
KAMAT

Application Reports



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In the food industry, cleaning of heat exchangers is part of the daily business. Blocked bundles reduce the exchange of heat and the resulting efficiency.

The pictures in this report show a job being carried out by a customer in Turkey.

Photo below:

New-type KAMAT Rotating Nozzle for streakless cleaning



The work was carried out with a KAMAT electric foot switch, a steel-coated hose DN 8 and a new-type KAMAT Rotating Nozzle. This special nozzle has two rotors, one of which rotates clockwise and the other one anti-clockwise. This method of rotation ensures that a streakless cleaning is achieved.

Normally, a pressure of between 1000 and 1200 bar is required for cleaning heat exchangers in the food industry, in order to achieve an effective work performance (good cleaning results in an acceptable time limit), to meet the requirements of the customer.



- KAMAT foot switch
- High pressure hose DN 8

Evaporator Cleaning in the Food Industry



During the production of fruit syrup the fluid has to be thickened.

This process is carried out in so-called "evaporators".

The tubes of the evaporators become blocked in the course of some months. When they are fully blocked, the production comes to a standstill.

Photo above: View of a factory in Poland, showing a large number of storage tanks



Photo on the right:

View of a work platform with five evaporators in an open position



Photo on the left:

Cleaning an evaporator. The opened-up evaporator on the right clearly shows the external contamination.

Photo on the right:

Tubes which are completely blocked.



Photo on the left:

The cleaning is carried out at a pressure of approx. 800 bar, using a hose, a foot valve and a rotating nozzle with 4 nozzle inserts on the rotor, at an angle of 85° rearwards.

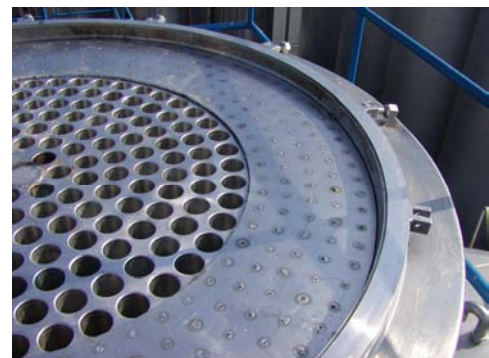


Right:

Evaporator after cleaning

Left:

Cleaned tubes of the evaporator



Descaling of Billets in Roller Mills

The prices which a steel plant can realise for its products in the world market depend on the quality of the product. The manufacture of high quality steel for steel slabs and billets demands a fully efficient descaling process. If the descaling process is not carried out properly or is done incompletely problems will arise in the course of the milling since scale remnants are rolled into the steel.

In recent years, there is a trend towards higher pressures (above 200 bar) combined with a reduction in flow. Very often, centrifugal pumps with high flow rates and low pressures are used for this application but they have two major disadvantages:

1. The high water capacity cools down the steel too intensively.
2. High energy costs for water supply, filtration and in-plant pumping systems.

KAMAT is meanwhile recognised in some of the largest steel plants worldwide as being a competent manufacturer of pumps and valves. A good example of our competence can be seen in a large steel plant in India. Here, the entire pump installation has a power rating of 8,800 kW and comprises 16 pumps of the model K 55000, supplied as 8 double-pump units, each with two 550 kW pumps.



Photo above:

The picture shows two of the double-pump units described above (1100 kW) shortly before shipment to India

Photo on the left:

KAMAT pump station consisting of 3 pump units, each of 250 kW power rating, installed in the Bhilai Steel Plant in India. This system was supplied in 2002 by the company SMS.



Photo above: On the billet leaving the furnace the scale is clearly visible



Photo below: This billet has been descaled with high pressure water. The dark marks which can be seen on the glowing steel are water drops only.



The rolls in steel mills are hydraulically "adjusted".

The hydraulic medium for this application is 95/5 emulsions (HFA), on the basis of 95% water and 5% oil.

The pressure which is required for the system is provided by KAMAT high pressure units.

As a rule of thumb, pressures between 165 and 225 bar are required.

To eliminate pulsation in the system, high pressure pulsation dampeners are supplied by KAMAT and fitted on the discharge side of the pump units.

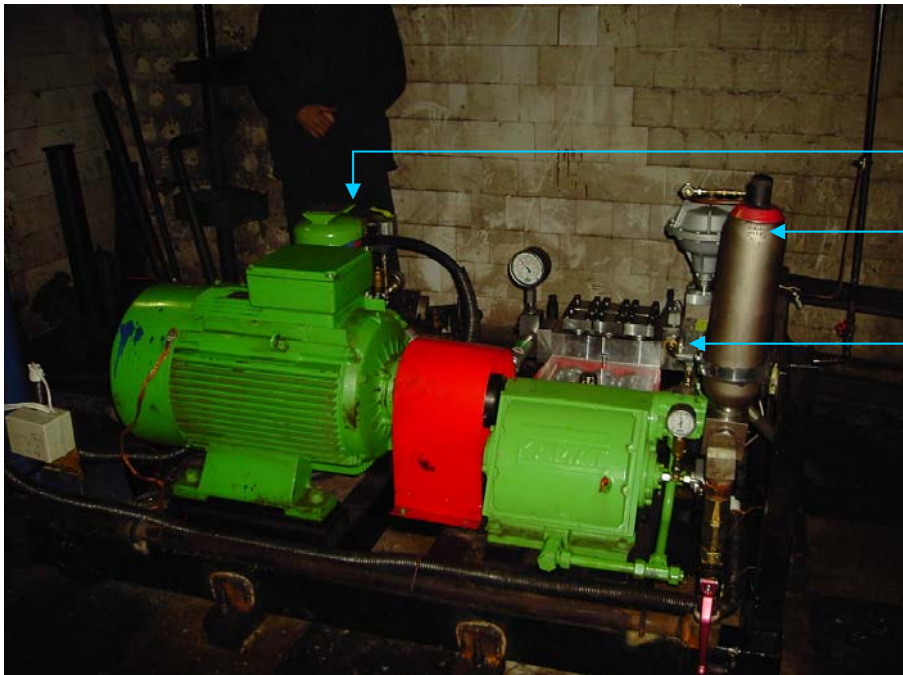
Photo above:

Steel mill of the MITTAL Steel Group in Romania. View of the reversing stand of the wide strip mill.

Photo on the right:

KAMAT high pressure unit in the machinery room of the rolling mill.





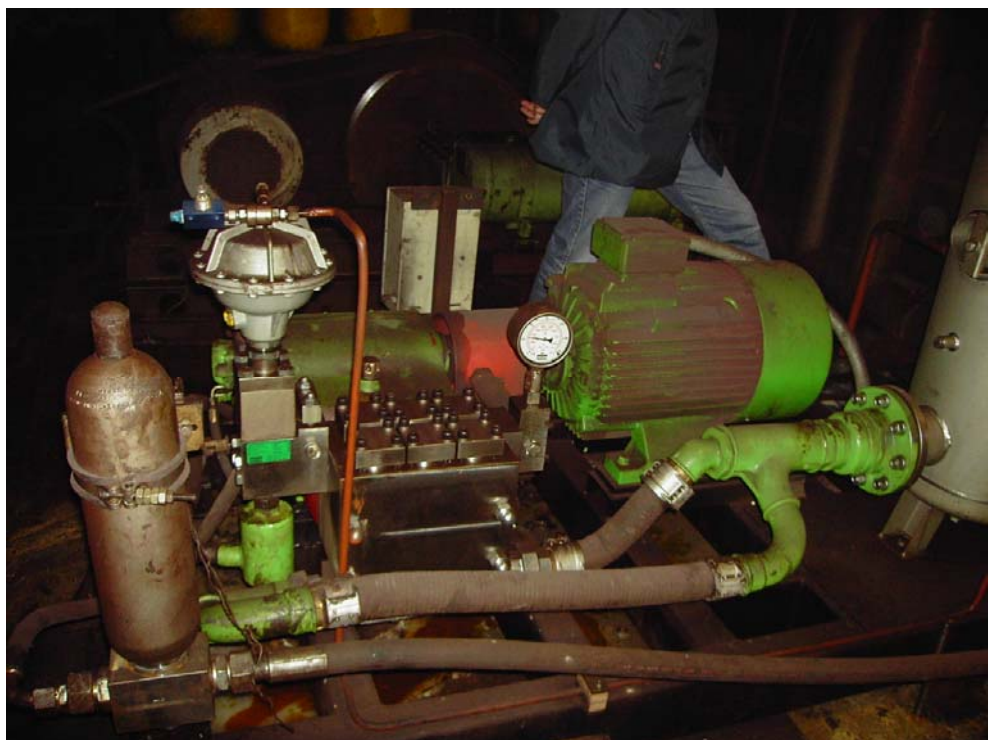
KAMAT High Pressure Unit with electric motor

- Suction stabilizer
- High pressure pulsation dampener
- Pneumatic on/off valve

Photo on right:

KAMAT machine after extensive duty over a period of several months.

The units are running up to 8000 operating hours per year.





Task: Removal of moulding sand from precision cast parts

The photo above shows cast parts (connecting rods) which are coated with moulding sand and need to be cleaned.

Our Italian partner designed and developed an enclosed booth for one of their customers. The booth is subdivided into two sections: One area for the worker and a separate area for the jetting operation

In the "jetting room" the cast parts to be cleaned are fixed to a hydraulically-pivotable work table.

From the operator's cabin the operator is able to carry out the work using a gimbal-mounted high pressure gun, without being subjected to any nuisance of noise or dirt.

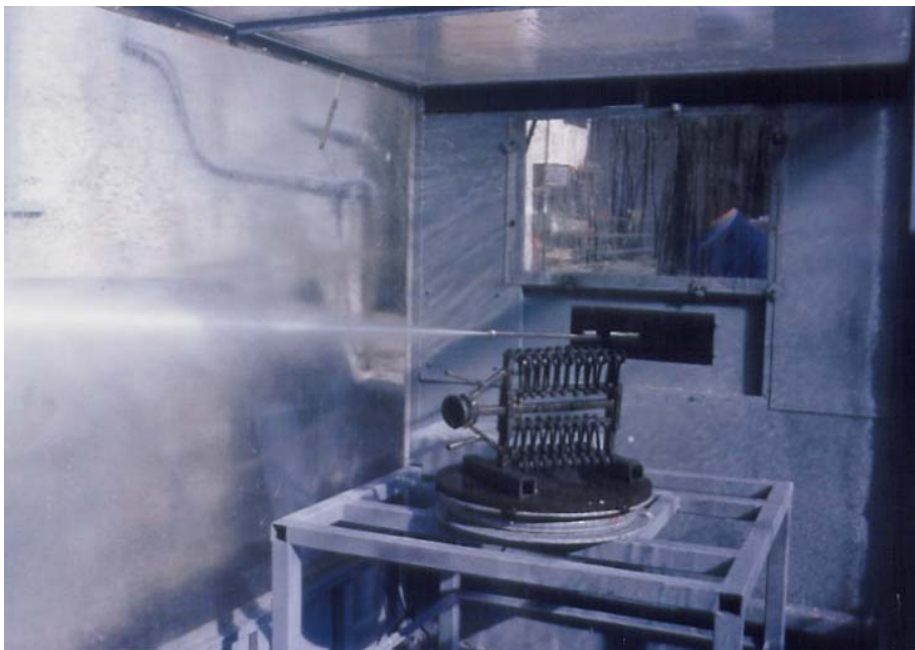
Application Report No. A 02-4e

Removal of Moulding Sand from Castings

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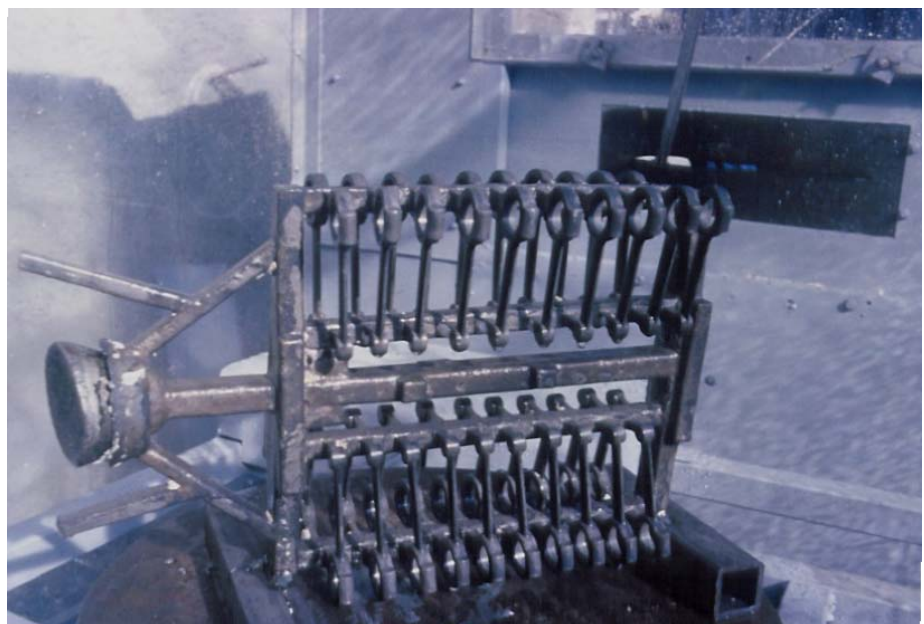
Status: 11/2004

PTC. Italy



The cleaning operation is carried out by means of a KAMAT High Pressure Pump Type **K 8028 A** (70 l/min. at 550 bar)

Precision-castings after cleaning with high pressure water



Cleaning of Condensers in Power Plants



Condensers in power plants need to be cleaned whenever the exchange of heat is no longer fully efficient.

Previous methods used (drilling, brushes and chemicals) have meanwhile been replaced by high pressure water jetting.

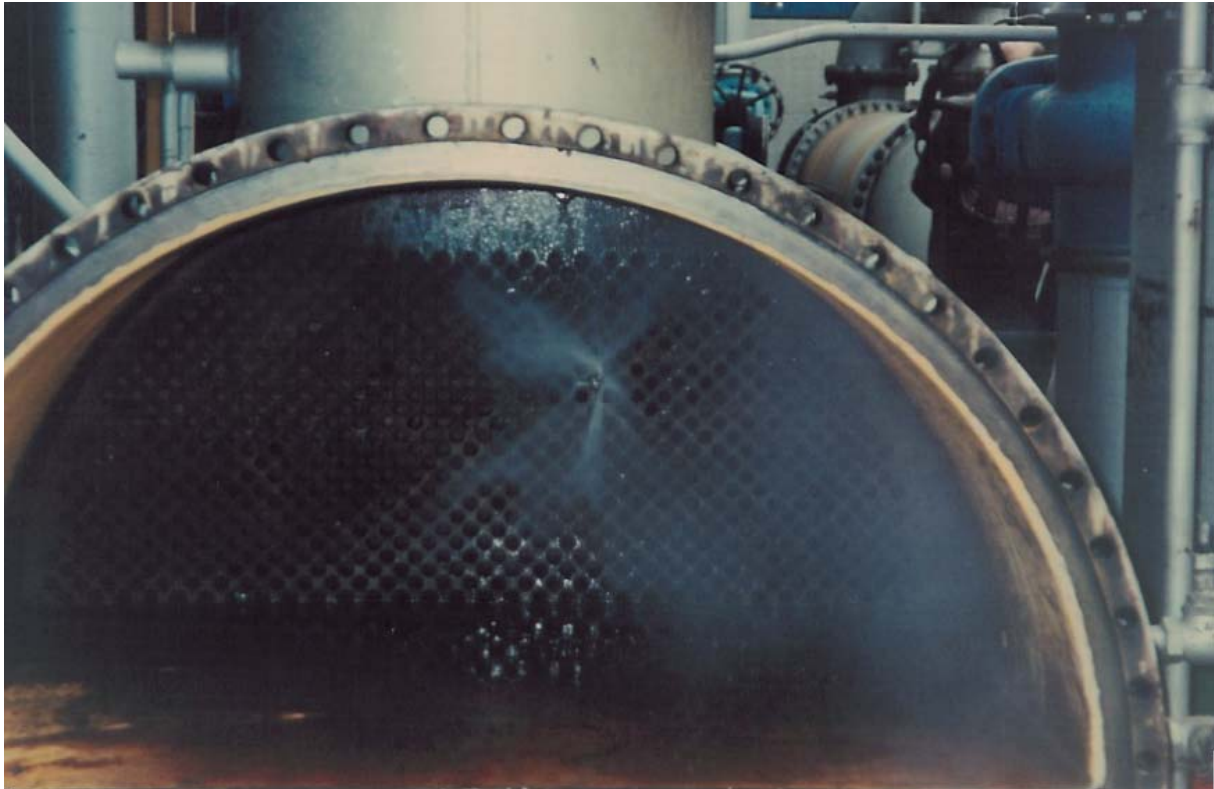
Using brushes or drilling caused damage or roughening of the surface of the tubes. Once the surface was roughened the build-up of deposits was encouraged, as they could adhere even better to the roughened surface.

The use of chemicals is no longer economically justifiable, due to the costs and problems of disposal.

The picture above shows the use of high pressure water on this application.

Accessories being used

- KAMAT Foot valve
- Rigid hose DN 6
- Pipe cleaning nozzle 1/4"



The picture shows the high pressure nozzle as it leaves the condenser tube.

These are the parameter normally required for the job:

Pump type	:	K 9000, K 11000 oder K 13000
Working pressure	:	500 – 1000 bar
Capacity per nozzle	:	40 – 60 l/min.



Cleaning of an ash transportation pipe in a power plant in Poland, using the KAMAT System "Tornado"

Mainly in coal-fired and oil-fired power stations there is a recurrent problem of deposits blocking up the piping used to transport the ashes (from the boiler room to the dumpsite).

Hard incrustations build up which narrow the tube inner diameter and making it necessary to increase the pump performance enormously, in order to flush out the ashes.

In this particular case in a Polish power station, the incrustations are about 30 mm in thickness at the beginning, but further down the line, they reach a thickness of up to 70 mm.

Cleaning of pipes using the “Tornado”



Photo above:

Propulsion unit fixed to the flange opening on the pipe

Ash transportation pipe (500 mm Ø and 1200 m length)

before cleaning

after cleaning



For the job, we used a KAMAT High Pressure Pump Unit Type **K 40036 A - DW 400 B**, built on a trailer with sound-proof van body

Performance:

Working pressure : 1000 bar

Capacity : 188 l/min.

Hose connection from the machine to the Tornado : 40 m DN 20

Cleaning length in pipe : 160 m

Cleaning results : 80 – 100 m/h

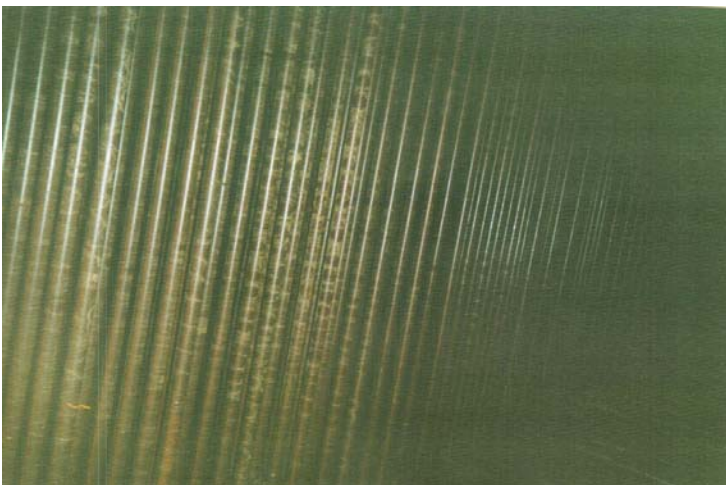
Cleaning of Boilers – Flame-exposed Side

Cleaning boilers in power plants is a job which has to be carried out regularly. If the walls and the pipe bundles of the boilers are polluted, their efficiency will be reduced. To keep the costs of heating up the boilers as low as possible, these deposits have to be removed regularly. Worldwide, most of the power plants engage service companies to carry out the work. Such service companies make use of high pressure water to do the job. There are two possible methods of solving the problem: Either manually, using high pressure guns or semi-automatically using tank cleaning heads with guiding devices.



Photos above:

The pictures show a soiled boiler which has been turned off, before the cleaning work has been started.



Photos on the left:

All pictures show the boiler on the flame-exposed side after the cleaning with high pressure water has taken place.

On this particular boiler, the work was carried out with high pressure guns, at a working pressure of 600 bar.

The insert nozzles used were size 2 mm.

One of our customers in Hungary approached us and asked us to find a solution as to how to clean the inside of boiler tubes, which were heavily incrustated with hard deposits. Previous attempts to clean the tubes using conventional methods had failed.

We carried out some tests and succeeded in cleaning the tubes using a Roto-Lance and a special nozzle. Using a working pressure of 2500 bar and a capacity of 23 l/min it was easy to remove the incrustations.

The photo below shows our KAMJET machine, which was used for this job.



Pictures above and to the right:

The photo shows the heavily incrustated tube





Pictures above and below: The tube after cleaning



In refineries and in petrochemical plants hundreds of heat exchangers (tube bundles) have to be cleaned every year.

During the shut-down period where the time available is limited, very often fully-automatic cleaning systems are used (refer to our report A 04-2e).

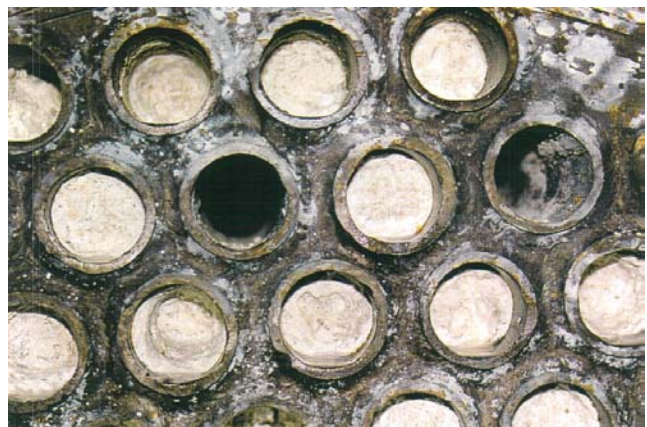
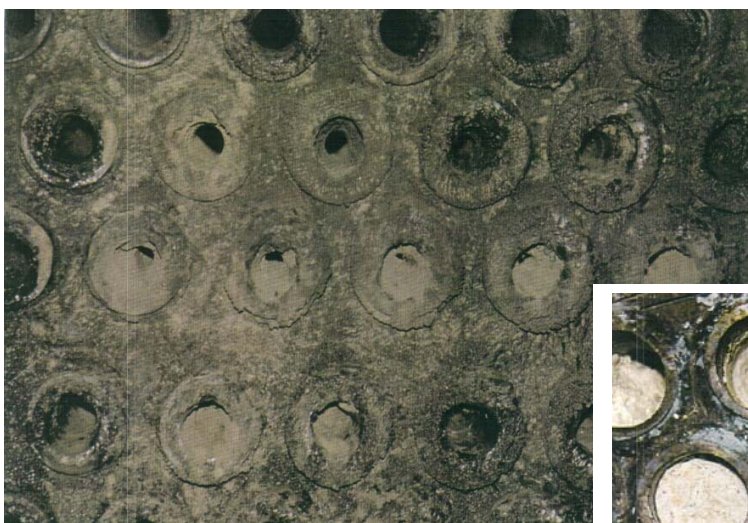
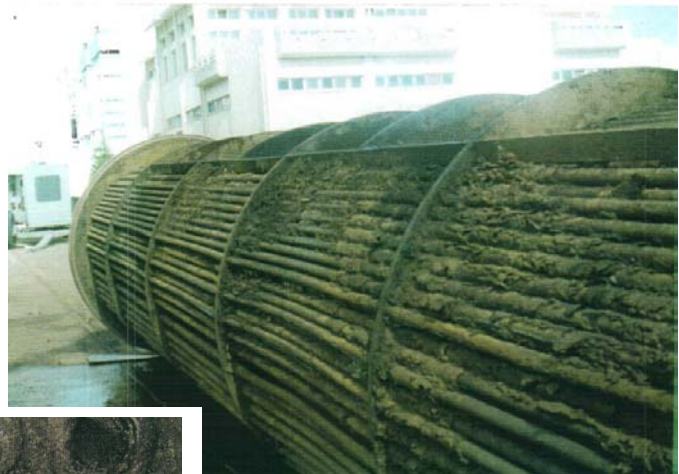
Whenever cleaning is required during the rest of the year, the work is carried out by contracting companies and is done manually.

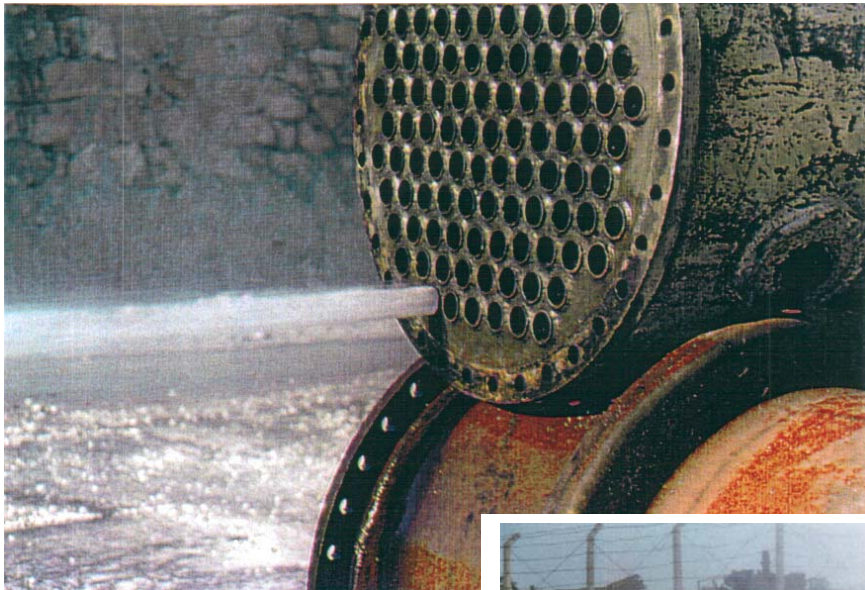
For instance, in a refinery in Turkey our customer is carrying out the work using a KAMAT pump model **K 13024 A** (1000 bar at 68 l/min).

Photos on the right and below:

The photos on this page show various types of tube bundles prior to cleaning.

The deposits on the shell side (external) and the incrustations on the tube side (internal) are clearly visible.





Photos above and on the left:

The tubes were cleaned internally using a steel hose (flexible lance) and a KAMAT foot valve.

Automatic Heat Exchanger Cleaning (Tube Bundle Cleaning)



In large refineries, every year hundreds of heat exchangers (tube bundles) have to be cleaned of deposits.

The external and internal cleaning is done by automatic cleaning systems, as shown below.



Photo on the left:

Our partner in Italy is able to supply automatic cleaning systems, for both inner and outer cleaning.

This system is driven by a high pressure unit with a power rating of 400 kW.

Photo on the right :

Shows a drawn-out tube bundle before cleaning. The extremely heavy deposits on the heat exchanger are clearly visible.



Automatic Heat Exchanger Cleaning (Tube Bundle Cleaning)



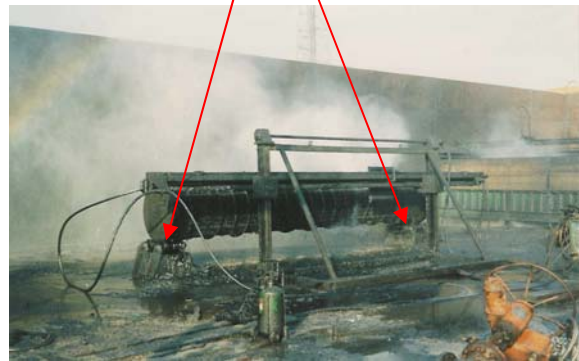
Photo on the left and below:

Automatic tube bundle cleaner in operation
(external cleaning)

• Driven roller bearings

• Guide track

• Nozzle bar



The cleaning systems can be equipped with either 3, 4, 5 or 6 lances, to work simultaneously.

The length of the lances can be designed to match existing requirements.

The cleaning rate of an automatic system compared to manual cleaning can be increased to more than five times.

Scissor-type lifting table with lance unit for internal cleaning

On all of the jobs shown above a KAMAT High Pressure Unit type **K 33036 A - DW 350 B** was used (900 bar - 178 l/min.).

In all industrial processes the same problem arises: The necessity to clean pipe lines where, in the course of time, the internal pipe diameter has become narrower, due to deposits gradually building up.

In the past, many companies used chemical methods to remove the incrustations. Nowadays, where environmental protection has become a serious subject, these old methods are hardly applicable any more. If chemical products are used today it is expensive to have them disposed of adequately, or to have them incinerated.

Other companies saw no other possibility than to dispose of the blocked pipes at special dump sites and to replace them with new pipe lines.

Using the KAMAT High Pressure Technology with a wide selection of special nozzles, the problems can be solved economically and without environmental pollution.

Various cleaning methods can be employed, either manually or automatically (*refer to our Application Report No. A 03-4*).



Photo above: The photo shows a pipe ID 100 in use in a plastics factory, blocked with plastic incrustations - **prior to cleaning.**

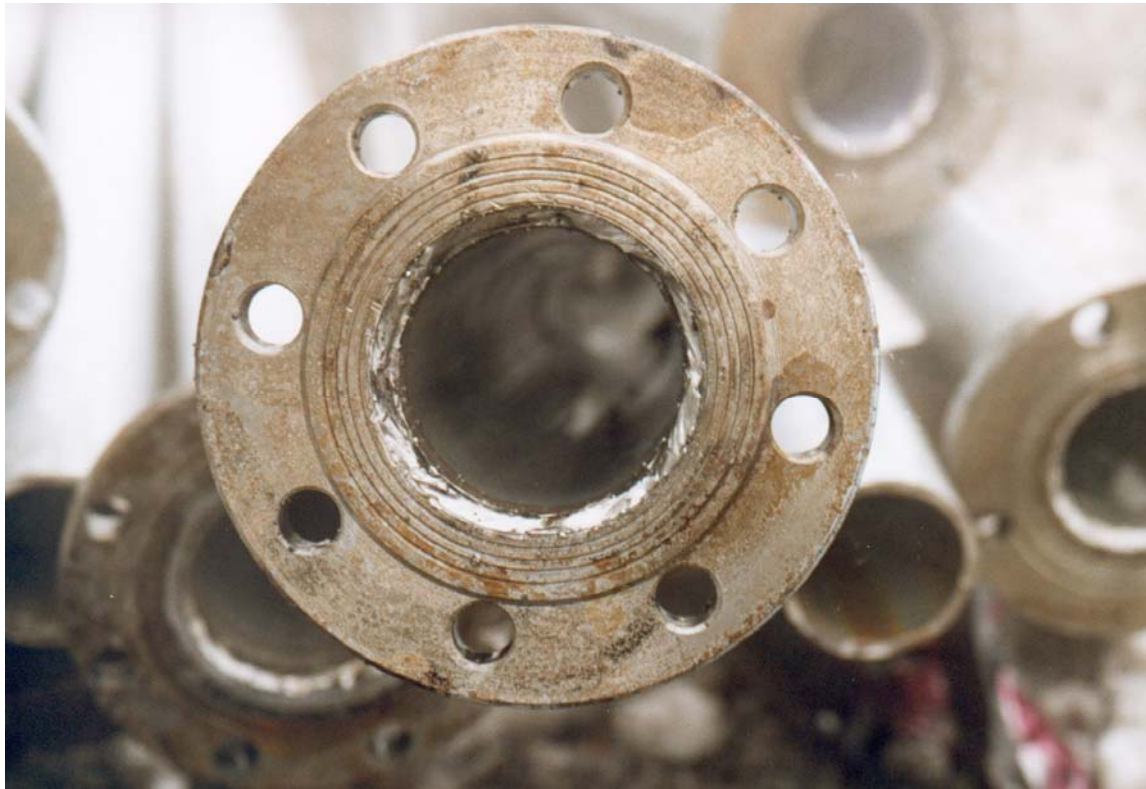


Photo above: The photo shows the same pipe ID 100 - **after cleaning**.
The flange of the pipe has also been cleaned.

Photo on the right:

The work was carried out using a pump model K 16026 A (900 bar at 83 l/min.), a foot valve and a rotating pipe cleaning nozzle type RTKH with 2 nozzle inserts on the rotor at 40° and 2 nozzle inserts at 80°.



Cleaning Parts of an Extruder in the Polypropylene-Production Process

In the course of the manufacturing process of polypropylene after a number of months there is a steady accumulation of deposits. One of our customers in Hungary carried out the job of cleaning an extruder, using a working pressure of 2500 bar.

The equipment which was used for the job: A high pressure unit model KAMJET (performance 23 l/min at 2500 bar) plus a KAMAT gun type Roto-Lance.



Pictures above and on the right:

The incrustations are difficult to remove and a working pressure of above 2000 bar is essential.

Application Report No. A 04-5e

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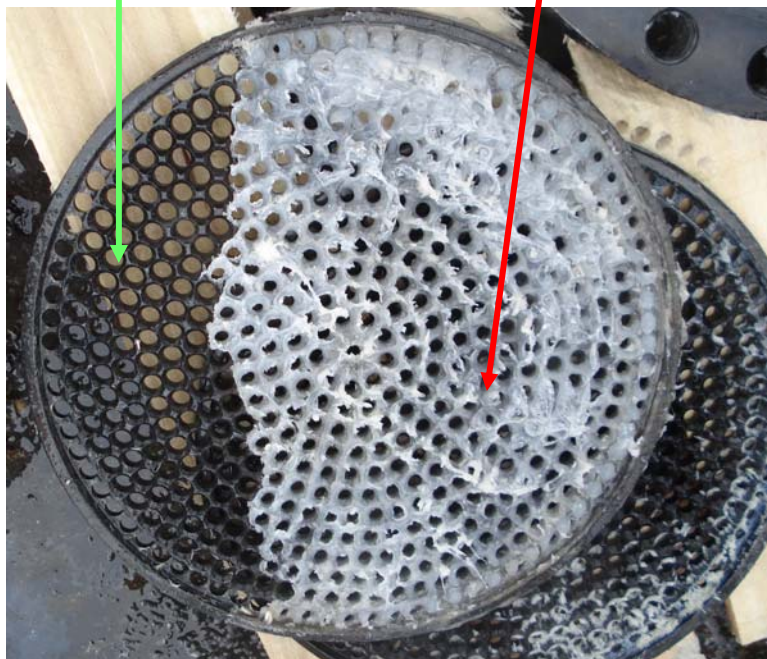
Cleaning Parts of an Extruder in the Polypropylene-Production Process

Status: 04/2007

S.Smets



Areas after
cleaning



Areas before
cleaning

At the present time, the standards of NACE 5 / SSPC – SP, 1995 are applicable and these standards have been underlined with the aid of photos by one of the leading suppliers of paint for the shipping industry, HEMPEL Marine Paints A/S in Denmark.

We list below the cleaning degrees as defined by NACE 5 / SSPC – SP 12 and which are illustrated in the handbook issued by Messrs. HEMPEL, "Photo Reference Water Jetting".

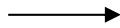
Four (4) standards are defined, as follows:

- WJ-4** "A WJ-4 surface must have all loose rust, loose mill scale and loose coatings uniformly removed".
- WJ-3** "A WJ-3 surface must be cleaned to a matt finish with at least two-thirds of the surface free of all visible residues (except mill scale), and the remaining one-third containing only randomly dispersed stains of previously existing rust, coatings and foreign matter".
- WJ-2** "A WJ-2 surface must be cleaned to a matt finish with at least 95% of the surface area free of all previously existing visible residues and the remaining 5% containing only randomly dispersed stains of rust, coatings and foreign matter".
- WJ-1** "A WJ-1 surface must be free of all previously existing visible rust, coatings, mill scale and foreign matter and have a matt metal finish".

Removal of Paint and Rust from Ships up to 2500 bar

*All of the applications shown were carried out in accordance with the international recognized standard **WJ-1***

*Semi-automatic surface cleaning using the KAMAT **Wall-Cleaner** on ship's hull in dry docks.*



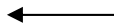
The Wall-Cleaner can be fitted to an external suction and filtering system.
(Refer to Application Report No. 05-6e).

Possible Rates of Removal:
(based on complete removal of coatings and rust = **WJ-1**)

- Roto Lance 9 – 15 m²/h
- Wall-Cleaner 25 – 35 m²/h
- Surface-Cleaner 30 – 45 m²/h



*The **Surface Cleaner** in operation on a ship deck.*



Like the Wall Cleaner, the Surface Cleaner can also be fitted up to an external suction and filtering system.

The Surface Cleaner is pneumatically driven and the speed of rotation can be set to exactly match the actual requirements.

Removal of Paint and Rust from Ships up to 2500 bar

The picture on the right shows manual gun works on a ship's hull while in dry docks. The operator is using a **KAMAT Roto-Lance** at a working pressure of 2,000 – 2,500 bar. →

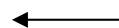
In day-to-day operation, guns are only used for treating those areas which are difficult to reach using the Wall Cleaner

The following rates of removal can be achieved:

- Using gun: 9 – 15 m²/h
- Using Wall-Cleaner: 25 – 30 m²/h



KAMJET 10000 23 l/min at 2500 bar



This picture shows a KAMJET in operation in a shipyard in Greece.

The Roto-Lance is being used (manual operation) to remove rust from a pontoon on a quay wall.

Cleaning of Ship Hulls up to 1000 bar

The conventional method of cleaning and paint removal in the ship industry and in general corrosion prevention is carried out at working pressures of up to 1000 bar. Using this method, a surface quality according to the internationally accepted standard of WJ 3 - WJ4 can be achieved. (Refer to our Report A05-0e).



KAMAT customers worldwide use high pressure guns and rotating nozzles to handle these tasks.

As can be seen in these pictures, in many cases the work is carried out from a hydraulic working platform - a so-called "Cherry Picker".

A cleaning rate of 30 to 50 m² / h is possible, depending on the condition of the surface and the resulting standard required.



The two types of rotating nozzles shown below are the ones most frequently used.



Rotating Nozzle PRD 1500



Orbital Nozzle KOD 1500

Removing Rust and Paint with Water / Sandblasting

The Water-Sandblasting Method:

A cleaning method which is very often used is the addition of sand or other abrasives to the high pressure water = Water-Sandblasting.

In more and more countries, the use of pure sand only is either forbidden or is considerably restricted by law; in these countries the water-sandblasting method is a possible alternative. The working tool comprises a high pressure gun onto which an injector is mounted and through which abrasive material (sand, quarry sand, blast furnace slag, etc.) is added to the water jet.

As a basic rule it can be said that the higher the working pressure, the lower the amount of additives is required. The latest generation of injectors are suitable for jetting at a working pressure of between 500 and 1000 bar.

The water-sandblasting method is absolutely dust-free.



- Surface after water sand-blasting, blank and roughened
- Storage vessel for the abrasive material

Steel surfaces treated in this manner are optically perfectly acceptable. All traces of the old paint layers and rust can be removed. Nevertheless, stubborn scale layers cannot be removed by this method - it is there for extremely difficult to get a degree of cleanliness certified to comply with the requirements of WJ 1.

Furthermore, the time required for treating a given area is far greater than when using working pressures of 2000 - 2500 bar. (Refer to our Report A-1e).

Dry Docks – Steel Preparation to WJ - 2

Not only on ships and ships' surfaces is the subject of rust removal and surface preparation a recurring subject - on dry docks the matter is of equal importance.

Our Italian partner carried out surface preparation of a dry dock in La Spezia, Italy.

The customer was demanding a surface quality of WJ-2 (our Report A5-0) gives details of the standards applicable).

To do the job, two high pressure units were used, each of them fitted with a KAMAT pump model K 9018 A, giving a performance of each 25 l/min at 1200 bar.

The accessories used were guns type KSP 1200 and KAMAT Rotating Nozzles Type PRD 1500.

Dry Docks – Steel Preparation to WJ - 2

High pressure unit
with diesel engine
and KAMAT Pump
Type K 9018 A
(25 l/min. at 1200 bar)

Worker with High Pressure Gun
Type KAMAT KSP 1200 and
Rotating Nozzle Type PRD 1500

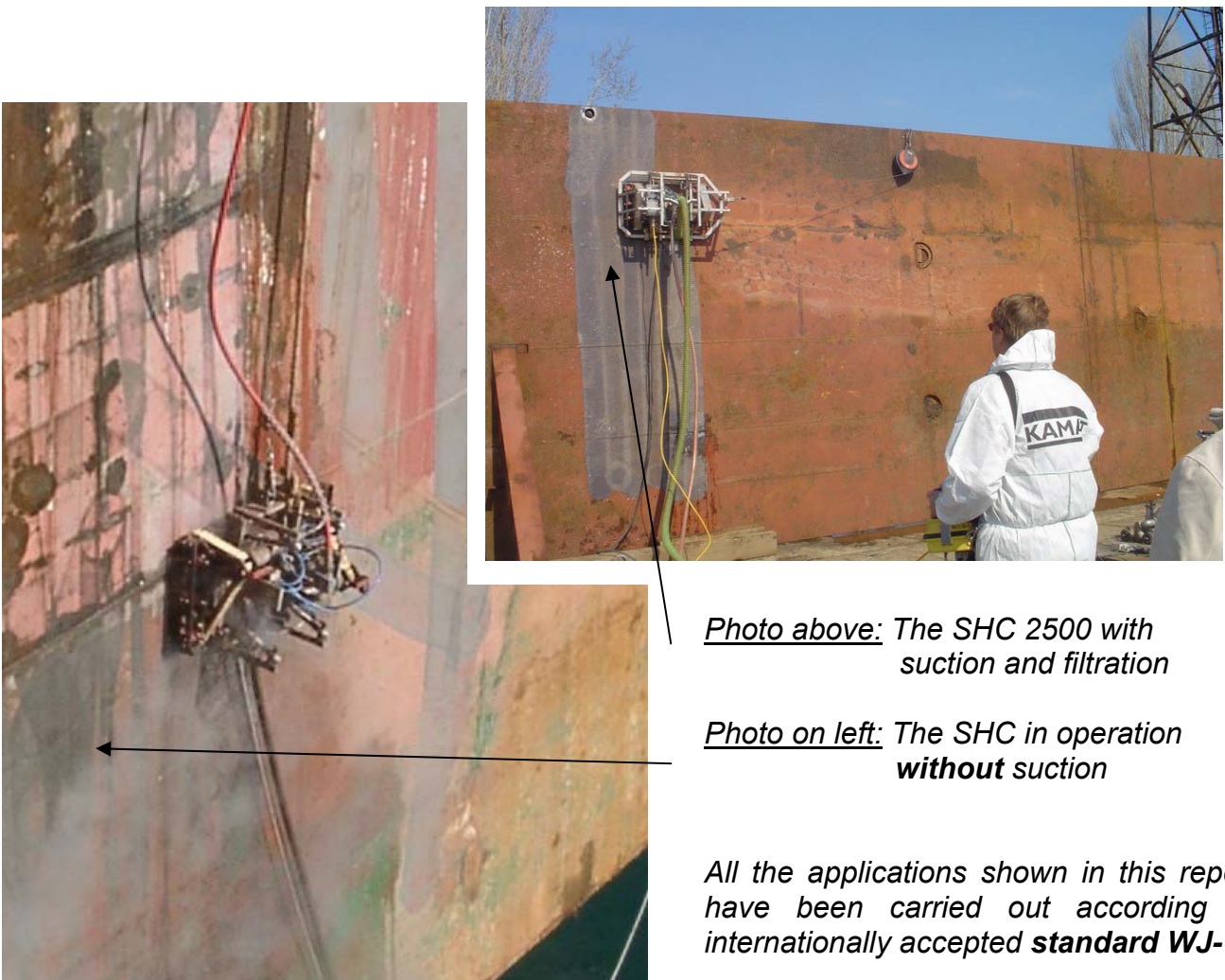
Using the method described above a surface performance of
30 - 40 m²
could be achieved

Automatic Ship Hull Cleaning at 2500 bar with Suction Device and Filtration

KAMAT customers in Greece, Romania and Hungary are already utilizing the new, automatic steel surface treatment system, which comprises a high pressure pump unit, the SHC 2500 / 250 (Magnet-Crawler) and a suction / filter system type KAMVAC.

All kinds of steel surfaces such as ship hulls, storage tanks (internal and external) are thoroughly cleaned to the cleaning standard of WJ 1, whereby paint layers and rust are completely removed. At the same time, all the debris removed is drawn off by suction using the KAMVAC system and all particles > 100 µm are filtered off. The dirty water is constantly pumped off by a special pump, without any interruption of the cleaning process.

A cleaning rate of 40 to 60 m² per hour can be achieved, depending on the thickness of the paint layers and the degree of rust.



*All the applications shown in this report have been carried out according to internationally accepted **standard WJ-1***

Automatic Ship Hull Cleaning at 2500 bar with Suction Device and Filtration



The KAMAT system in operation at a dry dock in Constance, Romania

- KAMVAC Suction and Filter System
- KAMJET unit



Technical Data SHC 2500/250

- | | |
|------------------------------|---------------|
| • Maximum flow | 40 l/min |
| • Maximum operating pressure | 3000 bar |
| • Working width (diameter) | 250 mm |
| • Width of housing | 700 mm |
| • High pressure fitting | 14x1.5 LH |
| • Weight | approx. 90 kg |
| • Number of nozzles | max. 8 |
| • Min. air pressure required | 6 bar |
| • Stepless adjustment speed | 0-4 m /min |
| • Control voltage | 24 V |

KAMVAC

Compact, mobile vacuum suction device with separator and dirty-water return pump in weather-proof, robust design and height-adjustable frame.

For suction of fluids and solids

Ideally suited for use with KAMAT SHC 2500, Wall Cleaner and Surface Cleaner 2500 bar, using hoses up to a maximum length of 50 m (DN 40 and 50).



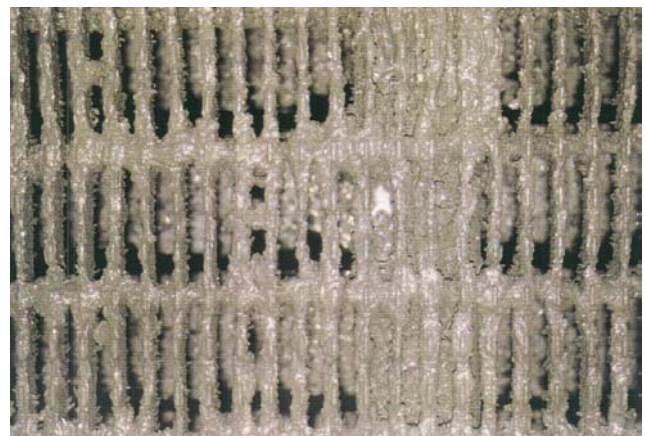
Cleaning of paint booths in the automobile industry is a daily problem. In large companies, the cleaning work has to be carried out on a weekly basis.

Our partner in Turkey, Messrs. HIDROTEK, has a frame contract for cleaning all of the paint booths and grids in the production facilities of the company HONDA in Turkey.



Photo on the left and below:

These pictures show the state of the floor grids in the paint booths, prior to cleaning.



Our Turkish partner carried out the cleaning of the walls and the ducts using high pressure guns. The floor grids were cleaned using a KAMAT surface cleaner.



Photo on the left:

Worker in the paint booth, cleaning the air ducts.

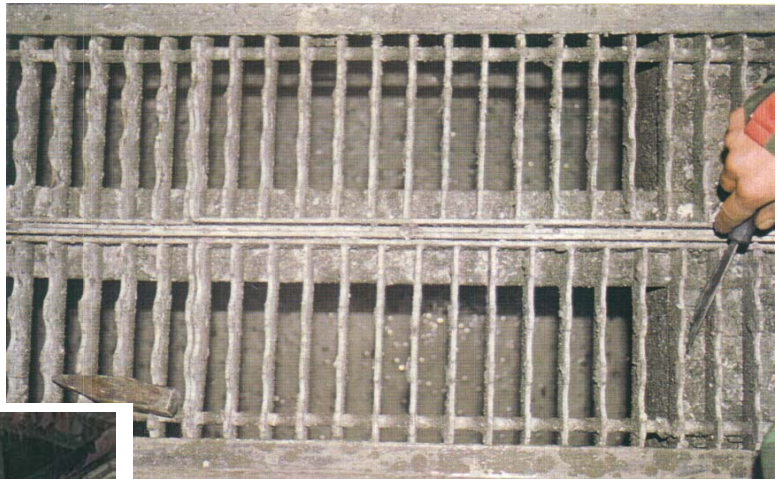
The work with high pressure guns was carried out at a pressure of 600 - 700 bar and with fan jet nozzles 15°, 2 mm Ø.

The following pictures show the grids after cleaning.



Photo on the left:

This photo shows the cleaned grid and the shaft below it, which was also cleaned.



In the process of paper manufacturing, particularly in the case of "recycled" paper, it is necessary to clean the perforated plates of the cylinders which are in use. The bores of the plates (exterior) have to be thoroughly cleaned so that there are no particles left which could find their way into the process once the system is restarted.

The work can be done manually or semi-automatically. In the case of manual cleaning, high pressure guns are used whereby the cylinder itself has to be turned slowly. As a semi-automatic procedure, a rotating nozzle is fixed to the cylinder and it moves along a guide track on the cylinder.

Some of the drums (with perforated plates) in use in the paper industry have conical bores and consist of one single cylinder. On this type of construction the cleaning can be done both externally and internally. Whenever the cleaning job is carried out from inside to the outside a rotating nozzle is fixed to a guide track and lead along the longitudinal axis of the cylinder.

Depending on the diameter of the cylinder the rotating nozzle can be fitted with extension arms so as to bring the water power as near as possible to the dirt.



The operator is guiding the high pressure gun with nozzle along the rotating cylinder.

Application Report No. A 07-5e

Cleaning a Filter Screen Drum

Page 2/2

Status: 10/2005

KAMAT Su Jeti



Photo above:

The picture shows the cleaned inner sleeve of a cylinder. The job was carried out using a KAMAT pump and an orbital nozzle, 2.5 mm at a working pressure of approx. 600 bar.

Photo on the right

The cleaned front face of the cylinder.



Plate-type heat exchangers are used in many different industries. In the following report, we are giving details of a job to clean plate-type heat exchangers in a sugar factory in Turkey.

The cleaning was carried out using a KAMAT pump type K 11026 A together with the following accessories: High pressure gun KSP 1200; 2.2 mm diam. fan jet nozzle with a jetting angle of 30°.

A working pressure of 400 bar was sufficient to remove the deposits.

For each plate, approx. 180 seconds were required to finish the cleaning job.

Photos on the right and below:

The two pictures show the degree of soiling before the plates were removed.



Very often, the customer demands that the seal of the plate must not be damaged during cleaning as its replacement is very expensive.

In such a case a stencil has to be prepared to prevent the water jet from damaging the seal.

In our case, however, the seal was replaced after the cleaning and it was not necessary to carry out any special preventative measures.

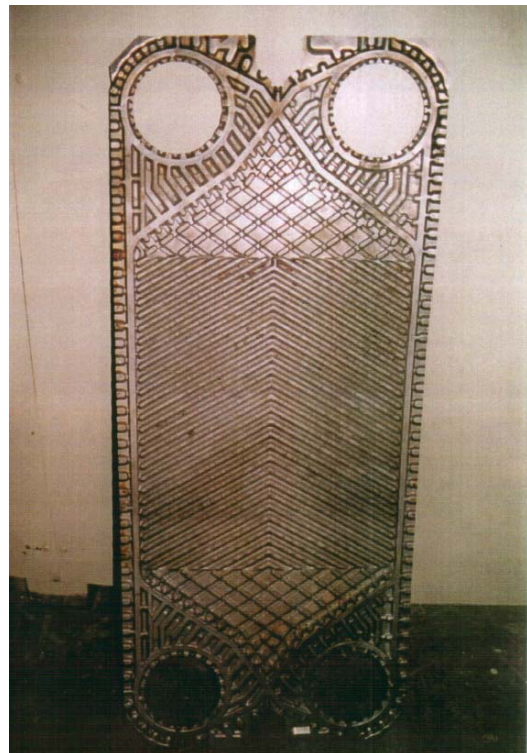


Photo on the left:

The plate is being cleaned with a high pressure gun, at a working pressure of 400 bar.

Photos on the right and below:

The pictures show the cleaned plates.



More and more, the technology of ultra high pressure water jetting (2000 to 3000 bar) is being applied, when it comes to renovating concrete surfaces.

In this particular case, it was necessary to remove a thick epoxy coating from the facade of a 17-story building in Milan, removing the damaged concrete at the same time.

The reinforcement bars were too close to the surface, which meant that they were not sufficiently covered with concrete. The problem was that water could find its way to the reinforcement bars and these began to rust, increase in volume and cause the concrete to break-up. For this reason, the concrete renovation was essential.



Photo above:

PTC Unit KAMJET K 10016

Max. working pressure: 2500 bar

Max. capacity : 23 l/min.

Photo on the left:

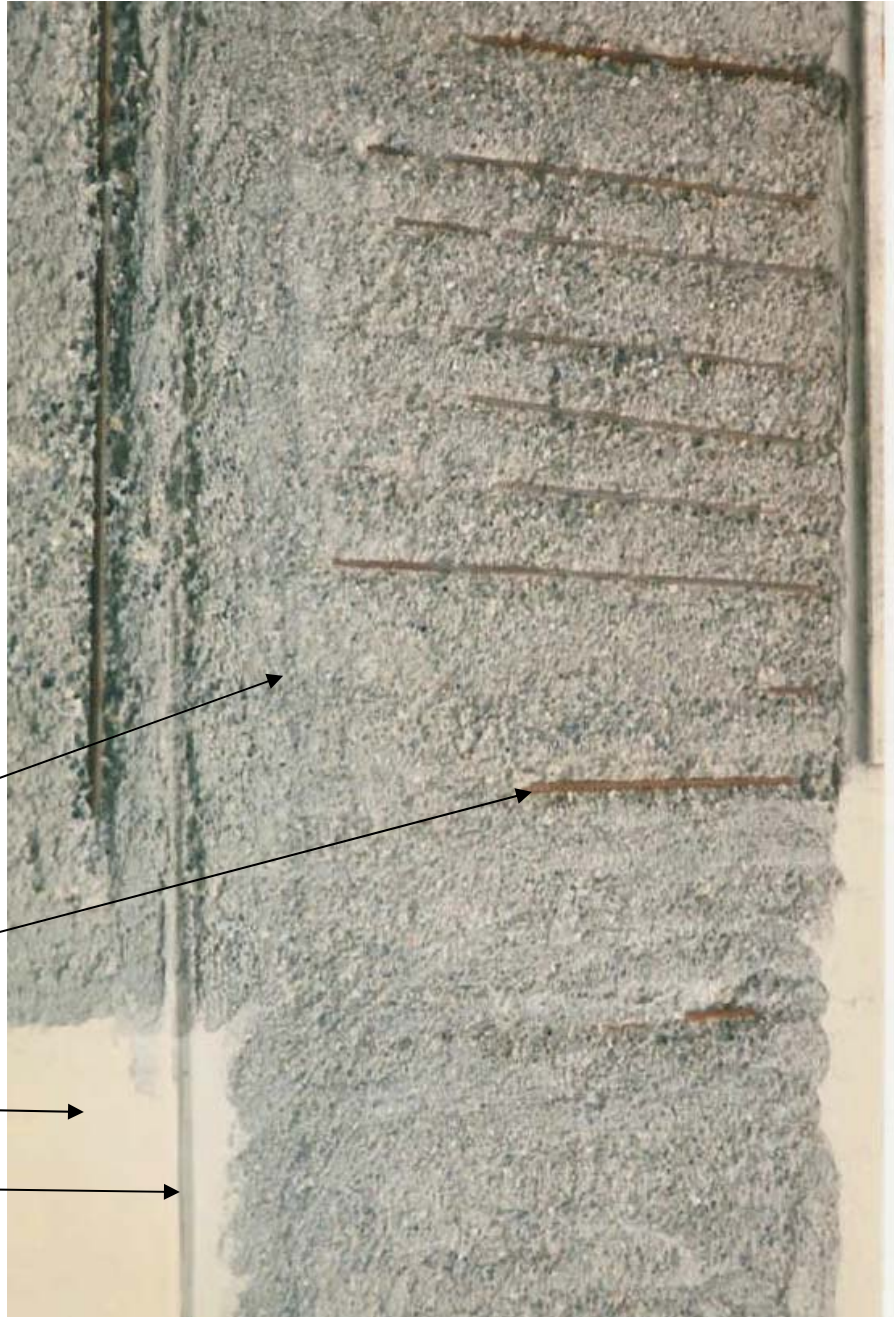
For this job, a pneumatically-driven KAMAT **"Roto-Lance"** was used, which achieves an even jetting performance.

On the photo the concrete area which was blasted at 2000 bar is clearly visible.

As described on the first page, the reinforcement bars near to the surface were exposed completely.

Concrete surfaces which have been treated with this method have an adhesive tensile strength of at least **1,5 N/mm²**.

- Treated surface
- Reinforcement bars exposed
- Untreated surface
- Expansion joint



This method of renovation is particularly suitable for work near to windows, expansion joints, antennas, cables, etc., as there is no damage to the surrounding areas.



On one of the motorway bridges in Italy an additional lane had to be constructed, i.e. the width of the bridge had to be extended.

The existing concrete first had to be removed at a width of approx. 1000 mm. Then, additional reinforcements were connected to the old reinforcements which had already been exposed.

Using this method of operation it is ensured that the iron rods are not damaged and that the structure of the bridge is not subjected to any vibration whatsoever. Tests have shown that when conventional methods of removing concrete are applied (chisel, hammer, etc.) very fine cracks are left behind on the bridge construction (these are visible when x-ray photos are taken).

The advantage of the new method is that the adjoining surfaces are roughened extremely well and permit an optimum bonding with the new concrete.

Our partner in Italy carried out the job using a hydraulically-driven removal unit which was fitted to a small BOBCAT loader. The removal was effected using a KAMAT high pressure machine and a working pressure of 900 bar.



Photo on the right:

KAMAT High-pressure unit
K 33036 A

- 900 bar
- 165 l/min.

Concrete removal system
mounted to the
BOBCAT loader.

Photo on the right:

The adjoining concrete surfaces and the reinforcements which have been laid open, following surface treatment.



Application Report No. A 12-1e

Removal of Coatings and Old Paint Layers from Building

Page 1/2

Status: 03/2005

HWT, Singapore



Our partner in Singapore, the company HWT, won a contract to remove old layers of paint and coatings from a building facade.

The aim was to lay open the natural stonework.

Photo on the right :

The work was carried out with KAMAT machines

Performance:

Working pressure: **2.500 bar**
Capacity **23 l/min**



Photo on the left:

Service technician working from the scaffolding.

He is using a KAMAT "**Roto-Lance**".

Removal of Coatings and Old Paint Layers from Building

Status: 03/2005

HWT, Singapore



Photo on left:

The **"Roto-Lance"** in operation. Formerly, jobs of this nature could only be successfully carried out by the sandblasting method.

But this method is now prohibited in residential areas, due to the high rate of dust formation.

Photo on the right:

Wherever scaffolding was not practicable, hydraulic platforms were used.



Photo on the left:

All coatings and paint layers were successfully removed from the stone ornaments, without causing any damage.

At the top of the picture the original coatings are still visible.

There are many possible applications for high pressure water jetting technology in the construction industry. All equipment that comes into contact with concrete, cement and coating material needs to be cleaned at regular intervals, depending on the length of time they have been in use.

Here are some examples:

- Feed systems for cement and concrete
- Concrete mixers
- Concrete mixers on trucks
- Cement silos



Photo above:

The filling section of a stationary concrete mixer before cleaning

Application Report No. A 12-2e

Cleaning Building Machinery

Page 2/2

Status: 12/2005

KAMAT Su Jeti



Photo above:

The filling section shown on the first page, after cleaning.

The work was carried out using a KAMAT high pressure pump type K 11024 A, a gun KSP 1200, at a working pressure of 800 - 900 bar.

Our Spanish agent is presently working on an interesting project, in cooperation with an engineering office in Madrid.

Off the Andalusia coast in the south of Spain, the Spanish government is erecting a power generation plant with offshore aero generators, to comply with international requirements (Kyoto Agreement – reduction of pollutant emission).

In the coastal area where the power plant is planned, there are several rare fish species which are under nature conservation. So when preparing the foundations on the sea floor only those methods can be considered that cause as little noise and vibration as possible.

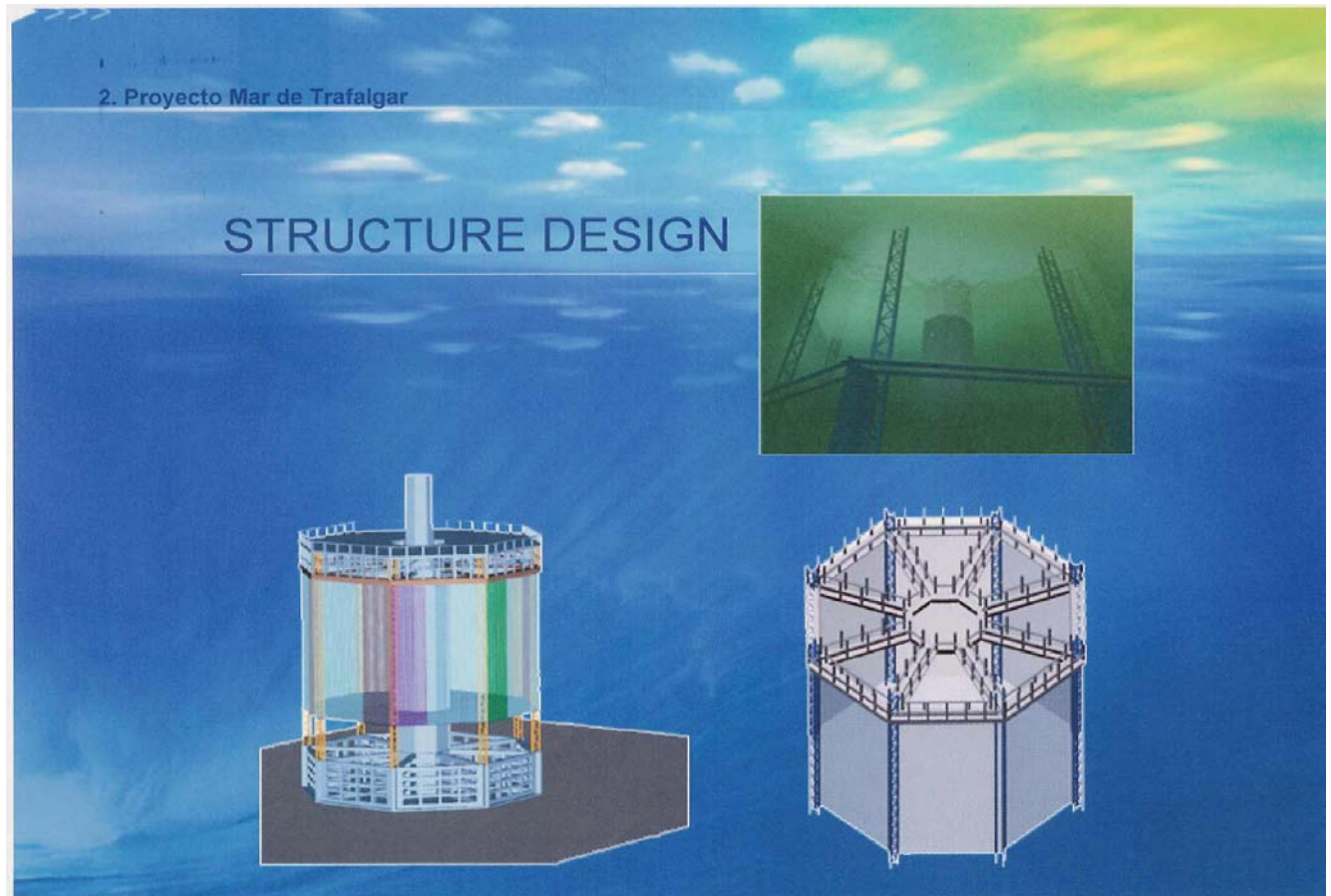


The idea of how to solve the problem is to drive piles through the tubes into the sandy seabed, by means of high pressure.

The zone marked green shown on the left is the area which is "inflated" with high pressure water (sea-water) and due to the expansion of this area, the pile is driven through the tube vertically into the ground.

Through the second hole in the top segment, liquid cement will be injected between the pile and the tube.

The rate of propulsion and driving of the pile will be controlled by a flow meter and a complex control and monitoring system.



Technical data of the planned power plant:

- | | | |
|--|---|--------------|
| • Total capacity of the aero generator power station | : | 1000 MW |
| • Number of aero generators | : | appr. 280 |
| • Power generated by each turbine | : | appr. 3,6 MW |

Proposed details using KAMAT pumps:

- | | | |
|--|---|---------------|
| • Medium | : | Sea water |
| • Planned maximum working pressure | : | 280 bar |
| • Capacity per pump | : | 240 l/min. |
| • Number of high pressure units required | : | 8 |
| • Type of pump | : | 13045 MC |
| • Pump drive | : | Diesel engine |

Application Report No. A 12-5e

Page 1/2

Cleaning of Corrugated Eternit Roofs (Asbestos cement roof panels)

Status: 11/2004

S.Smets

Roof plates made of asbestos cement weather strongly after 15-20 years. The problem which then arises is that the asbestos material in the eternit panels is blown away by the wind and pollutes the environment. Asbestos fibres are a considerable health hazard as they are respirable and can cause cancer.



A Surface Cleaner was designed especially for this application and the roof panels were cleaned with high pressure water (400 - 600 bar). After the cleaning process the panels can be recoated and painted as required.

The suppliers of the coating materials are only prepared to give a guarantee of 10 years on their products when the underground surface is absolutely clean and adequately roughened. Our method fully satisfies these requirements. This application has been successfully in use in Germany and Austria since 1995.

Rate of surface preparation (on average) : **300 - 400 m² / h**

Of course, the above-mentioned performance rate is dependent on the condition, and size of the roof surface.

Cleaning of Corrugated Eternit Roofs (Asbestos cement roof panels)

Surface Cleaner with special rubber seals (undulating-profile) in operation.

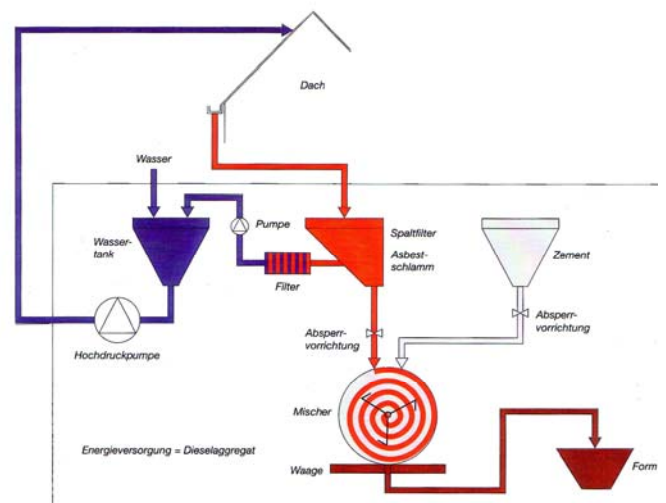
The Surface Cleaner is guided up and down by a rope from the ridge of the roof.



One of our customers in Austria is running a complete system based on KAMAT "know-how", as shown in the diagram on the left.

The dirt and debris (asbestos fibres) washed off in the cleaning process must be dealt with in an ecologically-sound manner. The waste water is led off via the roof drainage system into a collection vehicle. The sludge containing asbestos particles is drained off and fed into a mixer and is then mixed with cement. The mixing process is controlled and recorded on a weighing machine.

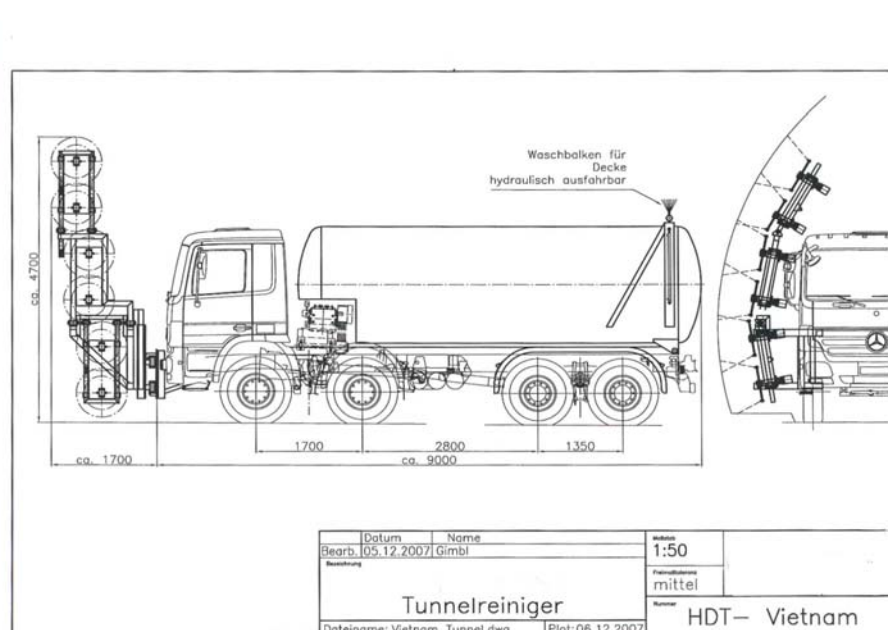
The mixture of sludge and cement is poured into blocks and can then be disposed of in an environmentally-friendly manner. For example, the blocks can be used for securing dumpsites.



Automatic Cleaning in Tunnels

A customer of ours in Austria received a contract from a large operating company to clean the walls and ceilings of several motorway tunnels. The systems previously in use employed brushes and a low-pressure spraying device. These systems no longer supplied satisfactory cleaning results, as the dirt to be removed was of a greasy nature. So more effective methods of cleaning had to be found.

In a cooperation with a longstanding partner company that concentrates on building special-purpose vehicles, a new type of vehicle was designed and built and sold to the customer in January 2006. Since this time the vehicle has been working extremely effectively in Austria.



Technical Data and Details:

- High pressure pump KAMAT K 25050 MC (400 bar - 318 l/min) - with an independent auxiliary drive system (PTO).
- 8 surface cleaners are fixed to a front plate - this set-up is used for cleaning walls of up to 7.5 m height.
- A nozzle bar equipped with fan jet nozzles is mounted on the rear of the vehicle. This nozzle bar can be extended (telescope extension) and is used for cleaning ceilings at a height of up to 7.5 m.
- The vehicle is driven by means of a hydrostat which allows a stepless adjustment of the driving speed between 0.1 and 6.0 km/h during the cleaning operation..



Photo above: The purpose-built vehicle TCT 400 H during operation. The nozzle arrangement at the front of the vehicle can be configured hydraulically to match the tunnel profile

All hydraulic circuits are supplied or driven by the vehicle engine.

The separate drive circuits are effected as follows:

- High pressure pump is driven direct by a PTO (independent auxiliary drive)
- Hydraulic circuit I : PTO on vehicle engine (gear-independent = tipper auxiliary drive)
- Hydraulic circuit II : Oil pump flanged direct to the hydrostat
- Hydraulic circuit III : Oil pump flanged direct to the hydrostat

Technical data of the chassis:

- Min. 360 kW engine performance at 1800 rpm
- 4-axle chassis 8 x 4 (both of the front axles are steered; both of the rear axles are driven)
- 2 auxiliary drive systems (PTO) on vehicle gear, one of which is gear-dependent, the other one is gear-independent

Removal of Coatings and Paint Layers from Sheet Metal Roofs

In the course of time, coatings on galvanized sheet metal roofs become weather-beaten, brittle and porous. Before a new coating can be applied, the old coating must be thoroughly removed. The roof itself, when exposed to the weather, will start to corrode after a number of years.

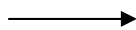
The market leaders for suitable coatings and paints insist on a complete removal of the top coat and of the primer, which is very often firmly bonded to the surface, either manually or by means of spraying systems before a new coating can be applied.

The paint manufacturers will give a guarantee of 20 years for their products provided the existing layers have been thoroughly taken off and the undercoat has been derusted (optimum surface preparation).

A specialist company in Austria has been handling the problem of removing coatings thoroughly from tin roofs for five years now. Before they purchased a KAMAT machine they had been doing the job manually using right-angle grinders. This conventional method is extremely loud and is a nuisance because of the amount of dust generated.

*Thorough decoating using the
KAMAT **Surface Cleaner 2500air**.
Working pressure:*

2000 – 2500 bar.

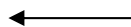


Rate of performance per day

100 - 250 m² - depending on the consistency of the old paint layers.



*Manual finishing of the joints using a
“**Roto-Lance**”, at a working pressure of
2000 – 2300 bar*



Application Report No. A 20-1e

Removal of Coatings and Paint Layers from Sheet Metal Roofs

Page 2/2

Status: 02/2004

S.Smets

Untreated area



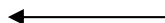
Steel sheet roof after surface treatment, prior to final treatment of the joints.

KAMJET 10000 →

Due to low noise level, the **KAMJET** was well-accepted by both the local residents and the controlling authorities.



Surface Cleaner 2500air
in operation



Removal of Coatings and Paint Layers from The Folds On Tin Roofs

In our Report A 20-1e we described the method of removing coatings and paint layers from sheet metal roofs. Not only the flat metal surfaces need to be treated; particular attention needs to be given to the finishing of the roof joints.

The photo on page (1) of our Report A 20-1e shows the method previously used by our Austrian customer for decoating the joints. He used to use a Roto-Lance and the work was very time consuming

He asked us to design and build a special device to simplify the job and to save time. The machine selected had to be able to remove thoroughly the coatings from the fold itself and additionally to cover a strip of 25 mm width to the left and right of the joint. If the decoating of the joints is done properly, the remaining flat roof surfaces can easily be treated with a standard Surface Cleaner so that it is no longer necessary to carry out any of the work manually with guns.

KAMAT constructed a special device called the Fold Cleaner "FRG 2500" and delivered the unit to the customer in Austria in January 2004. The mobile chassis is guided along the fold by means of skids at the front and rear and is equipped with two pieces of our "PRD 2500 air", each of which is fitted with a special nozzle head. The height of the unit is adjustable and the angle of the nozzle heads can also be varied.

The KAMAT "Fold Cleaner FRG 2500" in operation at a construction site in Vienna, Austria



Removal of Coatings and Paint Layers from The Folds On Tin Roofs



Fold Cleaner "FRG 2500"
in operation, driven by a
KAMJET 10000

Working pressure: 2000-2500 bar
Capacity: 23 l/min
Number of nozzles: 8 x 0.35mm

On the right side of the foto
the decoated joint and the
side strip can be seen



Method used in the past:

"Roto-Lance" for joint preparation = thorough removal of the coatings
including both 25 mm strips to the left and right of the joints
max. 20 running metres / hour

Present method:

"Fold Cleaner FRG 2400" for joint preparation = thorough removal
of the coatings including both 25 mm strips to the left and right of the
joints
approx. 80 running metres / hour

Savings:

According to our customer the new method reduces costs of
personnel, diesel and spare parts by up to 60 %

**In addition, a much higher degree of customer satisfaction is
achieved as the results speak for themselves!**

Application Report No. A 20-4e

Page 1/2

Removal of an “Anti-Slip” Coating from the Runway of an Aircraft Carrier

Status: 03/2005

PTC, Italy

Our Italian partner received a contract from the Navy, to remove a thick "Anti-Slip" coating from the runway of an aircraft carrier.

The coating was porous and partially no longer intact. Before the special surface coating could be renewed, the old coating had to be thoroughly removed.

Using a pneumatically-driven Surface Cleaner, at a working pressure of 2000 - 2200 bar, it was possible to complete the job to the entire satisfaction of the customer.



Removal of an “Anti-Slip” Coating from the Runway of an Aircraft Carrier

Status: 03/2005

PTC, Italy

**“Surface cleaner”** in operation**Unit with pump K 10016**Photo above:

A PTC High Pressure Unit Type incorporating a pump **K 10016** was used for this job, with the following performance:

- p max. : 2500 bar
- Q : 23 l/min.

The horizontal surface of the runway was cleaned using a KAMAT "Surface Cleaner". The pneumatic drive ensured that an even and consistent surface finish was achieved.

The special coating is extremely thick (approx. 15 - 20 mm); for this reason a cleaning rate of not more than 12 - 16 m² / h was reached.

Decoating a Collection Basin Under Storage Tanks

In a tank farm in Poland it was necessary to remove the coating on a collection basin underneath storage tanks. At the same time, the subsurface (concrete and brickwork) had to be prepared for a subsequent coating which is resistant to oil and moisture. After treatment, the adhesive strength of the subsurface was not less than 1.5 N / mm².



The job was done using an Orbital Nozzle, at a working pressure of 1000 - 1100 bar.

Photo on the right:

Both the old plaster layer and the old coating were removed from the brickwork foundation



Decoating a Collection Basin Under Storage Tanks

Status: 10/2005

PIOMAR, Poland

The photos on this page show how the work was carried out using a high pressure gun KSP 1200 and an Orbital Nozzle.

Treated surface
Untreated surface



Photo above:
After treatment, the roughened and cleaned concrete is clearly visible. This surface is ideal for applying a new coating.

In June 2004 we carried out some trials at Warsaw airport in Poland, together with our client. The aim of the demonstration was to remove rubber from the touch-down zones of the runways.

The runway surface is made up of asphalt and concrete.

In the area of the touch-down zone the surface is grooved laterally to the runway.

The task which was set by the Airport Authorities was to remove the rubber deposits completely, however without damaging the runway itself.



Since the cleaning job is carried out once a year only, the airport management decided to give the work to a local contractor and a relatively simple system was adequate for the job.

Our client provided a small unit of their own which was able to run at regulated speeds between 1-30 m/min. The unit was equipped with a hydraulic nozzle arm which could be swivelled in front of the unit to a maximum working width of 2.4m.

Runway Cleaning at 600 bar

We attached a KAMAT nozzle head type PRD 1500 to the swivel arm and equipped the head with 2 x nozzles inserts 1,4mm Ø. At a working pressure of 600 bar we were able to carry out and complete the work to the customer's entire satisfaction.

The removal rate achieved: **2.400 m²/h.**

After removal



Before removal



Runway Cleaning at 2000 bar

The KAMAT agent in South Africa took part in an international tender and was awarded the contract to build a special vehicle for runway cleaning in Angola. The tender specified the need for a system which required a **low** rate of water consumption per m², due to the lack of water.

KAMAT supplied a pump model K 10016 A, and our South African agent assembled the unit. A Perkins engine was selected to drive the pump. The unit was assembled as a Power Pack system on a new Mercedes chassis and was supplemented by a large water header tank.



At the front of the truck a hydraulically-driven rotating nozzle head was attached. The hydraulic system used to drive the head allows an exact adjustment of the speed to match the requirements and achieve effective cleaning. Should it be necessary to move off the runway at short notice, the nozzle head attachment can be lifted up hydraulically in a few seconds.



Technical Parameter and Performance:

- | | | |
|-------------------------------------|---|----------|
| • Working Pressure | : | 2000 bar |
| • Speed of truck | : | 3.8 km/h |
| • Rotating nozzle head: | | |
| - Number of nozzle arms | : | 4 |
| - Number of nozzles per arm | : | 3 |
| - Net working width | : | 1000 mm |
| - Distance between nozzle / Surface | : | 27 mm |
| - Speed of the nozzle head | : | 2200 rpm |

Average cleaning rate	:	2600 m²/h
------------------------------	----------	-----------------------------

Runway Cleaning up to 2500 bar with Suction Device

This high performance vehicle for professional runway and surface cleaning was designed and built in a cooperation with the company BROCK Kehrtechnik GmbH in Witten. The system was sold to Vietnam.

The rubber deposits on the runway are removed by high pressure water and the debris plus water is then entirely drawn off by suction. On this vehicle, all of the relevant components for the job are hydraulically driven. The required power is taken off two sources: Firstly, via the direct auxiliary drive system on the gear of the vehicle and secondly, via a hydrostatic transmission built into the cardan shaft.

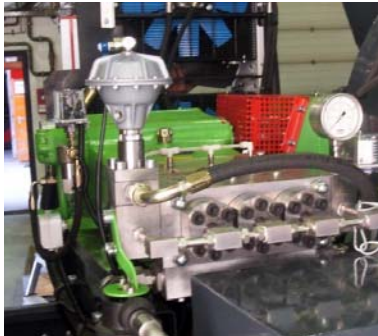


Technical Data:

Chassis	:	Daimler Chrysler ACTROS 2550 L – 6x2 with lift able und steerable trailing axle	
Motor	:	V 8 – 500 PS	
Tank volume	:	6.000 litres fresh water tank 7.000 litres dirty water tank	
Working width	:	1000 mm	
Working pressure	:	1000 – 2500 bar	stepless regulation
Capacity	:	15 – 29 l/min	stepless regulation
Rotation of nozzle arm	:	100 – 2000 Upm	stepless regulation
Speed	:	0,3 – 85 km/h	stepless regulation
Suction	:	> 700 m³/h	free air volume



Runway Cleaning up to 2500 bar with Suction Device



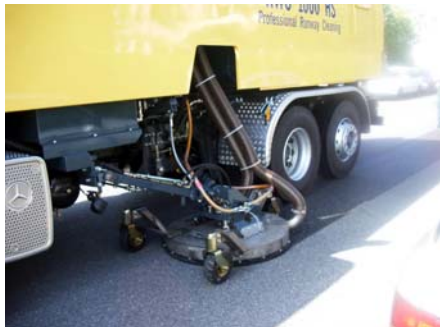
The heart of the vehicle is a 140 kW KAMAT high pressure pump with a performance of 29 l/min at a maximum working pressure of 2500 bar.

Two water filters (100 and 25 μm) are assembled in line in the inlet to the 6m² water tank.

In addition, there is a 10 μm filter fitted in the inlet side between the booster pump and the high pressure pump.

The vessel can be tilted for maintenance and to empty the dirty water tank.

This allows easy access to all components - high pressure pump, fan, boost pump, coolers and aspirator.



**Surface cleaner with suction device
in working position**



**Additional control panel
in driver's cab**



**Monitor in the driver's cab for transfer
of the cleaning results**

The **RWC 1000 HS** is an ultra-modern vehicle which successfully removes automatically all types of rubber deposits from the touch-down zones of airport runways. The high pressure pump works at a pressure of 1000 to 2500 bar (stepless adjustment) and a flow rate of 29 l/min. While the cleaning job is being carried out, the dirty water and the removed debris is completely drawn off and removed by suction.

The vehicle is able to cover an area of 1500 to 3000 m², depending on the condition of the runway and the thickness of the rubber deposits.

In case of an emergency the cleaning device can be lifted up within 3 seconds and swiveled into the vehicle. This means that the vehicle can leave the runway in less than 10 seconds.

A common problem which arises in the process of manufacturing cement, lime and plaster as well as in the combustion of hazardous waste is the removal of ring-shaped incrustations which build up in rotary furnaces.

These ring-shaped incrustations build up along a length of anything up to 15 m along the furnace axis. Wherever these rings form, the interior diameter of the oven is reduced, leading to an increased velocity of the medium and higher temperatures, both of which can have a negative effect on the required retention period and the thermal impact of the material to be treated.

In extreme cases, the entire cross section of the furnace can be blocked.

Conventional methods of handling the problems are:

- The ring-shaped incrustations are destroyed by special "cannons". Using this method, there is a danger that the "projectile" not only destroys the incrustations but also damages the internal fireclay.
- The furnace has to be shut-down and allowed to cool. The sinter can then be removed by mechanical means. Of course, this entails high production loss and high energy costs (re-heating the furnace).

Our method:

As can be seen on the sketch on page (2), a special high pressure lance is inserted into the front face (combustion side) of the rotary furnace. By pressing and releasing the trigger of the high pressure gun, short bursts of high pressure water are blasted inside the furnace and the sinter incrustations are broken up. The method has a double effect :

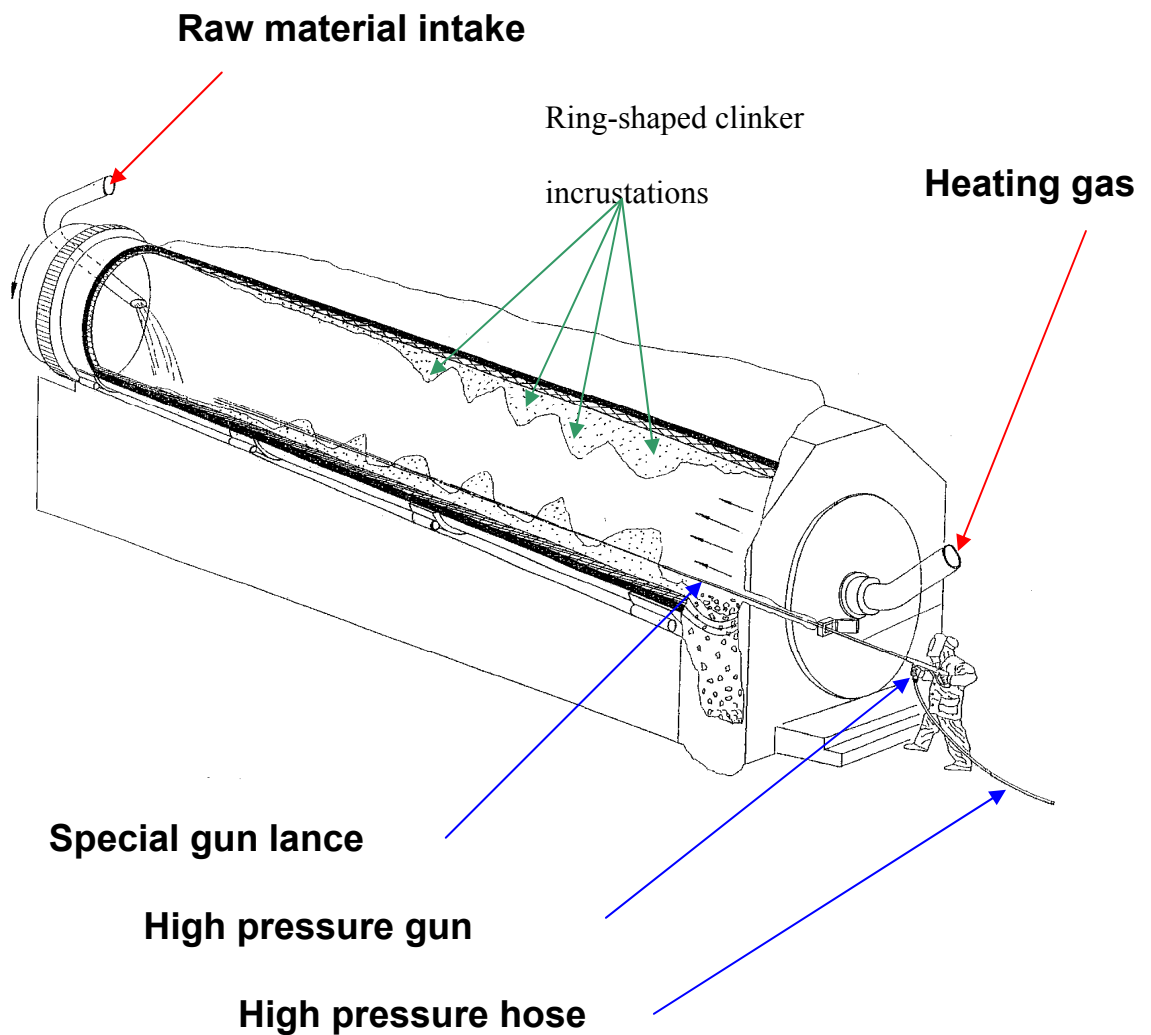
1. The high pressure water jet removes the material mechanically.
2. When the cold water jet hits the hot material, there is a thermal "shock" effect.

Advantages:

- Using this method there is practically no danger of damaging the fireclay (chamotte).
- The burner is actually switched off during the cleaning process but can immediately be reactivated after completion of the job, meaning that the furnace does not cool down during the repair.

The right type of equipment for the job is a high pressure pump with a 90 kW power rating, in combination with round jet nozzles (with special seals).

Pump performance : 600 – 800 bar at 55 - 70 l/min.



Ring-shaped clinker incrustations inside the furnace are cut and blasted by short high pressure bursts of water, without interruption of the production process.

Cleaning a Conveyor Belt In The Fibre Glass Industry

The conveyor belts of a production line in the fibre glass industry become glued up in the course of time and have to be cleaned at given intervals.

One possibility is to use a fixed installation comprising a traversing nozzle bar. However, in most cases the owners of the factories are reluctant to install such a system because of high investment costs and they prefer to assign the work to contractors.

One of our Turkish customers carried out the work using a KAMAT high pressure pump type K 11026 A:

Working pressure: 700 bar
Gun nozzle: 1.5 mm Ø
Jetting angle: 15 or 30°

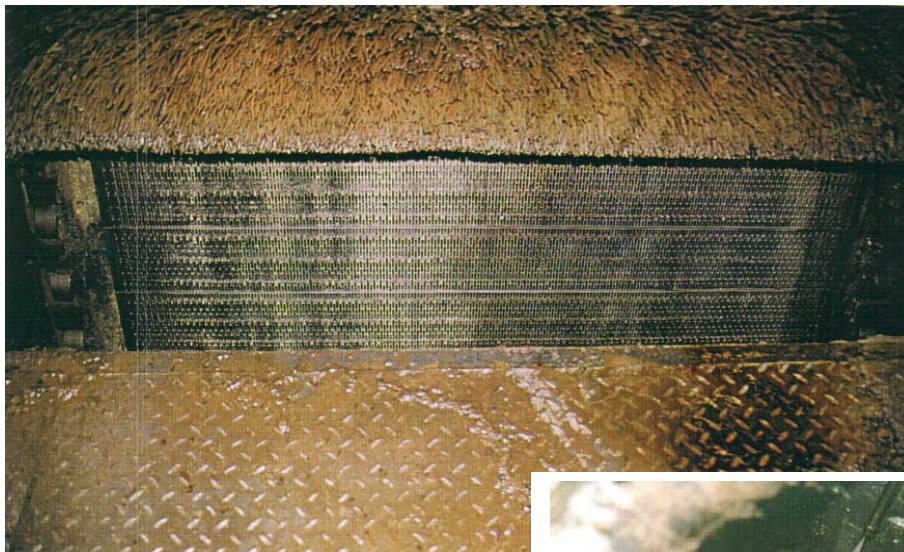


Photo above:

Conveyor belt before cleaning

Photo on the right:

The belt is cleaned with a gun and fan jet nozzle



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Cleaning a Conveyor Belt In The Fibre Glass Industry

Status: 10/2005

KAMAT Su Jeti

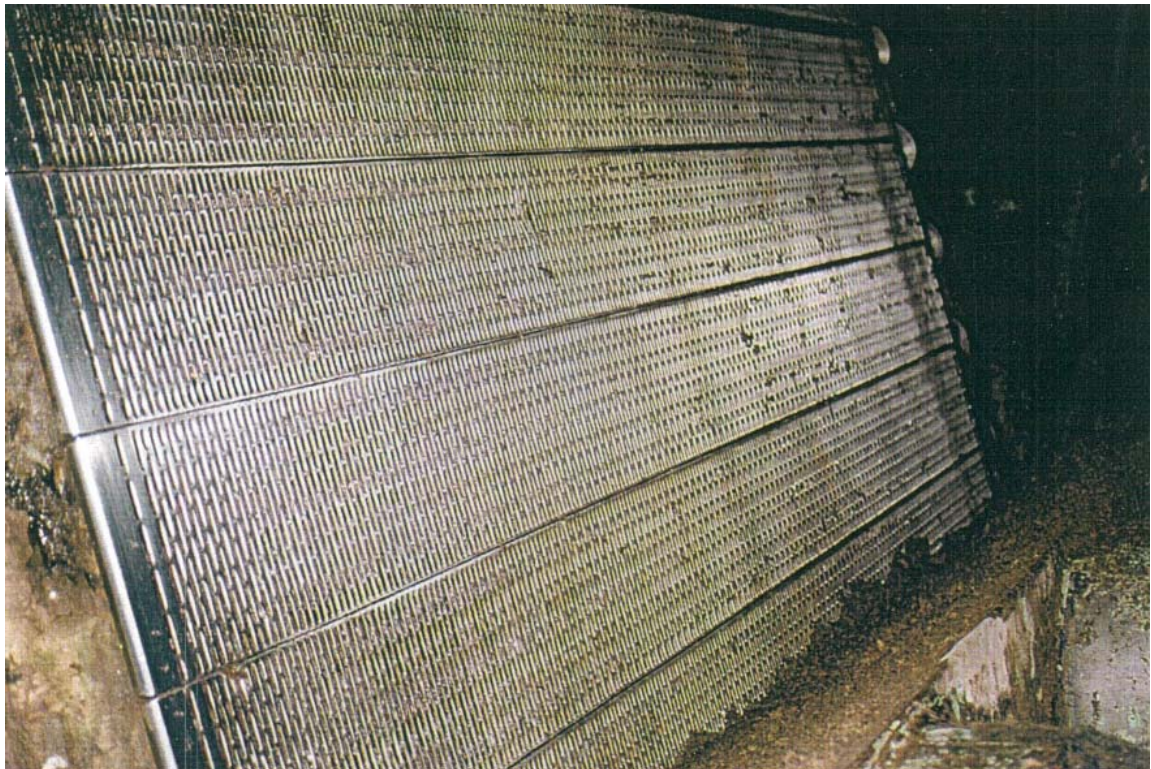


Photo above:

The photo above shows the separate elements of the conveyor belt after cleaning.

The same type of incrustations and deposits which have to be removed from the conveyor belt are also to be found in all production processes in the fibre glass industry. All production piping as well as air ducts also require cleaning.

High Pressure Water Inhibits Emission of Heavy Gases

The companies BAYER and KAMAT have developed a system to reduce the dangers involved when heavy gases are unintentionally emitted. Using water at high pressure, or steam, a protective wall of up to six metres in height is built up. What appears to be a "high-tech" development is, in fact, an ingenious way of applying standard technologies.

In spite of utmost precautions in the planning stages and ultimate construction and operation of plants for potentially explosive and poisonous gases it is impossible to completely eliminate the possibility of their being released inadvertently. In fact, real "lakes" of heavy gases can develop, which can even become ignited from a distance of several dozen metres.

The chemical industry uses a variety of methods to overcome the negative effects of gas blow-outs. The technologies most often applied entail the use of water or steam, depending on availability, with the aim of diluting gas. These are described below:

Water Shield:

Using this mobile solution, water at a pressure of four to five bar rebounds from a shield and forms a water fan. Although this system has the advantages of flexibility and low pressure it also has some serious disadvantages: High water consumption; low rate of dilution due to large-sized droplets; takes five to ten minutes' time to build up.

Monitor:

A fire-brigade nozzle generates a vertical fan-like water jet. Although this solution uses less water per metre than the water shield technique the disadvantages are more or less the same. In addition, the degree of dilution is even lower.

Water and Steam Curtains:

As opposed to the two mobile methods described above, a stationary system is also available. The advantage of such a fixed installation is that water or steam at a low pressure (four to five bar) can build up a protective curtain without any time lag. The disadvantages of this method: Low rate of dilution due to large droplet size. In addition, the single nozzles do not provide a complete protection so that gas is able to pass through the "wall" in an undiluted state.



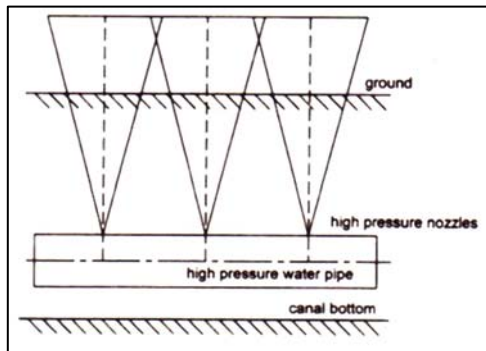
Test Set-up: A provisional construction is used to simulate the function of the Water Safety Wall when sunk into the ground.

The Answer: The KAMAT Water Safety Wall

The best solution to overcome the disadvantages of the mobile and stationary systems described above is the "Water Safety Wall". Experts arrange the fan-jet nozzles at a depth of up to 70 cm in a channel and these nozzles are supplied with water from a high pressure pump, at a pressure of 50 to 200 bar. The advantage of such a system using high pressure water lies in the fact that the Water Safety Wall needs only a fraction of the water volume (less than 30 litres per minute and metre) whilst achieving increased separation and dilution effects.

High Pressure Water Inhibits Emission of Heavy Gases

Status: 10/2006



Test set-up in action:

Build-up of a protection wall up to 6 m in height, at 200 bar working pressure.

Principal sketch:

Shows the arrangement for the set-up of the Water-Safety Wall.



What about the safety aspects?

Due to the fact that the nozzles are not located on the ground but are situated below ground level in a channel, a worker can escape through the Water Safety Wall, even at a water pressure of 200 bar, without being injured and without stumbling over any additional hazard.

Even if steam at five bar pressure is used instead of water there is no danger of personnel being injured (danger of scalding if in direct contact with the pipe) since the danger is eliminated when the steam expands, and this takes place just a few centimetres above the exit point.

Initial trials were carried out in cooperation with the Bayer Company Fire Brigade at the Bayer company premises and these first tests already proved the reliability of the patented invention. Even when there was a side wind of four to five metres per second, the Water Safety Wall set up at a pressure of 150 bar succeeded in reliably stopping the coloured smoke, used to simulate the heavy gases, right in front of the "Wall". In comparison, the conventional methods proved to be totally inadequate in coping with side winds, which further tests clearly showed. Even at considerably lower pressures, the protective effect of our system, where the nozzles are located below the ground, is certainly more efficient.

The controls of the system can be individually designed. Generally it can be said that a fully-automatic solution is not recommendable due to possible occasional false alarms raised by the multitude of sensors. A system where a person in the control centre is responsible for assessing the false alarms before starting the Water Safety Wall is preferable.



KAMAT High Pressure Unit

Diesel-driven high pressure pump units are the best choice for this application as they work independently of the electricity network. KAMAT recommends a trial run on a monthly basis to check that the system is working properly. To be on the safe side, KAMAT installs an additional pump on the unit as a stand-by.

The water quality available from the public mains supply is absolutely acceptable - our pumps work reliably when there are dirt particles of up to 250 micrometers. It may be necessary to consider a filtration system if water is left stagnant in any transmission lines for a longer period.