Section	
Name	Epoxy Basics.
Last Updated	08/04.
Aim	Provide a basic help reference for inexperienced users of epoxy products.
Scope	Contains a list of epoxy basics, a glossary, as well as common unit conversion.
References	

Epoxy Basics

1 Tips for New Epoxy Users

- Epoxy coatings are used because of their chemical resistance, durability, low porosity and strong bond strength. Other protective coatings are available but not as common, field-applied, brush-on/roll-on/trowel-on coatings.
- Epoxies consist of a "base" and a "cure". The two components are mixed in a certain ratio. A chemical reaction occurs between the two parts generating heat (exothermic reaction) and hardening the mixture into an inert and hard plastic (thermoset plastic).
- Epoxies yellow or "chalk" (lose their gloss) in direct sunlight (UV). For pigmented epoxies, select colours that are dark or contain a lot of yellow (such as green). Clear epoxies especially will yellow and cloud up. Often epoxies are top-coated with urethanes that will retain their colour and attractive gloss.
- After the two epoxy components are combined, there is a working time (pot life) during which the epoxy can be applied or used in the intended manner. The pot life will be anywhere from minutes to hours. At the end of the pot life, the mixture becomes very warm and quickly begins to harden.
- Epoxies, as stated, will harden in a relatively short time, however complete curing (hardening) will generally take several days. Most epoxies will be sufficiently hard within a day, but may require more time before complete usage under maximum exposure, traffic etc.
- A temperature change of 10^{o}C will double or half the pot life and complete cure time of the epoxy. Higher temperatures will tend to lower the viscosity of the epoxy, but also reduce the working time (pot life). Spreading out the mixed epoxy instead of keeping it in a container will extend the pot life as it will prevent the build-up of heat/temperature in the bulk of the product during reaction, and therefore stop the reaction speeding up.
- Epoxies generally become too thick and cure too slowly if used in temperatures below 5^{o}C. Moderate to room temperatures are invariably the preferred range for working. After curing, the epoxies can withstand extreme temperature ranges.
- There are special epoxy formulations that have increased chemical resistance, increased temperature resistance, ability to be applied underwater, increased hardness and impact resistance, increased UV resistance, increase sag resistance (application onto vertical surfaces) etc.
- NMP epoxy formulations are primarily non-hazmat, meaning they are non-flammable, non-corrosive and can be shipped or airfreighted anywhere with no restrictions.
- Modern epoxies do not require an "induction time" - after mixing the two components the mixture must sit for a specific time to allow it to reach a certain level of cure prior to application. Induction times are generally advised in traditional epoxies that tend to blush (see below) on exposure to the atmosphere. NMP epoxies do not require an induction time and can be applied immediately after mixing.
- As they cure some epoxies "blush". Blushing is the formation of a waxy film in the surface of the curing agent due to the moisture in the air. Because nothing sticks to the waxy film (including additional layers of epoxy) it must be washed off. Most epoxies blush to some degree but some premium epoxies do not, in fact some can be applied underwater (NMP range of underwater/moisture tolerant epoxies).

- The best time to re-coat epoxy is within the "re-coat window" of the coating. Because epoxies take days to reach full cure, a second coat applied within this period will establish a chemical bond to first coat rather than forming a simple mechanical bond. Refer to the technical data sheets for information of the product's re-coat schedule.

- Surface preparation is the most crucial aspect of any coating job. It is the single biggest reason behind premature failure of systems. See notes on general surface preparation for more detail on how best to prepare all forms of substrate.

- Proper mixing of the two epoxy components (base and cure) is vital. If possible, use a mixing blade with an electric drill to improve dispersion. Often encountered in poorly mixed batches are the "no-mix" regions on the side and bottom of the tin. This should never be used in the coating as it isn't mixed well enough to cure and will leave "soft" areas in the film. To guarantee this is avoided, transfer the coating to another tin before applying.

- Drops of epoxy on the roller or around the mixing bucket will harden and leave lumps when you coat over them. Don't allow drips to cure.

- Different batches of epoxy will blend together more uniformly if you can keep your epoxy bucket from getting empty and not starting and stopping for each batch. Try for a never-ending coating bucket (analogous to a water glass that is continually replenished).

- After the epoxy has begun to gel, it's too late to remedy anything. Any attempts to fix spots after this point will inevitably result in worsening of the problem.

- Measure out the area expected to be coated with each epoxy kit. This is the best way to ensure correct consumption and correct film thicknesses. Refer to Product Application notes on recommended film thicknesses and their associated coverage.

- With epoxy flooring, the epoxy is generally applied under and above an aggregate (generally quartz or aluminium oxide). The result is a non-slip quartz or aluminium oxide floor. The aggregate/epoxy combination is a lot more durable and resilient than epoxy alone as the aggregate toughens the systems considerably.

- Epoxies and other coatings/paints should not be applied directly to galvanised surfaces. Galvanisation is itself a protective coating; one that works by forming its own protective layer. Epoxies applied to galvanised surfaces will soon peel off. If galvanised surfaces are to be coated, be sure to use an approved primer and other surface activation methods, e.g. whip-blasting to achieve a very fine profile, however not remove any of the zinc.

2 Glossary

Abrasive Blast Cleaning – A method of preparing surfaces before applying the coating. The abrasive, such as grit, is propelled through nozzles by compressed air onto the surface.

Acid Etch – Acid etching refers to the use of acids (and water) to remove any concrete laitance and to open the surface of the concrete to promote adhesion. Acid etching has historically been the preferred method for preparing concrete for thin film coatings, however increased environmental awareness has seen alternative methods used.

Airless Sprayer – An airless sprayer is the most common type of spray equipment used to install floor coatings. Since most floor coatings are heavy bodied, it is necessary to pump the liquid coating through the line to the spray nozzle using hydraulic pressure, hence the term airless spray.

Back Roll – Back rolling is an application technique required when installing heavy bodied coating and topcoats. After the coating has been squeegeed or trowelled onto the floor, it is often necessary to roll out the squeegee or trowel marks to obtain a completely smooth surface. Can also be done after the coating has been roughly rolled into place first to achieve a smoother finish.

Bleeding – Discolouration caused by migration of components in the underlying film.

Broadcasting – Broadcasting is a method of applying aggregate into the floor coating to achieve a non-slip, toughened floor. To broadcast the aggregate, simply spread over a large area by hand. Broadcasting is done in a manner similar to spreading grass seed or feeding chickens. Typically aggregate is supplied to the surface until it has a "dry" or saturated appearance. The epoxy is then allowed to cure, with all the excess aggregate subsequently swept or vacuum removed and used again later if so desired. A

finish coat is then applied to encapsulate the aggregate and form a non-slip surface. The overall texture of the finished coat depends on the topcoat thickness (i.e. thick topcoat gives smooth finish as aggregate isn't allowed to protrude as much).

Cissing – The recession of a wet coating film from a surface leaving areas uncoated. Also called "fish-eyes".

Cobwebbing – The formation of fine filaments of partly dried coating during the spray application of a fast-dry coating.

Control Joints – Control joints are used in addition to, or in place of, expansion joints to control or channel stress cracking of concrete. They are different from expansion joints in that they are indentations in the concrete slab. They work on the principle that these indentations will slightly weaken the concrete, so that any cracking will be along these lines.

Conventional Sprayer – A conventional spray system utilises air passing over a venturi to create the suction to pick up the coating from a reservoir. The coating and the air are then forced through the nozzle. This type of spray system is limited to low viscosity coatings.

Cratering – Residual effect from burst bubbles. Can be seen as larger pinhole type defects.

Crazing – The formation of minute criss-cross cracks on the surface of a coating.

Epoxy Mortar – Epoxy mortar floors are a combination of specially formulated epoxy and aggregate. A well-designed mortar system will easily hand trowel/power trowel to a smooth and even finish. Poorly designed systems will roll in front of the trowel and/or tear behind the trowel creating and undulating surface or a very porous surface respectively.

The most common aggregate used is quartz sand with granite occasionally added for strength and wear properties. The reason epoxy mortar is used in preference to other coatings is to level a rough, badly worn or uneven substrate or in areas of extremely heavy traffic or impact.

Epoxy Overlay – A term for any seamless floor thicker than a coating, usually over 50mils (1280 microns).

Expansion Joints – Expansion joints are the linear openings placed in a concrete slab to permit sections of slab to move independently of one another. This movement allows the sections to withstand normal expansion and contraction caused by temperature variation, moving traffic loads and shrinkage during curing. Expansion joints run through the entire depth of the slab, where as control joints have partial depth.

Grinder – The use of abrasive stones on a rotating floor grinder to remove the surface of concrete or a seamless floor. Floor grinders are classified by their weight and the number of stones on the grinding wheel. A typical term would be a two head grinder, usually having three to four grinding stones.

Hand Trowel – A hand trowel refers to a flat sheet of carbon steel with a wooden handle attached. Standard dimensions are from 6.25cm x 30cm up to 11.25cm x 35cm.

Hydroblasting – The use of high-pressure water (up to 10,000psi), with or without the addition of abrasive grit, to clean and remove corrosion and coatings in preparation for recoating. Also known as water-jetting, the method is gaining acceptance as traditional sand or dry abrasive blasting is being phased out. Water-blasting produces much less expensive grit waste to dispose of (often considered a hazardous material) and less dust (which can damage sensitive, nearby electronics). Both of these often result in the need for large containment or capture systems. While dry blasting is generally faster, the containment and disposal problems usually make hydroblasting the more economical method overall.

Jiffler Mixer – "Jiffler" is a brand name but is now synonymous with a type of coating mixer, which fits into an electric drill. It is distinctive in that it has two impellers, each with three blades and each blade with numerous holes to increase agitation and flow. Jifflers are suited for low viscosity materials for thin-film applications since they are inclined to pull air into heavy bodied coatings when mixing. Entrained air can cause severe bubbling and/or pinholes in the surface of heavy bodied coatings, and therefore should not be used.

Jiffy Mixer – Also an original brand name, but now used to describe a coating mixer. Used with an electric drill, the Jiffy is distinguished by a cylindrical appearance to the mixing cage. It has two vertical mixing blades running parallel to the shaft, anchored to two rings which are attached to the shaft by two additional horizontal blades inside each ring – a complex configuration. The purpose of this design was to limit the air being introduced to the mixing process, while providing good

agitation. It should be used with low speed drills (less than 450rpm), with the mixing cage constantly submerged to prevent air entrainment. Use for heavy bodied mixtures.

Kohl Mixer – Also a brand name, now the terminology for a mortar, batch mixer. The Kohl type mixer uses a stationary mixing blade and a rotating mixing vessel. After mixing for the prescribed period, the drum is pulled from the mixer to transfer the mix to the area of installation. These mixers are geared very low to combat the high viscosity of mortar slurries. The mixer is ideal for small areas, however has limited compatibility with large areas, as the drum can only be approximately 2/3 full to avoid spillage.

Orange Peel – A "pockmarked" appearance of a sprayed film due to its failure to flow out to a level surface.

Pinholes – minute holes in a dry film that form during application and dry of coatings. An extremely damaging defect in terms of creating catastrophic coating failure, as it can allow moisture penetration and therefore corrosion to continue, for example.

Sagging – Excessive flow of a coating on vertical surfaces causing imperfections with thick lower edges in the film.

Streaking/ Floating/Flooding
– The formation of irregular lines or streaks of various colours in a coating film caused by contamination or improper mixing of pigment.

Thinner – A volatile liquid, single or blended, added to a coating to facilitate application by lowering viscosity. Usually done when using conventional sprayers.

Thixotropy – The property of a coating whereby the consistency is reduced on brushing or stirring but increases again on standing. It can be achieved through the addition of certain modifiers, and is used to impart flow control in the fluid.

Tie-Coat – A coat applied to a previous coat to improve the adhesion of subsequent coats.

Whip-blasting – Light abrasive blasting.

Wrinkling – The development of wrinkles on a film during drying.

3 Conversion Factors – Table

To Convert	From	To	Multiply By
Pressure	p.s.i.	kPa	6.895
Volume	U.S. Gallon	Litre	3.785
Area	sq. ft	sq. m	0.0929
Area/Volume	sq. ft/U.S. Gallon	m^2/L	0.0245
Film Thickness	mil (0.001 inch) microns	micrometre micrometre	25.4 1.00
Length	inch feet yard mile	centimetre metre metre kilometre	2.54 0.3048 0.9144 1.6093
Weight	lbs	kg	0.4536
Temperature	Fahrenheit (F)	Celsius (C)	1.8 * (F – 32)