coke) from racing engines
Condensates from plastic moulding tools
Epoxy resins from mixing equipment
Film deposits from optical components
Flash from foiled mobile phone lenses
Flavouring deposits from food conveyors
Fluxes or coatings applied incorrectly
Gasket residues from engine heads
Glue residues from wood presses
Graphite based die coating from HP casting dies
Greasy films prior to application of adhesives
Ink from printing and packaging processes
Masking media
Paint from carbon fibre parts
Plaster from complex castings
Production spillages or leftovers from machinery
Protective coatings
Radioactive deposits
Smoke damage

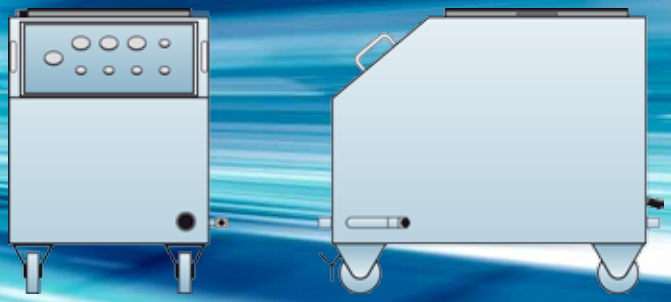
Refurbishing:

Aircraft
Classic cars
Cutting and forming machinery
Printing and envelope machinery
Process machinery
Road transport vehicles
Trains
Military equipment

If in doubt about an application please arrange for us to conduct a trial in our test facility

CLEAN surface

Technical Data



Equipment and Operating Requirements

The Clean Surface Blaster is a pneumatic low maintenance dual hose unit that can be fitted with a full range of blast nozzle sizes and configurations. All nozzles operate with air pressures ranging from 4 to 10 bar with just 30 kg/h of dry ice.

For frequent periods of light cleaning, e.g. plastic moulding tools or hot diecasting dies etc, the compressed air can be taken from the factory ring main, typically fed from a 7 bar compressor. The system must be able to supply a minimum of 3 m^3/min (105 cfm) of dry air without pressure loss. For tougher applications it may be necessary to to upgrade to a high pressure/high volume system.

The most common nozzle sizes and operating conditions are listed in Table I, together with cleaning times for a standard test plate. For applications where cleaning times need to be kept to a minimum it is important to consider the high pressure option even if it means additional investment for a compressor upgrade. This is because the cleaning efficiency increases as the air pressure increases and greater efficiency will give considerable savings in operator costs and down time.

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 within the system. Water ice will not only wet and slightly abrade the surface being cleaned but also quickly build up in the nozzle and block the dry ice flow.

TV250/ TV500 /TV750 standard interlocking straight nozzle

TV250/45/LR/80 long reach nozzle with diffuser angled at 45 degrees

Table I: Nozzle Capacity & Performance

Nozzle	Pressure	Volume	CT	Noise
Size/Type	bar	m3/min	sec	dB(A)
TV250HP	5.5	2.5	38	112
TV250LN	5.0	2.5	52	106
TV250	5.5	2.5	62	110
TV500	7.5	5.0	25	117
TV750	9.5	7.5	12	120
Suffix: HP = High Performance LN = Low Noise				

CT is the time taken to remove a 50 x 60 mm area of standard Polyester paint from a steel substrate at 50% Rh.

Noise levels are measured 1m above and behind the nozzle exit. The actual noise generated by the equipment will depend on many local factors and care must be taken to provide all exposed personnel with adequate protection.

Table II: Technical Specification

Blast Unit	
Dimensions L x W x H	770 x 490 x 700mm
Dry ice hopper capacity	20kg
Dry ice feed rate	20 - 40kg/h
Compressed air connection	1 inch BSP
Weight (empty)	55 kg
Standard hoses	
Air supply hose	25mm NB x 10m
Blast hose assembly with:	
Air hose and	25mm NB x 5m
Ice hose sheathed together	19mm NB x 5m
Maximum Working Pressures:	
Compressed air hoses	16 bar
Dry ice hose	10 bar
Blast Unit	15 bar

For more details please contact our technical staff

14 Highmeres Road, Leicester
LE4 9LZ, United Kingdom
Tel: +44 116 224 0072
Fax: +44 116 224 0074
E: sales@cleansurface.co.uk
W: www.cleansurface.co.uk

CLEAN surface

Designers & Manufacturers of Dry Ice Cleaning Equipment