Cleaning in the Industry - A challenge in many respects

Industrial cleaning is equally important to buildings as it is for production facilities. It includes cleaning and maintenance of floors, but also of ceilings, walls and glass surfaces. The following article focuses on the cleaning of industrial floors and equipment. It will first deal with floors on which production facilities stand or are bolted to and which are subject to traffic and thus are subjected to great stress. They not only have to look neat but must be slip-proof too.

Industrial floorings are usually smooth, seamless, highly compacted and heavy-duty screeds. Screeds are classified as

1. Cement screed: In the industrial sector only so-called hard-aggregate floor screeds made of limestone and clay are produced, which can absorb very high loads because of their strength and strength class. Cement screeds are sensitive to acidic and strong alkalis. Acids in contact with cement screed produce a structure similar to “washed-out concrete”, i.e. the ground becomes rougher, accumulates more dirt and makes cleaning more difficult.

2. Calcium sulphate screed: This term summarises all screeds where the binding agent is made of anhydrous calcium sulphate (anhydrite). Because of the binding agent used they have hygroscopic properties and are sensitive to moisture. Thus, long exposure to water should be avoided, especially in basic cleaning. Therefore, only the one-step method should be used.

3. Magnesium screed is often referred to as magnesite screed and is characterized by a special toughness and the ability to bond mineral aggregates extremely strongly. Magnesite screeds are usually impregnated on the day of completion, which reduces soiling and dust formation and facilitates ongoing maintenance.

4. Mastic asphalt screed is a void-free, dense mixture of fillers such as rock flower, sand, grit or gravel and bitumen. Mastic asphalt is dust free, water resistant, mostly alkali and acid resistant but not resistant to solvents. As high proportions of organic fillers are used in its construction, application of the one-step method is important so as not to weaken it.

Measures to improve the surface finish ...

... must be considered in cleaning as well. These include:

- **Permeable impregnation**, where the impregnating agent, depending on surface quality, penetrates 0.5 to 3 mm into the screed and solidifies it.
- **Chemical compression**, where a compression fluid such as an impregnation fluid is applied. The surface is hardened and thus more resistant to chemical and mechanical stresses.
- **Permeable sealing**, where the film thickness is relatively thin, measures 0.1 - 0.3 mm and is visually similar to a coat of paint.
- **Coatings** with a typical layer thickness of 0.5 to 2 mm. A thickness of
  2 - 6 mm is called flooring. Depending on the material used a relatively structured or almost smooth surface can be obtained.

Having briefly touched the science of flooring, lets talk about cleaning.

Initial cleaning (cleaning at the end of construction)

This requires - depending on the size of the object - removing the coarse dirt with a sweeper vacuum or with a wet/dry vacuum cleaner first. *Stubborn contamination* such as paint, emulsion paint, tars or adhesives are carefully removed with a spatula or a blade.

- Remains of mortar are removed with the green hand pad.

- Emulsion paint: soak for about 5 minutes with undiluted alkaline basic cleaner and then carefully work it with a green hand pad. Then rinse thoroughly. Attention: Do not use on natural shine emulsions or polymer coatings.
- Paint/adhesives: careful apply paint thinner. Apply the solvent to a cloth first and then work the paint or adhesive with it. Never apply a solvent directly onto the flooring.

Basic cleaning in the two-step method

Adherent contaminants such as oil, grease and dirt crusts are removed by wet scrubbing with a powerful scouring and vacuum machine. Provided the surface allows it - work with full contact pressure and green scrubbing brushes or pads using the two-step method. It is recommended to work in sections to avoid moisture penetration of the floor. The first step is to apply the cleaning solution with a scouring and vacuum machine to the surface to be cleaned, which is then scrubbed two to three times - until the dirt has been dissolved

completely. In a second step, the soiled solution is absorbed by the suction bar and the machine's suction equipment.

Finally, the entire surface is reworked with clear water using the one-step method. That is: apply water, scrub and vacuum.

The recommended detergent is an alkaline floor precleaner with a pH value of up to 12 at a concentration of 3-5% (or more, depending on the degree of contamination). Stripping cleaner should not be used as coatings may otherwise come off.

As a principle, use the one-step method when basic cleaning industrial floors without a finish or sensitive to water or moisture as otherwise the floor becomes too wet and damage can ensue.

Maintenance cleaning

Red scrubbing brushes or pads are used when removing *light contamination* with the one-step method. The scouring and vacuum machine works with a low to medium contact pressure. A cleaning agent is used in a dosage of 0.5 to 3% - depending on dirt entry - to remove oil, grease, soot or mineral contamination. Postwiping or rinsing is not required. The floor is immediately accessible. Oil-resistant suction lips must be used to achieve a streak-free result. The suction bar should be set parallel to the floor area.

A particular challenge is the removal of brake and skid marks usually found in turns and before loading ramps and high rise racks. A special, highly alkaline cleaner agent (pH 13) is sprayed undiluted onto the soiled areas with a detergent sprayer or a spray bottle. After a contact time of 5 minutes, the surface is cleaned with a scouring and vacuum machine with green discs or roller pads and then rinsed with clean water (one-step method).

Attention: Do not use this method on polymer and wax coated industrial floors as it would cause them to dissolve.

Roller or Disk: The scrub head makes the difference

Whether a scouring and vacuum machine is equipped with a disc or a roller scrub head depends on the surface structure of the industrial floor.

- It is usually easy and safe to clean and maintain smooth surfaces with a disc brush system.

- If floors are untreated and the surface is rough and “holds” the dirt, roller scrub heads must be used. This applies to floors that were scattered with hard aggregates (sprinkled with quartz sand when the coating was still fresh). In such cases, cleaning with counter-rotating roller brushes will be successful. The counter-rotating motion of the brushes/pads, the high and uniform contact pressure (up to 260 g/cm²) across the entire working width of the scrub head, the high speed (up to 1,100 RPM) and the good floor contact efficiently removes the dirt from those structures. Moreover, pre-sweeping can often be dispensed with as a presweep unit is integrated and takes up large dirt particles. The roller brush speed and thus their wear can also be reduced according to the degree of contamination.

Wood block floors are often used in industrial plants. They consist of single, square-edged blocks of wood (pine, larch, oak) that were pressure impregnated under boiler pressure and result in an end-grained-surface when put together. Wood pavements are very durable and resistant to abrasion.

As an alternative to sweeping with sweeping compound, scouring and vacuum machines with roller scrub head can be used in the one-step method. This method allows grease and oil stains to be removed from such water or moisture-sensitive flooring.

Maintenance cleaning may only require a sweeper vacuum if the type of contamination or the cleaning requirements do not require wet cleaning. A main sweeper roller with soft bristles is beneficial for very fine dirt. Sweeper vacuums are always preferable to a hand brush as secondary contamination caused by raised dust is prevented. Due to their area performance, their use is also more efficient.

Dry-ice blasting as a mechanical cleaning method

The cleaning of machinery and production systems deserves special attention. Primarily dry-ice blasting has gained ground in recent years.

This technique provides for the gentle and efficient removal of fats, oils, binders, adhesives and silicones from various surfaces. Because this procedure is non-corrosive and hardly abrasive, it is also suitable for

cleaning, de-burring and removing paint from delicate surfaces.

Dry-ice blasting is used,

-- when conventional cleaning methods are unsuccessful or if it would cause enormous extra effort to clean conventionally or

- when e.g. legislation would not permit cleaning with water, chemicals, solvents or other particle blasting methods.

These are the main elements of this cleaning method:

1. The blasting medium is dry ice pellets, i.e. CO_2 frozen to minus 79 °C. When the pellets impinge on the surface, the thermal effect causes brittleness and the dirt cracks.

2. This thermal effect is greatly assisted by the acceleration of the pellets by an air compressor to over 150 m/s.

3. Sublimation is another aspect that makes this cleaning process so effective: The pellets penetrate the cracks generated in the dirt. The state of the ice pellets, which was solid just a moment ago, changes into a gaseous state (CO_2) and escapes into the air. Due to the resulting increase in volume by a factor of seven hundred, the dirt is literally blown off from the surface.

The ice pellets are fed into a compressed air jet via a dry ice blasting unit and hit the cleaning object via a spray hose with gun and nozzle. The selection of the appropriate device with the required performance depends on the cleaning task.

Particularly the following factors need to be considered:

- Prerequisites for efficient performance are a **sufficient amount of air and enough air pressure**.

- The quality of the dry ice pellets: Fresh dry ice should always be used to ensure efficient cleaning. Within 24 hours, the density of the pellets reduces by 20%. This deteriorates the cleaning performance significantly and requires much more dry ice. It is recommended to get the pellets shortly before the cleaning process. Prompt delivery can be arranged with the pellet manufacturer. A pelletiser is recommended in case of constant or high demand.

- Safety Equipment: In addition to normal work clothing, the following safety clothing should be worn:

- *Hearing protection*, as the noise level can be over 80 dB(A) during dry ice blasting and depends on air pressure and air volume as well as nozzle type and nozzle size.

- *Gloves* to protect against frostbites from dry ice pellets.

- *Safety goggles* to prevent eye injuries from flying particles.

Advantages of this technology

The fledgling dry-ice blasting technology offers a number of advantages. These include:

-- No humidity: Dry ice sublimes back into the atmosphere as carbon dioxide. There is no waste water and no other spray agent residues. Only the dirt falls to the ground and can be vacuumed or swept away.

-- No wear, no erosion: Dry ice pellets are hardly abrasive (their hardness on the Mohs scale of mineral hardness is similar to that of gypsum). Thus, the machinery, tools and other industrial items to be cleaned are not damaged.

-- No disassembly of the machinery required: Components are cleaned in their assembled state, i.e. parts to be cleaned do not have to be disassembled or reassembled. It results in little machine downtime and drastically reduced production losses.

-- No waste disposal costs for chemicals and spray agent waste: No spray agent is left after cleaning. Thus mechanical parts or seals are not contaminated. There are no waste disposal costs for chemicals or solvents.

-- Reduced labour costs: The workload for cleaning and maintenance of e.g. production lines is dramatically reduced as a lot of pre- and post-processing time is saved.

Industrial vacuum for the disposal of chips and other waste media

Clearly defined cleaning processes are required to ensure the various and partially very time consuming workflows in the production areas. This includes the disposal of waste media and recyclables generated (e.g. metal shavings) directly at the machine. This can be

ensured only by reliable and powerful industrial vacuums. When choosing the right equipment, the following points should be considered:

- AC or three-phase vacuum cleaner, according to the daily period of application. Choose the three-phase variant for more than two hours of daily use or shift operations.
- Select the container size according to the routine dirt-volume.
- Type of dirt to be collected (dry, moist or wet).
- Separation of fluids and solids through a screen insert (usually optional).
- Filter system and dedusting (manual or automatic).
- Harmful dust (e.g. check certification of vacuum cleaner for such as wood dust).
- Explosive area or medium to be vacuumed up (check certification).
- Selection of the right hose material and its length along with accessories tailored to the application.

Industrial cleaning is an unusually complex field. Many aspects must be taken into account if the desired result is to be achieved. This is true for every industrial sector. And similarly true for the cleaning of floors, machinery and equipment.

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