

## Environmentally friendly cleaning with CO<sub>2</sub>

In industry there is a growing demand for automated solutions for cleaning large areas, high-quality semi-finished products and complex building elements. This demand requires compact equipment that does not use solvents (VOC) or large quantities of water. For these reasons, the Linde Group "Cryoclean" cleaning procedure is gaining ground against more traditional procedures on the market.

Having to treat large quantities of water from washing processes or using volatile organic solvents for cleaning purposes is becoming a sore subject. Traditional cleaning methods and the over-use of substances are having economic and ecological consequences and are leading increasingly to the realisation that carbon dioxide as a cleaning technique is an efficient alternative.

In the past, "Cryoclean" dry ice, Fig. 1, blasting was primarily used for cleaning light metal casts from foundries or used in the rubber and plastics industry. Nowadays the scope of applications is increasing steadily. Applications now include the treatment of welding seams and soldered joints. Whereas it is often rather difficult to manually remove burnt patches in places that are difficult to get at, this is relatively simple with the help of "Cryoclean" technology.

### Treating welds with "Cryoclean" snow

The "Cryoclean" now process gained significant market share recently, largely due to its use for automatic cleaning jobs. By expanding liquid CO<sub>2</sub>, gaseous and solid CO<sub>2</sub>-snow is achieved. Using specially designed nozzles, the snow crystals are homogeneously blasted on the surface to be treated using compressed air. Like other "Cryoclean" processes the CO<sub>2</sub> snow particles sublimate without any residue. This is a significant advantage for products with complex geometry or undercuts because, unlike cleaning with solvents, there is no difficult drying process.

The "Cryoclean" snow process provides a new approach to the treatment of welds or soldering connections. Prior to this procedure, diligent cleaning of welds or soldering connections was of the utmost importance. Otherwise tensile oil,



Fig. 1 "Cryoclean" dry ice blasting

separating agents or organic lubricants would lead to failures in the joint. The new process removes the need for harsh washing using organic cleaning agents, lengthy drying procedures as well as further wastewater treatment.

Following the welding process the welding seam needs cleaning as well. Quite often fume residues can be found in hard to reach places, and manual cleaning

is not possible, Figs. 2, 3. This is ideal for "Cryoclean" snow technology, particularly for aluminium, mild steel and low alloy steel welds. It is also applicable for soldering on zinc plated steel.

### "CryoAdd" – the "Cryoclean" process with additives

The "CryoAdd", Fig. 4, procedure has been developed for all applications where "normal" dry ice pellets are not powerful enough. In this procedure dry ice pellets are also accelerated by compressed air.

However, in order to develop additional kinetic energy, abrasive additives are added to the stream of pellets. This "Cryosand" comes in various forms for different kinds of application. Food-grade "Cryosand" can be used for cleaning jobs in the food industry while medium and strong "Cryosand" are used for removing rust from steel structures and



Fig. 2 Weld of Aluminium before and after "Cryoclean" snow treatment.



Fig. 3 Soldered zinc-plated sheets before and after "Cryoclean" snow treatment.



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**Fig. 4.** "CryoAdd" proves during de-rusting of steel profiles.



**Fig. 5.** "CryoAdd" removes oxides from orbital welds.

in restoration work. These sands are also good solutions for cleaning huge heat exchangers full of encrusted dirt, such as sulphuric residues. Compared to traditional sand or glass bead blasting procedures, this cleaning process is much faster.

"CryoAdd", Fig. 5, is also far more thorough, but is still gentle on the underlying surfaces. The cleaning delves deep into porous surfaces and leaves behind no blasting material residue at the undercut. As a result, corrosion of structures from which the rust has been removed returns far more slowly. The amount of abrasive substances (sand or glass beads) is reduced by using "Cryoclean" pellets,

because less cleaning energy is needed on account of the lower temperature. This in turn reduces the amount of abrasive waste material. At the same time fewer CO<sub>2</sub> pellets are used than in the conventional cleaning procedure with "Cryoclean" dry ice pellets. For the first time ever "CryoAdd" enables the removal of oxide from welding using a dry ice blasting procedure.

### "Cryoclean complete" – all inclusive

Recently, Linde has successfully overcome a problem that has long been associated with CO<sub>2</sub> cleaning: the manual handling of the pellets. The solution is a unit

called "Cryoclean complete", and is directly connected to a tank via a liquid CO<sub>2</sub> supply pipe. An integrated pelletiser produces high-quality pellets "on demand", and the integrated blasting unit uses the pellets immediately. The customer, therefore, is relieved of pellet logistics. This machine is ideal for removing tensile oil or grease from sheet metal and other semi-finished steel products onsite. The intelligent control system takes over automatic pellet supply on demand.

According to manufacturer's data the process is an eco-friendly cleaning solution and can replace a number of traditional, less effective cleaning agents that are harmful to the environment. Linde's "Cryoclean" product range is a solution for almost every cleaning task, ranging from slight impurities like dust or fingerprints to de-rusting, which was virtually impossible before with CO<sub>2</sub>.

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