SURFACE PREPARATION

Section	
Name	Surface Preparation.
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Aim	Document recommended surface preparation methods for JAXXON products.
Scope	Covers concrete and metal.
References	

Surface Preparation

This is obviously a very broad question that could fill a text book when answered fully. The aim of this document is to cut through all the confusing theory and provide a useful preparation summary, including why surface preparation is done and the importance of contamination identification.

1 Why prepare the surface?

The simple reason surface preparation exists is to help coatings stick better. It does this in three ways –

1. Removes physical barriers to adhesion – contaminants such as oils, greases, rust etc. can get in the way of the coating as it tries to bond to the surface.

2. Removes threats to adhesion – materials such as salts can be a big problem if left on the surface, causing defects and coating failure.

3. Increases surface area – roughening the surface increases the area available for bonding to take place.

Most of the problems related to surface preparation stem from the first two points above rather than the third. In other words, establishing a nice surface profile on the floor is relatively straightforward, it's cleaning thoroughly first that can cause problems.

2 Concrete

2.1 Identifying Contamination

The extent of identifying contamination only has to go as far as understanding what broad category it falls into – grease/oil, acidic/alkaline etc. The identification techniques below can be used for this purpose.

The first four are quite unsophisticated and usually performed in the field with minimal equipment requirements. The fifth involves the use of more advanced instrumentation and may not always be practical or possible, while the sixth has to do with a different kind of threat.

1. Visual inspection – obviously this is the least scientific approach to contamination identification. Large, visible contamination such as dirt, dust, laitance, mould, rust (for metal) and flaky coatings can be easily detected. Microscopic contamination will not be visible though and that means

having a good look is not enough on its own.

2. Surface tension/wetting – a liquid will only flow across a substrate if it has less surface tension, so adding a droplet of water onto concrete can reveal a lot. In particular, a water droplet that beads suggests there may be grease, oils and/or fats present, which is often the case in commercial kitchens and car parks.

3. Surface soundness tests – if a concrete slab crumbles too easily then it's either a low-quality slab or has deteriorated for some reason. A good way to test both the strength of the concrete and the adhesion of a coating is with tensile adhesion equipment. The equipment used is quite affordable, very portable and doing a test at the beginning of a project will be a good indicator of the results you're likely to get.

   Doing a small test grind to see how easily the top layer is removed is another simple test that can be used to assess the surface.

4. pH tests – concrete is alkali, meaning the pH will generally range from 12 for fresh, down to 8 for older concrete. Therefore, concrete with pH lower than this range (1-5) may have been contaminated with acid at some point. Also, pH tests that show a neutral range (6-7) could have grease/oils present. Kits that use colour-changing litmus paper to measure surface pH are readily available.

5. Analytical methods – scientific analysis is more about understanding the condition of the concrete structure as a whole, however defects within the bulk of the concrete can affect the quality of the surface so it's worthwhile to mention as far as coatings are concerned.

   The preferred way to go about this is through non-destructive methods, such as ultrasonic testing, radiography, magnetic particle testing, eddy current testing and half-cell potential, so that no damage is done to the slab. Problems with cracking, thickness, rebar corrosion, spalling and chemical exposure can all be detected this way.

   The equipment used is very specialised and expensive, and the tests are usually carried out by professional consultants.

6. Moisture issues – this has been left to last because it's a little different to the rest. Hydrostatic pressure isn't a typical contaminant as such, mainly because it comes from below and travels through the slab rather than something spilled on top. Regardless of how it happens, this migration of moisture can pose a real threat to coatings in general and needs to be dealt with properly.

   To determine if there is a moisture issue, simply grinding a patch and seeing what colour it turns can be informative. If it darkens soon after, this can be a warning sign that hydrostatic forces are at play. Another sign to look out for is efflorescence, which basically is a visible mark that results from water coming to the surface and depositing silt-like substances as it dries. For a more scientific approach, moisture meters can also be used to measure the levels at points on a slab. With this equipment, most sources list 5-6% as being the maximum acceptable moisture content of concrete.

   There are two ways of dealing with hydrostatic issues, both of which look to create a barrier to prevent water migration from happening. Water-based epoxies are the most popular and are typically 40-50% solids products applied onto a pre-wet slab. As the epoxy is water-based, it thins down very quickly and penetrates deeply before crosslinking. There are also colloidal silicate solutions that promote the ability to penetrate into the slab, reacting with the residual lime and cement to form a gel barrier instead.

2.2 Types of Concrete

A concrete slab can fall into four basic categories and how you approach surface preparation depends on what type. The four types and key points for each are –

1. New concrete – new concrete surfaces should be allowed to cure for a minimum of 28 days before coating. The biggest danger after this point is the laitance, which is the loosely bound powder that comes out of the slab as it hardens and, if not removed, can prevent the floor coating from getting a strong grip. Grinding or shotblasting are the most popular ways to remove the top layer off a slab and any laitance on it.

2. Contaminated concrete – as discussed before, the biggest threats to industrial flooring are fats/oils/grease on the surface and moisture migration in the slab. For fats etc., the surface must be degreased with a detergent or specialist degreasing product before mechanical preparation takes place. If the order is reversed, there's a risk contamination can be driven further into the slab and become even harder to remove. For heavily contaminated areas, a foaming caustic cleaner with warm water is often needed.

   For hydrostatic issues, the aim is more about blocking the pressure rather than somehow removing it altogether. To do this, a moisture barrier is applied after preparation has been completed and before coating takes place.

3. Damaged concrete – surfaces suffering significant physical damage in the form of gouges, chips and cracks should be repaired before work begins. Epoxy and cementitious products will work under two-pack, solventless epoxies.

   If a damaged slab is also contaminated then, once again, this should be treated first before anything else happens. Whether repairs get done before or after mechanical preparation will depend upon the amount to be done and the levelling requirements.

4. Coated concrete – the first step with an existing coating is to carefully examine the condition. If it's still intact and showing strong adhesion, it can be over-coated providing there are no incompatibility issues. A small adhesion test will confirm one way or the other. Clean the coat first, rinse thoroughly and dry, then sand using power sanding equipment (80-120 grit paper) and a vacuum. A final wipe down with methylated spirits will leave it ready for over-coating.

   If the film isn't sound then you need to treat it like a contaminant and strip it off.

With the condition of the slab understood and the right steps taken to clean and repair it, the next step in surface preparation is to roughen the surface. There are several common ways this is done.

2.3 Preparation Methods

2.3.1 Acid Etching

This method is quick and easy, however environmental and safety concerns have seen it used less in recent times. If acid etching is used, thought will need to be given on how to collect and dispose of the waste.

Treatment with a 10% w:w hydrochloric acid solution will remove most surface contaminants and provide a light profile through a corrosive etch. It must be noted that acid etching will not remove grease and oil, so a degreaser should be used before acid etching if necessary.

The actual process of acid etching involves scrubbing the solution into the surface with a stiff bristled brush or broom until the concrete stops fizzing. Once this point is reached, the surface should be rinsed thoroughly with water (water-blast or high-pressure hose) before collection with a wet vacuum.

The next step is to neutralise the surface with an alkaline solution before giving it a final rinse and vacuum. Options for an effective alkaline solution include mixing 440g/1lb baking soda with 20L/5gal water or one part ammonia with eight parts water. There is also gel-type products promoted as environmentally friendly that can be used on vertical surfaces and neutralised with water.

The result should be a clean, granular feel coupled with a sandy-coloured appearance to the slab. A final check of pH with litmus paper should be done to make sure there’s no acidic residue.

2.3.2 Power Tools

Diamond grinding with a vacuum attachment is most popular and widely used when it comes to concrete because it profiles the surface nicely for the majority of flooring systems. Shotblasting is also prominent, however it tends to open up the surface a little more and is probably more suited to thicker, higher build flooring.

2.3.3 High-pressure Water-blasting

High-pressure water-blasting can be effective on concrete provided the water pressure is high enough to remove all contamination (approximately 35MPa/5,000psi with rotary head). While water-blasting is quick and dust-free, it requires a skilled operator to do it and can be messy, which is rules it out for many indoor flooring applications.

A good summary of the entire concrete surface preparation process can be seen as –

After degreasing and repairing/patching (if required), it is recommended that surface preparation be achieved through diamond grinding (or other suitable methods) to obtain a clean, granular feel to the concrete. Properly prepared surfaces should be structurally sound and free of laitance, efflorescence, glaze and any loose or bond-inhibiting curing compounds. If a moisture barrier is required, it should be applied after preparation has been performed and before any flooring material is applied. Ensure the prepared surface is clean and dust-free again if there is a delay between preparation and application.

3 Metal

Basically, the goals of preparation are the same with metal as they are for concrete – remove barriers to adhesion (surface contamination, loose coatings, rust, mill scale etc.) and establish a clean, sound surface with a mechanical profile. Removing surface contaminants is actually much simpler with metal because it isn't a porous mixture like concrete and a solvent wipe is often all that's needed.

Power tools such as grinders, needle guns and wire brushes can be used in small or awkward spots with irregularities or protrusions, however care must be taken to avoid creating a profile too rough for the intended coating. For larger areas, abrasive-blasting with or without water can be done using most commercial equipment, down to 24MPa/3,500psi units with venturi sand injection. Blasting on steel should be done to class 2.5 (AS 1627.4), with a typical profile of 50-70 micron/2-3 mils in a jagged pattern. A rule of thumb is to create a profile approximately 30% of the intended film thickness if possible, which may not be practical for high-build systems.