

Industry Spotlight Aluminium

Big cleaning problems in Alumina refineries?

Big blasting solutions !

Contractors or plant maintenance engineers involved in the industrial cleaning sector often face big problems in removing the waste and by products resulting by continuous production processes but probably none more so than those working in the Alumina refining industry.

Many Alumina refineries around the world employ the "Bayer" process to extract the raw Bauxite from the mined material and turn it in to the Alumina powder used to make the light, versatile metal we know as Aluminium. The Bayer process has been around for many, many years now and it basically involves making a slurry of ground bauxite and caustic soda and then dissolving out the alumina in steam heated digestors. The resulting solution is then passed through a number of processes which include filtering, cooling, precipitating and calcining at up to 1,100°C.

As in any continuous process using a combination of pressure, heat and chemicals a build up of hydrate scale inevitably occurs in the various vessels and pipe work throughout the plant. The scale build up eventually becomes so thick that the production capacity of the plant is threatened.

Subsequently any Alumina refinery must have an ongoing planned cleaning maintenance programme in place to stop it from grinding to a complete halt. The word cleaning is used lightly here to describe a job that is more akin to demolition. The

scale in these plants is rock hard. It has been compared to class 500 N cured concrete so you just don't 'clean' it off. Traditional methods such as jack hammering and dynamiting are labour intensive, dirty, dangerous and very, very time consuming. They do not do the actual plant much good either.



Heavily contaminated pipes.



Every dent, scrape or bend left in a metal surface is an open invitation for fast scale build up and a potential weak point. Eventually pipe sections and vessel walls become so 'tired' they must be completely replaced. The ideal of course is to have a smooth polished metal surface finish once the scale has been removed.

To achieve this end many companies have turned to high pressure water blasting as their primary method of scale removal. This is particularly so in Australia where every Alumina refinery either employs specialist contractors or operates its' own HP blasting equipment. Often it is a combination of both.



Heavily contaminated pipes blasted to smooth finish by tank cleaning head.



We are a major supplier of pump units, cleaning systems and water blasting accessories to the Australian refineries and industrial cleaning contracting sector. Our equipment can be found across the whole Australian continent and is in use in Nabalco's Gove plant up in the Northern Territories, in Queensland Aluminium and in the

Alcoa and Worsely Aluminium plants situated close to Perth in Western Australia. Hammelmann have been connected to this industry for over 20 years and as their pump range has developed to feature more powerful pumps so the number of applications for HP blasting within the refineries has increased.



Some years ago a typical contracting pump in the industry would have been rated to 250 kW (350 hp) but very quickly 350 & 450 kW (450 hp & 550 hp) took over followed by the 550 kW (750 hp) units commonly in use today. In fact it is not unusual for two 550 kW pumps to be operated in tandem when a bit more power is called for.

The formula for successful removal of heavy hard scale is not purely water pressure based. Although UHP blasting at pressures above 2,800 bar (40,000 psi) has been introduced for some particular applications pressures around the 1,000 to 1,250 bar (15,000 to 18,000 psi) mark are the norm. These sort of pressures when combined with the 190 to 260 l/min (50 to 70 gpm) produced by a Hammelmann S1500-55 diesel powered pump unit result in some real heavyweight blasting jets. Having powerful jets is one thing but they need to be brought to bear on the scale as effectively as

possible. Water blasting tools capable of handling large volumes of water at high pressure have become a bit of a Hammelmann speciality as a result of the demands of the plant maintenance specialists in Australia. While down time is the dreaded money munching nightmare of all plant managers many companies place as much or even more emphasis on personnel safety as they do on speed of operation.

Consequently as many tools as possible have been designed for deployment within lines and vessels without the need for hands on operation. The ingenuity of the engineers and operational specialists working in this industry never ceases to amaze the designers at Hammelmann. While it is a sure thing that the operatives have over the years learned a lot about various aspects of high pressure technology from the people at Hammelmann it is just as certain that a manufacturer can learn a lot about on the spot problem solving from the operatives at the sharp end.



Rotary multi jet head

One good example was the conversion of a standard Tank Cleaning Head into a pipe line scale remover. One way of cleaning a pipe in position is to open up access points at both ends of the section to be blasted and pull a rotary multi jet head through by cable attached to a pneumatic winch.

This is fine when the scale is not too thick. The multi head virtually grinds it off and flushes it out. When the scale is really thick however it needs to be broken off.

The answer to the problem was to attack it with two heavy impact jets emitting from a tank cleaning head, but how? A tank cleaning head rotates around its' vertical axis with a twin nozzle radial arm rotating much like a propeller and is definitely not designed to lay in a pipe.

An operations manager with a major contractor had the idea of fitting the head on swivels within a sledge cage to protect the nozzle arm and pulling it through. It worked but there was definite room for improvement. The next thought was how to make it self propelled rather than having to have a pull though arrangement ? They fitted an additional part to one end of the head known as a striker or kick plate. With this idea the head is placed at one end of the section to be cleaned BUT without any pull



Tank cleaner with striker plate

Industry Spotlight Aluminium

through cable.

As the arm of the head rotates each water jet blasts the scale and also the plate. Once the scale in front of the head has been blasted down to small sized lumps the force of the jets striking the plate "kicks" the head forward down the pipe. The beauty is that the head blasts the scale away, moves down the pipe line, including around bends, at its' own pace pulling the hose behind it and the large volume of water flushes most of the debris back along the pipe.

Hammelmann have since incorporated and refined this simple but effective idea to produce pipe cleaning tank heads in 1,200 bar (17,000 psi), 150 l/min (40 gpm) - compact L and 250 l/min (66 gpm)- large XL models.

A tank cleaner developed specifically for the alumina refineries is the XXL model. This jumbo sized unit can blast 500 l/min (132 gpm) at up to 1,500 bar (21,000 psi) and was borne out of an Australian contractor's habit of pushing the combined product (approx. 370 l/min - 98 gpm) of 350 kW (480 hp) and 550 kW (750 hp) pumps running in tandem through a standard 250 l/min (66 gpm) XL tank head. It worked OK but Hammelmann thought a dedicated high flow head was probably a better idea.

Tank heads are generally used to blast scale from the Ball & Rod Mills, Digestors, Flash Vessels and Launder Boxes employed in the Bayer process.

Desilicators and Precipitators are blasted with two Hammelmann custom designed, hydraulically powered rotor jets per vessel each operating at 1,000 bar - 235 l/min

(15,000 psi - 62 gpm).

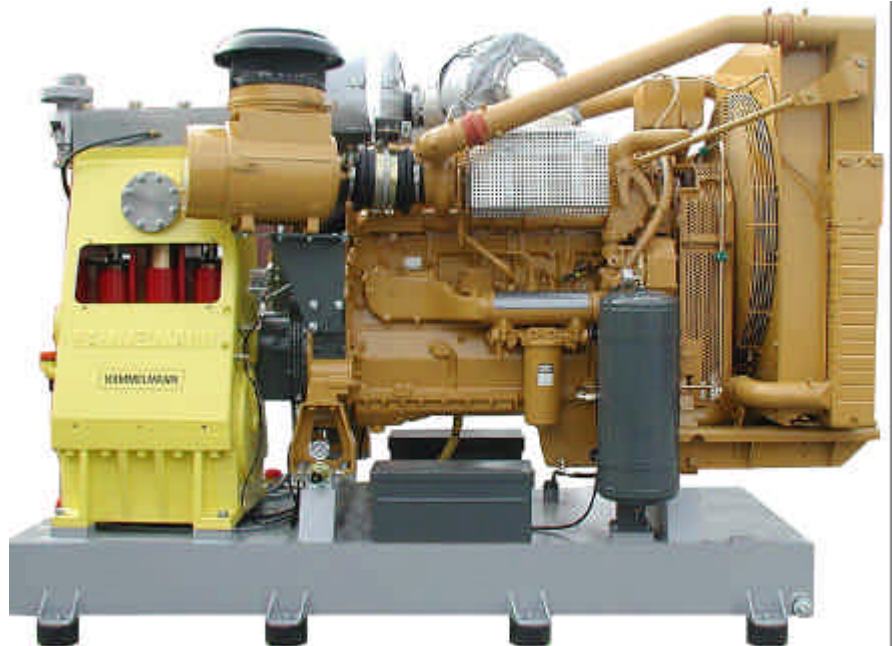
The sophisticated but sturdy special deployment devices to get the tools into position in these often complex shaped vessels have in the most been developed by the various refineries or contractors themselves. Hammelmann have contributed input whenever necessary.



XXL, 500 l/min. (132 gpm), 1,500 bar (21,000 psi) tank cleaning head and pipe cleaning tank head

As was mentioned previously Ultra High Pressure (2,500 bar / 36,000 psi and above) has found its' way recently into the Alumina refinery maintenance specialist's armoury. In addition to the jobs it is well known for such as surface preparation prior to re coating it is also ideal for manual blasting of scale and other deposits.

In a further development of UHP technology Hammelmann have recently supplied 3,000 bar (43,500 psi) heat exchanger bundle tube blasting units to Alumina refineries in India and Australia.



Diesel driven pump unit, operating pressure: 1,500 bar (22,000 PSI), flow rate: 128 l/min. (34 GPM), power rating: 400 kW (550 HP)

As high volumes of water cannot pass through the small diameter tubes at any pressure high enough to remove the extremely hard scale the answer is reduced flow but at Ultra High pressure. The units delivered to India are vertical tube blasters while the horizontal units delivered to Australia have the unique capability of blasting tubes almost 18 metres (59 feet) long.

All in all at Hammelmann we see our close involvement with the Alumina refining sector as an advantage in the overall ongoing development of technology. It is often very demanding but also very rewarding. The new HDP 400 pump series for instance is already attracting a lot of interest from the industry as it delivers a powerful 400 kW (550 hp) punch from a very compact unit.

Generally speaking, there has been a definite rise in enquiries from Alumina producing companies globally, who are obviously seriously considering switching to High and Ultra high pressure water blasting for some or all of their plant cleaning maintenance procedures. This is in line with the trend seen in many other industries today.



Hammelmann
Maschinenfabrik GmbH

Postfach 3309 • D-59282 Oelde Telefon (0 25 22) 76-0
Zum Sundern 13-21 • Germany Telefax (0 25 22) 76-444
eMail: mail@hammelmann.de • Internet: www.hammelmann.de

HAMMELMANN