SPECIFICATION GUIDE TO SELECTION, PREPARATION, APPLICATION AND MAINTENANCE OF EPOXY COMPOSITION SURFACING SYSTEMS©

Prepared by:

HAL-KOTE Consulting

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INTRODUCTION

The following information comprises our *Generic Specification Guide To The Selection, Preparation, Application And Maintenance of Epoxy Composition Surfacing Systems* (Sections 1-6) and Actual

Detailed Specification for the various actual systems (Section 7) - From sealing and priming to more complex floor topping/surfacing systems.

At present, there are no standards in our industry. The information in this binder is an ongoing attempt to establish high generic standards in the resinous flooring industry.

We need your help - By understanding the basic facts about epoxy (and other polymer) surfacing systems, you would be helping us help you and/or your clients achieve better, more consistant solutions to special surfacing requirements.

Sections 1 - 6 describe the basic selection factors and basic items that need to be included in specifications. After subsurface preparation, one of the most important factors is the polymer to aggregate ratio. This ratio is not included in the specifications that most manufacturers publish. You should know how much of the polymer is actually in the surfacing system you select. It is the most important factor in determining the performance, physical capabilities and life of the system you select. The polymer to aggregate ratio, along with thickness and several other factors, will improve your specification and add to your ability to control the quality of your projects.

Section 7 describes actual system specifications (paragraphs 3.04.1 to 3.04.14). After selecting the system to be utilized from Section 1 & 2, please refer to Section 7 (3.04.1 to 3.04.14) for generic specifications. These specifications can be utilized and followed by any reputable manufacturer or contract installer. Most of the products on the market today can be incorporated into these floor (or wall) surfacing systems.

Our guide and generic specifications are centered around epoxy (the polymer) systems. Other polymers can be substituted and/or selected for certain applications, especially those involving specific chemical resistance to certain reagents and/or temperature restrictions, extraordinary time restraints, and other very special circumstances.

Epoxy can be utilized most effectively and efficiently in 95% of specialty surfacing problems. Please consult us (or other reputable manufacturer) for advice as to when other polymers (vinyl ester, polyester, polyurethane, siloxirane, methyl methacrylate [MMA], novolac, furon, and/or polymer alloys) could or should be employed.

Please feel free to contact us at any time for additional information, questions, or to arrange for our unique educational seminar.

Thank you for your help.

1.0 SYSTEM SELECTION

1.01 GENERAL

1.01.1

Thousands of possible combinations of polymer resins, curing agents and aggregates are available for use in epoxy flooring systems. Each combination offers a different balance of performance properties, so it is essential that the designer prioritize performance requirements when selecting materials for a particular flooring application. This section contains sample performance profiles for three different types of epoxy coating and topping systems:

A. ***Flexible modified epoxy*** for crack bridging, impact absorption, application over substrates with high deflection or vibration, and for water proof membranes under system in "wet" areas (See note under **Section 1.04.2** - Page 7).

B. ***Semi-rigid Bisphenol A epoxy*** for general purpose floor topping and coating.

C. ***Novolac/Bisphenol F epoxy*** for applications under more severe chemical exposure or higher temperature.

1.01.2

It should be recognized that many factors must be weighed in selecting the particular materials for any specific application, and that many other types of epoxy systems are available to meet specialized needs. But the three basic types above, provide the tools required for achieving most flooring objectives. In cases involving special requirements, the designer should consult with a technical specialist for additional options.

1.02 SELECTION FACTORS

The following is a partial list of factors to consider in designing/selecting a polymer surfacing system:

A. ***Aesthetics***

- Color Granule pattern and size of granule
- Solid color coating in color(s) as selected by Owner's representative
- Clear finish

B. ***Texture/Safety***

Flooring system shall be designed for compliance with OSHA requirements:

- 40-60 mesh fine quartz texture for light anti-slip finish in pedestrian traffic areas
- 28 mesh color granule anti-slip surface where decorative anti-slip finish is required
- 12-20 mesh course finish for pneumatic tire vehicular traffic in wet areas
- Surfaces subject to extreme heavy traffic and abrasion shall be textured with aluminum oxide
- Untextured (dry areas)

C. ***Flexibility***

High flexibility is required in some areas, especially around drains & at coved bases so movements, temperature changes & impacts won't crack or chip the surface. Flexibility is also required to reduce tendency for subsurface cracks to transmit to the surface, causing it to crack. In addition, some structures undergo high vibration or deflection and require a more flexible system to prevent cracking. If the floor develops surface cracks or chips, contamination can be drawn into the matrix or into the subsurface causing further deterioration and an

unsanitary environment.

Rigid systems are required for higher chemical resistance, higher scratch resistance, and to efficiently transmit loads to the rest of the structure in situations where the system has a structural role, such as in repair of columns, structural slabs and piers.

D. ***Chemical Resistance*** is the ability of the floor system to withstand exposure to cleaning compounds, water, or other materials being handled in the particular subject environment. Knowledge of the particular chemicals to which the floor system will potentially be exposed, as well as their concentrations and temperatures is a critical factor in proper floor system design.

E. ***Pitch***, or the need to slope the floor toward drains so that cleaning and rinsing water doesn't stand and allow bacteria to breed, will help determine whether a trowel-grade mortar must be installed as part of the flooring system. Sloping with concrete is less expensive than sloping with epoxy mortar, and is preferred when under new construction; but in restoration work, the time delay for concrete curing (28 days) may not be possible.

F. ***Coved bases*** at wall/floor joints are required in sanitary areas such as food processing plants or laboratory animal rooms so that contamination doesn't stand in corners or at edges of floor.

G. ***Structural***

Maximum expected service load must be calculated and flooring system design capacity should be at least three times this anticipated maximum or as otherwise required by State and local building codes. This includes evaluation of not only the type of traffic (heavy versus light) expected, but also subfloor strength, its structural supports, all static and dynamic loads, as well as the strength of the epoxy composition floor system itself. In renovation or restoration projects, the condition of the substrate and the need for any structural repairs must be considered.

H. ***Heat***

Most standard Bisphenol A epoxies soften at 100-160°F. Surface exposures in excess of this range require the use of harder, higher temperature resistant epoxies, such as epoxy novolacs.

I. ***Thermal Shock***

Rapid temperature change creates stresses which must be considered in a number of applications, including:

- Coolers & freezers

- Floors which will be hot water washed or steam cleaned regularly
- Floors near heat-releasing equipment which operates intermittently, such as batch dryers and ovens
- Exterior applications subject to wide temperature swings

J. ***Sanitation/Permeability***

While surface texture also impacts on ease of cleaning, permeability is the single most important factor affecting both sanitation and rates of deterioration of surfacing systems and concrete subsurfaces. The ratio of the polymer to aggregate/filler is the most important factor in achieving a non-porous, impenetrable surfacing system.

K. ***Environmental Requirements***

Volatile Organic Compounds content (V.O.C.) is regulated in many areas by law, and industrial maintenance coatings must comply with the maximum allowable solvent content where so regulated. Odors pose other potentially serious problems in both new construction and renovation work, as personnel detecting typical solvent an d some polymer odors are likely to protest a perceived hazardous material exposure, even if exposure levels are below the permissible OSHA limits. Odorless or low odor systems should be specified wherever exposure of non-installer personnel is likely.

I. ***Aggregates***

Aggregates/Fillers are initially important for reducing stress caused by the resin/hardener polymerization reaction and the heat released by that reaction. After the reaction, aggregates/fillers contribute to thickness, texture, appearance and abrasion resistance. The following aggregates are commonly used:

- Quartz - High purity silica sand in various particle size ranges
- Colored Quartz - Silica particles with colored coating, usually in 12 or 28 mesh sizes, used for their decorative appearance in combination with clear resin while providing non-slip texture
- Aluminum Oxide/Carborundum - Harder than quartz, used for non-slip texture and high abrasion resistance in heavy abrasive environments
- Glass Beads, Walnut Shells, Metallics - Special purpose aggregates for increasing light reflectance or other special purpose applications

M. ***Thickness/Film Build***

The number and types of coatings used will determine overall system build or thickness. Some common types include:

- Sealer (Primer) - 5-10 mils thickness, used for penetration into concrete to bond subsequent layer, to prevent dusting, or to prevent vapor transmission
- Coating - with optional anti-slip aggregate - 10-50 mils thickness for use as a thin layer of protective surfacing or as a topcoat in a composition system (topping)
- Topping - 60-250 mils thickness - used for the following applications:
    - High traffic with turning
    - High impact resistance
    - Thermal shock resistance
    - Maximum chemical resistance
    - Color pattern & texture variations
    - Maximum durability

N. ***E.S.D.*** - Electro-Static Dissipative surfaces to prevent damage to electronic equipment or products and to minimize static electrical shocks in highly volatile areas.

1.03 DEFINITIONS

Polymer - Resinous synthetic material used as the binder in a protective coating or the matrix of a composition surfacing system, e.g., epoxy, polyurethane, MMA, polyester, etc.

Polymer/Aggregate Ratio - Ratio of the amount of polymer (resin plus curing agent; liquid components) to the amount of aggregate/filler by volume (coarse aggregates, fine fillers and extenders). This is the most useful factor in designing non-porous, impermeable surfacing systems.

NOTE: Another way to specify the polymer/aggregate ratio: No more than 25 lbs. aggregate to no less than one gallon epoxy (liquid components) covering no more than 25 sq. ft. area at 1/8" thick (or 17 sq. ft. area at 3/16" thick).

Polymer Composition Surfacing (Topping) - System consisting of a primer/sealer, possible underlayment, matrix of polymer & aggregate/filler, and a coating (topcoat).

Coverage Rate - Relates amount of a particular component or composition used for a unit area; e.g., sq. ft./gal. It is important to distinguish between coverage rates for liquid components only and the coverage rate for a mixture composed of the coating, aggregates and fillers.

Aggregate/Filler - Organic & inorganic particles and/or fibers added to polymer liquid components to produce a matrix composition.

Liquid Components - Polymer resin and curing agent, which must be mixed together at a prescribed **Mix Ratio**. Ratios of resin to hardener are usually expressed by volume, to facilitate field measurement.

Sealer (Primer) - Generally solvent thinned polymer applied 5-10 mils thick.

Coating - Generally 90-100% solids polymer with some fillers & pigments applied at 10-50 mils thickness.

Topping - Composition surfacing consisting of coating material and additional aggregate/filler, applied at 60-250 mils thickness; i.e., mortar, slurry, broadcast.

Resin Rich® - High polymer/aggregate ratio method of installing composition flooring systems that achieve maximum impermeability and performance characteristics.

1.04 PRODUCTS

A distinction is to be made between individual components or materials used in the flooring system and the composite system assembled to meet a project's aesthetic and functional requirements. The polymer composition special surfacing system is composed of several materials or components, utilized for specific functions within the system.

1.04.1 - GENERAL SPECIFICATION FOR EPOXY QUARTZ COMPOSITION FLOORING SYSTEM

A. ***Epoxy Composition Flooring System*** shall be a ***Resin Rich®*** composite consisting of:

- Low viscosity clear epoxy primer, for maximum bond potential.

- 100% solids epoxy mortar underlayment for cracked, spalled or depressed area patching; for sloping & pitching to drains; for forming cove bases; for sealing around drains.
- 100% solids ***Resin Rich®*** epoxy mortar matrix layer with high polymer to aggregate ratio for thickness & texture.
- Two 100% solids topcoats for final seal & texture.

B. ***Primer*** - Subsurface conditions dictate the selection of an appropriate primer;

- Highly polished, dense concrete shall be primed using a water or solvent thinned 30% solids epoxy with chemical coupling agent additive designed to promote chemical bond to bare concrete.
- Worn, spalled, very porous concrete shall be primed using 100% solids epoxy primer.
- Bonding to oil saturated concrete, after chemically removing as much contamination as possible and mechanically abrading, shall be enhanced by utilizing a special oil tolerant, 100% solids modified epoxy primer.
- Damp subsurfaces shall be primed for adequate adhesion, when time won't permit thorough drying, with waterborne or moisture insensitive epoxy primer. This technique must be limited to applications which will not result in encapsulation of moisture in concrete or the creation of negative side hydrostatic force behind the epoxy composition flooring system.
- Very smooth, non-porous subsurfacing, such as glazed tile, shall be prepared for excellent adhesion by first treating with a ceramic etch compound and then priming with epoxies that contain additional wetting agents and chemical coupling agents.

Approved Products - _____

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C. ***Special Polymer Underlayments*** - The following special purpose polymer underlayments shall be used as applicable;

- 100% solids elastomeric epoxy membrane and underlayment with long term flexibility shall be used to provide waterproofing of small working cracks, and to act as a stress relieving/stress absorbing base coat between substrate and flooring, and to enhance bond potential.

- 100% solids elastomeric epoxy mortar shall be used for patching, joint nosing repair, for forming wall/floor intersecting coved base radius and for filler around drain housings (see accompanying detail sketches). Polymer to aggregate ratio shall be 1:2 by volume.
- Expansion joint treatment: *See accompanying detail sketches.*
- Pitching and sloping shall be performed using semi-rigid, 100% solids epoxy combined with graded, high density quartz aggregate with polymer to aggregate ratio of 1 to 4 by volume. At perimeter of the room where thicker section of mortar is required, the polymer to aggregate can be lowered to 1 to 6 and the matrix can be extended with larger, pea gravel aggregate. Thin section pitching mortar - from 2" to "feather" edge - shall be prepared using higher polymer to aggregate ratios with smaller aggregates. See accompanying detail sketches.

NOTE: If the floor surfacing system requires pitching or sloping, first prime the subsurface, do all patching, crack repair, & drain detail work, then install pitching & sloping mortar, then install 100% solids elastomeric epoxy layer, then proceed with the matrix (body) layer.

Approved Products - _____

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D. ***Matrix Layer*** - Matrix layer shall be composed of semi-rigid, 100% solids, Cycloaliphatic amine cured epoxy and standard grade 28 mesh quartz (or colored quartz for multi-color pattern floors). Polymer/aggregate ratio to be 1:2 by volume, which will produce the required impermeable, non-porous surface.

	Polymer	**Aggregate**
Approved Products -	_____	_____
	_____	_____
	_____	_____
	_____	_____

NOTE: Other aggregates, Resin Rich® slurries, Resin Rich® mortars can be used for special functions - aesthetics, textures, installation time constraints or other job site conditions.

NOTE: For heavy duty, primarily day used areas, a power trowelled epoxy composition slurry with polymer/aggregate blend ratio of 1:4.5 by volume (minimum) can be employed.

For forming vertical surfaces, use semi-rigid, 100% solids Cycloaliphatic amine cured epoxy and aggregate composition with polymer/aggregate ratio of 1 to 4, or polymer/aggregate ratio of 1 to 3 with thixotropic agent such as fumed silica added to the matrix composition.

E. ***Topcoats*** - Use semi-rigid, 100% solids Cycloaliphatic amine cured epoxy without aggregates or fillers. Use clear epoxy for multi-colored quartz patterns and use pigmented epoxy in color selected by Owner for solid-colored floors.

NOTE: For rough textures, apply single topcoat 15 mils thick; for smoother textures, apply second topcoat at 10-15 mils thick.

For areas subjected to constant temperatures greater than 160°F, use 100% solids Novolac epoxy for the topcoat and in the matrix layer.

In areas that may require greater chemical resistance, please consult with flooring system installer and manufacturer for assistance in selection of appropriate material for the specific chemical exposure.

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1.04.2 - PERFORMANCE CRITERIA - COMPOSITE SYSTEM

The typical performance properties listed in Tables 1-4 shall represent the **minimum** standards for each type of component as listed. Materials which fail to meet all of these criteria will not be acceptable for use.

NOTE: For floor areas that will be constantly or frequently wet; such as processing areas, frequently sanitized areas, areas subjected to frequent chemical spillage, & areas subjected to thermal shock - a 30 mil thick membrane or special polymer underlayment consisting of 100% solids elastomeric epoxy (or urethane) should be incorporated into the system to achieve:

- Higher thermal shock resistance
- Increased impact resistance
- Stress crack bridging ability
- Permanent waterproof barrier
- Increased bond potential
- Extra protection around drains

See **Section 1.04.1-C** & accompanying Detailed Sketches.

TABLE 1
TYPICAL 100% SOLIDS, SEMI-RIGID BISPHENOL A EPOXY FLOORING COMPOSITE PERFORMANCE

DESCRIPTION	TEST	COMPOSITE	LIQUID COMPONENTS ONLY
Compressive Strength	ASTM D-695	11,000 psi	8,000 psi
Compressive Modulus			300 Kpsi
Flexural Strength	ASTM D-790	4,400 psi	9,400 psi
Flexural Modulus	ASTM D-790	1,200 Kpsi	
Tensile Strength	ASTM D-638		6,000 psi

	ASTM C-307	2,400 psi	
Tensile Modulus	ASTM D-638 ASTM D-307	 102 Kpsi	190 Kpsi
Tensile Elongation	ASTM D-638		3 - 15%
Linear Shrinkage (77°F)	ATM D-2566	2×10^{-4} in./in.	6×10^{-4} in./in.
Surface Hardness, Shore D	ATM D-2240	85	83
Water Absorption	MIL-D-3134 Para. 4.7.8	.04%	
Mar Resistance	ASTM D-5178		1.15 kg.
Heat Distortion Temperature		120°F to 160°F	
Indentation Characteristics	MIL-D-3134 Para. 4.7.3	0.012 in., no cracking	
Slip Resistance (coefficient of sliding friction)		Dry Leather 0.49 Wet Leather 0.57 Dry Rubber 0.72 Wet Rubber 0.71	
Density	ASTM D-792	127 lb./ft.^{3}	67.5 lb./ft.^{3}
Abrasion Resistance	ASTM C-501 (H-22 wheel)	28.5 wear index	150.5 wear index

TABLE 2
TYPICAL CHARACTERISTICS OF 100% SOLIDS, SEMI-RIGID BISPHENOL A EPOXY - LIQUID COMPONENTS

PROPERTY	METHOD	RESULT
Flammability	ASTM E-84-75 Average 3 runs	Fuel Contribution: Negligible Flame Spread : <25 Smoke Generated: <400
Adhesion (to concrete)	MIL-D-3134 Para. 4.7.14	335 psi, failure in concrete
Pot Life	Techne GT-4	20-25 Minutes at 77°F 60-70 Minutes at 50°F
Thin Film Working Time	Gelation Timer	Approximately 1/2 Hour at 75°F, when mixed

		with aggregate & troweled onto subfloor	
Thin Film Dry Time	BK Drying Recorder	Light Traffic:	8 Hours at 75°F 11 Hours at 50°F
		Normal Traffic:	24 Hours at 75°F 33 Hours at 50°F
Toxicity		Non-Toxic, USDA Accepted	

TABLE 3
TYPICAL PROPERTIES, 100% SOLIDS FLEXIBLE EPOXY

DESCRIPTION	TEST	PERFORMANCE
Tensile Strength	ASTM D-638	1,243 psi
Tensile Elongation	ASTM D-638	109%

TABLE 4
CHEMICAL RESISTANCE GUIDE

	BISPHENOL A EPOXY			NOVOLAC EPOXY		
Chemical Reagent	Occasional Spillage	Frequent Spillage	Continuous Immersion	Occasional Spillage	Frequent Spillage	Continuous Immersion
Deionized Water	✓	✓	✓	✓	✓	✓
Methanol	✓			✓	✓	
Ethanol	✓			✓	✓	
Toluene	✓			✓	✓	✓
Xylene	✓			✓	✓	✓

Butyl Cellosolve	✓	✓		✓	✓	✓
MEK				✓		
10% Lactic Acid	✓	✓	✓	✓	✓	✓
10% Acetic Acid	✓	✓		✓	✓	
70% Sulfuric Acid	✓	✓	✓	✓	✓	✓
98% Sulfuric Acid	✓			✓	✓	✓
50% Sodium Hydroxide	✓	✓	✓	✓	✓	✓
30% Sodium Hypochlorite	✓	✓		✓	✓	✓
Trichloroethane	✓	✓		✓	✓	✓
Hot Water (80°C)	✓			✓	✓	

2.0 CONCRETE SUBSURFACE PREPARATION

2.01 GENERAL

2.01.1
The objective of subsurface preparation is to provide maximum chemical & mechanical bond potential between the cured concrete subsurface & an epoxy overlayment.

2.01.2
The concrete must be made clean, dry, free of any oil, grease or other bond breaking contamination.

2.01.3
New concrete subsurfaces must be cured for at least 28 days, or longer, if required to reach full design strength and low enough moisture content to permit overlayment (<3%).

2.01.4
The prepared concrete subsurface must be treated to provide an etched, porous, “toothy” profile (subsurface profile to be equal to #40-#60 mesh graded sand or sandpaper); yet be structurally & integrally sound.

2.01.5

Special Note About Surface Preparation for Coatings & Toppings - Our experience indicates that the **best methods** of surface preparation are **mechanical** in nature including shotblasting and scarifying. A properly prepared floor is **clean & dry** and has **sufficient texture** to it.

Acid etching & other surface preparation methods are acceptable but may not create as good a bond between the concrete & the floor coating because they generate a smoother surface profile.

Sanding or buffing is considered the **best type** of surface preparation for previously coated floors but is **not effective** for concrete.

2.02 PROCEDURES

2.02.01 - CHEMICAL PREPARATION

A. Thoroughly scrub with heavy duty detergent or cleaners appropriate to emulsify the particular contamination present.

B. Thoroughly rinse with clean water. Repeat this procedure as required to remove contamination. Remove rinse water by forcing to appropriate drains or by power vacuum. Perform all chemical cleaning in strict accordance with federal, state and local regulations, which prohibit introduction of certain chemicals and contaminants into sewers, open bodies of water and into the ground.

C. Spread acid solution by sprinkler can and scrub into concrete with stiff broom or power scrubber. Use 25% aqueous solution of HCI (muriatic acid) cut 4 or 5 to 1 with water. Alternatively, to minimize potential damage to metal equipment adjacent to area being prepared, or to steel reinforcement, use 40% phosphoric acid. **Do not allow etching solution to dry.**

D. Thoroughly rinse with clean water. Repeat this procedure as required to remove contamination & acid residue. Remove rinse water by forcing to appropriate drains or by power vacuum. Allow to dry.

E. For oil, fat & grease saturated concrete (whether saturated by petroleum based or other organic fatty esters) both mechanical & chemical preparation procedures may be required, as well as mechanical keying.

2.02.2 - MECHANICAL PREPARATION

A. ***Shotblasting*** using steel shot & self-contained abrasive blasting equipment, such as Blastrac, is the preferred method of mechanical preparation. Blasting should be performed so as to leave clean, “white” concrete with a uniform stipple finish. This method is generally limited to horizontal surfaces not within 4-6 inches of walls, columns or other fixed obstructions. Additional mechanical methods must be used to supplement preparation for areas not within reach of the shotblasting equipment. Any contaminants which remain after shotblasting may require chemical removal, as described above.

Blast tracking media shall be one of the following as suitable for encountered substrate:

Type	Diameter	Profile	Application
BT#1	.017”	Very Fine	New Concrete
BT#2	.023”	Fine-Medium	Concrete Sealer; Thin Paint Coats
BT#3	.028”	Fine-Medium	Thin Polymer Coats
BT#4	.033”	Medium	Thick Buildup; Thick Polymer Removal
BT#5	.039”	Coarse	Heavy Buildup
BT#6	.046”	Extremely Coarse	Removing 1/8” - 1/4” Surfacing

B. ***Sandblasting***, or use of other pneumatically impelled abrasive media, is another acceptable method of preparing both vertical and horizontal surfaces. Care must be taken to provide a uniformly textured surface. All spent abrasive media and loosened concrete particles must be carefully removed following blasting using vacuums & brushes.

C. ***Scarifying***, using motorized scarification equipment, generally incorporating rotating banks of hardened, star-shaped steel teeth, is particularly useful when high builds of soft materials must be removed. These may include asphalt adhesives or mastics, elastomeric coatings which do

not respond to shotblasting, or unsound thin cementitious overlayments. Scarifying generally leaves a more deeply scarred subsurface, which must then be leveled in the course of overlayment if a uniform finish is to be achieved. Scarifying may result in incomplete removal of penetrated materials, and must then be supplemented by other chemical or mechanical processes.

D. ***Sanding***, or surface abrasion with heavy grit media is often used to reach corners & edges in conjunction with shotblasting. It is also useful when recoating sound epoxy surfaces to improve intercoat bonding when removal down to subsurface is not required or desired.

2.02.3 - MECHANICAL KEYING

This is sometimes used in conjunction with other methods to increase contact area between substrate & topping, thereby increasing adhesion. One method of keying is by providing criss-crossing saw cuts (1/4” deep) to create maximum bond potential. Another method is by chiseling parallel grooves in the subsurface. This procedure should be used when substrate surface strength is marginal or when trying to overcome some residual surface contamination.

2.02.4 - EDGE DETAILING

All leading edges, around drains, transitions to other floor surfaces, joints & cracks should be sawcut & chased to key epoxy overlayment into concrete subsurface.

2.02.5

Do not rely **on the inherent porosity of poorly finished, broom finished, or bull float finished concrete. These conditions will not provide adequate, structurally integrated bond potential.**

3.0 SPECIFICATION FOR INSTALLATION OF EPOXY COMPOSITION FLOORING (OR REFER TO SECTION 6.0)

3.01 GENERAL

This section includes specifications for installing epoxy composition surfacing systems. The intent of this specification is to provide a durable, non-porous, resilient, chemical resistant, safe, easily cleaned surfacing system that is well bonded to the subsurface.

3.02 SCOPE OF WORK

Properly prepare the subsurface to achieve maximum bond potential & install the polymer composition surfacing system as described herein to the areas indicated on the plans.

3.03 RELATED WORK

A. Concrete & concrete repair.
B. Expansion joints.
C. Drains
D. Wall structures & surfacing.
E. Transitions to other flooring materials.

3.04 RELATED DOCUMENTS

Carefully examine all documents for requirements that affect this section of work;

A. Architectural plans.
B. Structural plans.
C. Specifications, finish schedules, drawings, sketches, details & sections.

3.05 INSTALLER QUALIFICATIONS

The epoxy composition flooring installer shall be an experienced specialty flooring contractor meeting the following minimum qualifications:

A. Shall have a minimum of 5 years experience installing the specified or similar flooring systems.
B. Shall be certified or licensed by the flooring system manufacturer.
C. Shall have successfully completed a minimum of 5 projects of comparable scope & size in the past 5 years.

D. Shall employ only qualified tradesmen with experience in epoxy composition flooring installation.
E. Shall be a member of a specialty trade association that promotes education in the areas of composition flooring technology & practices.

3.06 SUBMITTALS

The following shall be submitted by the Contractor along with completed Bidding Documents. Bids **not** containing the following submittals may be rejected without further consideration.

A. Product/Material technical data sheets for all system components. These shall include physical performance data indicating flexural, compressive, tensile & bond strengths, porosity, chemical resistance & elongation percentage in conformance with the requirements of the materials specifications herein.

B. Certification from each of the component manufacturers that said components are compatible with the other components scheduled for use on the project.

C. Color/Color Pattern Charts.

D. Physical samples of the proposed flooring system (minimum 3” x 6”) indicating:
- Color/Color Pattern
- Texture
- Thickness
- Manufacturer, and any applicable manufacturer’s formulation, product & color names & numbers

E. Certification/License from flooring system manufacturer.

F. Maintenance instructions with recommended periodic inspection schedule and/or maintenance agreement.

3.07 JOB CONDITIONS

3.07.1 - GENERAL CONDITIONS

The epoxy flooring Contractor is to visit the site prior to submitting bids for the project & make himself aware of all project conditions, extent of repairs & remediation required. He shall immediately advise Owner of any conditions requiring correction by others before flooring installation can be performed.

3.07.2 - SUBSTRATE CONDITIONS

The following substrate conditions must be satisfied prior to start of epoxy composition flooring installation:

A. New concrete must have been steel trowelled or power trowelled as densely as possible & cured prior to subsurface preparation for a minimum of 28 days, and shall have reached minimum design strength & shall have dried to a maximum of 3% moisture content. Required moisture & compressive strength testing shall be the responsibility of the Owner, and these requirements shall be assumed to have been satisfied unless written notification to the contrary is received by the Contractor, or unless otherwise agreed to in writing by the Contractor.

NOTE: If project schedule will require installation of floor surfacing system sooner, accelerated or high early strength concrete may be utilized. Consult with flooring system manufacturer and installer.

B. Concrete subsurfaces on or below grade must have been adequately waterproofed with proper vapor barrier beneath and at perimeter of slab. Vapor barrier to be minimum of 6 mil thick polyethylene, installed without gaps, open seams, tears or punctures to assure continuous vapor barrier performance.

C. It shall be the Owner's responsibility to advise the flooring contractor of any known moisture seepage or vapor barrier deficiency problems prior to start of work.

D. The Contractor shall exercise due diligence in reporting any observed substrate deficiency or moisture related condition to the Owner as soon as observed to permit most economical mitigation of same. The Contractor shall perform ASTM D4263 moisture test in any case where in his experienced judgment, there is reason to believe a moisture infiltration or encapsulation problem may be indicated.

E. Any corrective action required to overcome such moisture related deficiencies shall be performed prior to proceeding with installation of epoxy composition flooring, and is beyond the scope of the epoxy composition flooring installation contract unless otherwise specifically included therein.

3.07.3 - ENVIRONMENTAL CONDITIONS

A. Do not proceed with application of materials when subsurface temperature is less than 45°F unless using a low temperature curing system, specifically designed for use under the actual conditions encountered.

B. Do not apply materials when surface to receive coating is not clean & dry, or if relative humidity is above 90%, or if precipitation is imminent. Humidity requirements may be waived in situations where the flooring system is demonstrated to be humidity insensitive, both in terms of performance and appearance.

3.07.4 - SAFETY & HEALTH CONDITIONS

All work is to be performed safely, in compliance with OSHA guidelines & regulations. The epoxy flooring Contractor shall perform all work in conformance with owner's guidelines for contractors;

A. During coating application, it is the mutual responsibility of Owner and Contractor that the coating mechanic and others near the workplace are protected from breathing vapors and from coming into skin or eye contact with material.

B. In confined areas, workers shall use NIOSH/MSHA approved self-contained breathing apparatus with a full face shield, operated in a positive pressure mode.

C. In unrestricted, well-ventilated (open/outdoor) areas, workers shall wear an organic vapor canister respirator of a type approved by NIOSH/MSHA, unless manually installing (non-spray application) 100% solids coatings with low vapor pressure.

D. To prevent excessive skin contact with the material, use fabric coveralls and neoprene or other resistant gloves. To prevent eye contact, particularly when mixing or pouring materials, wear a full face mask or OSHA approved protective goggles.

E. Keep products away from heat, sparks and flames. Do not allow use of spark producing equipment during application and until vapors are gone. Post "No Smoking" signs.

F. The solvents from coating materials can carry considerable distances & care should be taken to do the following:

- Post warning signs a minimum of 100 feet from the work area
- Cover all intake vents near the work area
- Minimize or exclude all personnel not directly involved with the coating application
- Have CO_2 or other dry chemical fire extinguishers available at the job site
- Provide adequate ventilation

G. After completion of application, do not allow traffic on coated surfaces until the coating material has cured and the protection course (where applicable) is in place.

3.08 PRE-INSTALLATION INSPECTION/MEETING

A. Work by other trades in areas to receive special polymer composition flooring should be completed to the greatest extent possible prior to installing special flooring.

B. A pre-installation meeting shall be held at the project site with owner's representative, general contractor and installers of any work to be done after completion of special flooring. The

purposes of the meeting shall be to inspect subsurface for suitability to proceed, to coordinate & discuss any potential conflict with other trades, and to determine what additional cleaning, protection & changes in other environmental conditions are required.

C. The Owner/General Contractor will provide a normal room temperature of 70°F, sufficient lighting, permanent or full time temporary electrical service (110v/20a/1ph and 220v/100a/3ph or 440v/60a/3ph), clean water source and containers for removal of project refuse. Contractor will consolidate refuse at predesignated site for removal by the Owner/General Contractor.

D. Special flooring installers to have sole access to area being treated during entire installation and for at least 24 hours after final coat installation. Work area must be free of other trades during, and for a period of 24 hours after floor installation.

E. Owner/General Contractor will be required to provide secure storage for all equipment, and secure indoor storage for all materials needed for this project.

F. All movable equipment and apparatus to be removed by Owner/General Contractor prior to starting project.

G. All floor drains must be made operational by Owner/General Contractor prior to start of flooring installation, to permit proper washdown of base slab.

3.09 PROJECT SCHEDULE

A. The epoxy flooring Contractor shall coordinate all activities to minimize interference with the operations of Owner.

B. Within 14 days of contract execution, the epoxy flooring Contractor shall submit a complete project schedule inclusive of all activities from mobilization to project closeout. Schedule shall include a complete, detailed Construction Phasing Plan which shall include:

- Schedules for each activity with commencement & completion dates.
- All phasing operations including a plan with outlined areas.
- All means of ingress & egress that will not be available during periods of construction - indicate anticipated dates & period of closing.
- Temporary means of egress & ingress.
- Details of temporary enclosures.
- Restrictions & potential problems.

C. The Owner/Contractor will notify the flooring installer if the Construction Phasing Plan is not satisfactory. The installer will revise and resubmit within seven days.

D. The flooring Contractor is to minimize the period that the work area is to be unavailable to Owner by the use of overtime or by scheduling work during periods when the work area is not in use.

3.10 MATERIAL DELIVERY, STORAGE, HANDLING

A. Material must be delivered to job site & inspected by Contractor prior to start of job. Material shall be delivered in original sealed containers, clearly marked with supplier's name, brand name and type of material.

B. Material must be stored in a dry, enclosed area protected from the elements. Storage area is to be kept between 65°F - 85°F and may not be in direct sunlight. Containers must be kept away from heat sources to prevent high-temperature induced pressure buildup and possible container rupture.

3.11 APPLICATION

3.11.1 - CONDITIONS & SURFACE PREPARATION

A. Prepare all surfaces for flooring installation in accordance with the requirements of the project documents & drawings and the surface preparation guidelines as detailed in **Section 2.0**.

B. Substrates must be above 45°F, dry and free from hydrostatic pressure, moisture vapor transmission, paint, curing compounds, oil, dirt or other materials which could hinder floor system adhesion.

C. New concrete should be cured 30 days minimum and must be acid etched or mechanically abraded prior to coating. Old concrete should be inspected for structural soundness and mechanically prepared prior to coating.

D. Wood surfaces must be clean, porous & free from wax, varnish or other materials.

E. Metals must be clean, rough & free of oil, coatings, rust or scale. Abrasive blasting or power tool cleaning is required prior to coating.

3.11.2 - APPLICATION

Refer to attached drawings & sketches for more defined & complete information on materials to be used & installation details for the project. The following are general application guidelines - The exact procedure may vary depending on job site conditions, time restraints, and functional/aesthetic requirements; however, coverage rates, finished thickness (&/or Day Film Thickness), & polymer to aggregate ratios must be defined and executed to this specification.

A. ***Priming*** - Apply 50-100% solids epoxy, liquid components only, as recommended by manufacturer. Apply 5-25 mils thick as required by subsurface condition and as recommended by manufacturer. Carefully measure proper proportions of resin & hardener, then thoroughly mix for at least 3 minutes using low speed drill/mixer (250 rpm). Avoid whipping excess air into the mixture. Apply with roller, squeegee, notched squeegee, special trowel, or other appropriate spreading tool to ensure required thickness &/or coverage rate. Apply with pressure to force priming material into subsurface pores to achieve maximum mechanical & chemical bond. Observe manufacturer's recommended recoating "window" (cure time) for subsequent coating or topping matrix - Typical time window is 8-24 hours after primer application. For 100% solids epoxy primers, which are to be topped with an epoxy

composition system, the next layer can be immediately applied over the wet (uncured) primer. The next primer can be seeded with fine selected aggregate to achieve additional mechanical bond if recommended "window" is exceeded due to job site conditions.

B. ***Patching*** - Patch & fill all low, spalled, worn, deteriorated areas & stress cracks (concrete) with polymer mortar. Mix resin & hardener, after carefully measuring proper proportions, then add selected aggregates to blend into high polymer to aggregate ratio (1 to 3 up to 1 to 4.5 by volume) uniform consistency - slurry mortar. Apply by trowel or screed at thickness required to fill, patch, or level subsurface area. Apply pressure with steel trowel or power trowel to ensure maximum uniform density.

Stress cracks can be filled with neat 100% solids elastomeric epoxy (or urethane) material, prior to patching with slurry/mortar mixture. All patch, fill, &/or leveling materials to be applied at required thickness to achieve specified level.

NOTE: **All** expansion joints **must** be honored. *See accompanying Detailed Sketches.* Expansion joints must be treated with appropriate elastomeric material as recommended by manufacturer. For monolithic resurfacing systems - first, mark & record expansion joint locations, then apply system in strict accordance with manufacturer's recommended installation specification; then, after cure, saw cut & chase all expansion joint locations & treat with appropriate material.

C. ***Pitching*** (If required) - Use epoxy or other polymer & aggregate blend as recommended by manufacturer - maintain contours as specified in project drawings & specifications. Surfaces to be pitched toward drains must be pitched a minimum of 1/8" per linear foot. For water to freely flow to drains, minimum pitch should be 1/4" per linear foot. Polymer to aggregate ratio to be minimum 1 to 6 ratio (by volume) at 2" or thicker. Polymer to aggregate ratio to be minimum 1 to 4.5 ratio (by volume) at less than 2" thick. Polymer/aggregate mortar to be placed with trowel or screed, then steel trowelled with pressure (or power trowelled) to ensure uniform density. Subsequent topping matrix layers should be applied within manufacturer time frame to ensure both mechanical & chemical bonding.

NOTE: Pay particular attention to details indicated in accompanying Detailed Sketches. All transitional areas and areas adjacent to drains & trenches must be saw cut, chased, & keyed at least 1/4" deep & 1 1/2" wide.

D. ***Special Polymer Underlayments*** - Use neat or high polymer to aggregate ratio (by volume) 100% solids elastomeric epoxy material with long term flexibility to achieve stress relieving &/or waterproof membrane. Apply to properly prepared subsurface or over appropriate primer within manufacturer's recommended time frame (window). Carefully mix following manufacturer's instructions & apply by roller, notched squeegee, or notched trowel to required thickness - minimum 20 mils thick. Note that the thickness of this layer is included in the overall thickness of the system and is part of the topping matrix.

E. ***Topping Matrix*** - Mix resin & hardener at manufacturer's specified ratio for three minutes (if material contains pigments, ensure that pigmentation is uniformly blended). Add aggregates (or aggregate blend) and mix until uniform consistency is achieved. Spread materials to specified thickness, using trowels, notched trowels, screed, notched squeegee, gage rake or other spreading tools. Observe minimum polymer to aggregate ratios as specified under **Section 1.0** - minimum thickness 3/16" (187.5 mils). The topping matrix layer can be applied by the following methods:

1. **Broadcast Method** - Apply neat 100% solids epoxy resin/hardener mixture by notched trowel (or notched squeegee) at a rate of 80 sq. ft. per gallon (20 mils thick), allow to self level, then carefully broadcast selected aggregates (or blend of aggregates/color/colors) into uncured resin/hardener mixture at a rate of 1/2 lb. per square foot until saturated. After the above layer has cured, sweep away excess aggregate.

Repeat the above process two more times until 3/16" thickness is achieved. This will result in a polymer to aggregate ratio of 1:2 (by volume).

-or-

2. **Slurry Broadcast Method** - Apply slurry mixture consisting of 100% solids epoxy resin/hardener & selected aggregates - polymer to aggregate ratio of 1:1 (by volume) - by trowel at a rate of 25 sq. ft. per gallon (60 mils thick), allow to self level, then carefully broadcast selected aggregate (or blend of aggregates/color/colors) into uncured resin/hardener mixture until saturated. After the above layer has cured, sweep away excess aggregate.

   Repeat the above process again to reach 3/16" thickness. This will result in a polymer to aggregate ratio of 1:2 (by volume).

-or-

3. **Slurry Mortar/Power Trowelled Method** - Apply 1/4" thick slurry mortar consisting of high solids epoxy resin/hardener & selected blended aggregate with trowel or gage rake. The mixture must have a uniform wet consistency with a polymer to aggregate ratio of 1:4.5 (by volume). Within 5-10 minutes of initial application, power trowel area covered. Power trowel with manufacturer approved equipment to produce uniform compaction of the material & achieve maximum density.

F. ***Anti-Slip Texturing*** - For greater skid, impact & wear resistance, broadcast selected aggregate (quartz, silica, aluminum oxide, etc.) into uncured topping matrix & allow to set.

G. ***Top Coat(s)*** - To lock in surface aggregate (with or without anti-slip texturing) apply neat polymer resin/hardener mixture with squeegee, then roller to produce uniform consistency, after any excess aggregate has been removed by sweeping &/or vacuuming. For rough texture, apply single top coat at 100 sq. ft. per gallon (15 mils thick). For smoother textures, greater gloss & color retention, greater chemical resistance, & easier cleaning, apply additional top coat(s) (5-10 mils per coat) to achieve desired (specified) texture. Refer to *Materials Specification* in **Section 1.0**.

3.11.3 - APPLICATION CAUTIONS

A. Environmental conditions affect handling characteristics of epoxy resin systems. Cool temperatures slow reaction and increase epoxy viscosity, making application more difficult. Store materials for 24 hours before use at 70°F - 75°F, if possible. Warm temperatures accelerate cure & reduce pot life. Blend only as much material as will be used prior to gelling time at actual particular working temperatures.

B. Observe all warnings, procedures & guidelines contained in Material Safety Data Sheets for the products. Copies of MSDS's for all system components should be kept in the immediate work area at all times.

3.12 QUALITY CONTROL & ASSURANCE

A. All installation work to be performed in such a manner as to permit execution & validation of a Single Source Warranty covering all defects in materials and workmanship for a period of at least one year following substantial completion of installation.

B. Contractor shall provide an experienced project supervisor and trained workmen, so that all work may be performed in an efficient, effective and workmanlike manner in conformance with project design specifications and in fulfillment of project objectives.

C. Provide copy of installation instructions to Owner's Project Manager so installation can be monitored and verified.

D. A certified technical representative of the manufacturer is to be available on the job site before and during key portions of the subsurface preparation and installation, for consultation & inspection, to assure all procedures are executed properly.

4.0 MAINTENANCE OF EPOXY COMPOSITION FLOORING

4.01 GENERAL

4.01.1
Since epoxy composition flooring is stronger, tougher, more resilient and chemical resistant than conventional flooring systems, it will stand up to traffic for longer periods than the concrete or wooden subsurface.

4.01.2
The cleaner the floor is kept, the longer the floor will last. If not removed regularly, fine particles of dust, dirt & debris act as abrasives with traffic. For the pharmaceutical, cosmetic and food industries, it is particularly important to keep clean, sanitary surfaces. Proper cleaning techniques are essential.

4.01.3
Proper cleaning is a function of utilizing both a cleaning solution that will dissolve or emulsify the type of soil or contamination present and thorough application & rinsing techniques. For general purposes, a floor subjected to normal pedestrian traffic can be cleaned using any high quality detergent & water solution. It is important that clean water is then used to rinse.

4.01.4
Epoxy composition flooring will not be affected by most special purpose cleaning compounds, when used properly and rinsed thoroughly. Always perform a small spot cleaning test in an inconspicuous area prior to general use of any cleaning products, however, as some cleaners contain chemicals which may be aggressive to some particular epoxy products.

4.01.5
The best cleaning technique is achieved by utilizing soft bristle scrub brushes (either hand types or mechanical types) to positively attack the soil with the appropriate cleaning solution. Selection of the correct cleaning compound is important, but the cleaning technique is an equally important factor in effective cleaning. After the surface has been subjected to the cleaning solution & properly scrubbed, particular attention must be given to removing the resultant emulsion of cleaning solution and soil. This is best achieved by rinsing with clean water and vacuuming, or using a squeegee to remove to floor drains. A second rinsing with clean water is recommended to minimize the possibility of leaving any residue. If rinsing is not complete, a film may develop.

4.01.6
An important feature of epoxy composition flooring is that it is non-porous. This makes cleaning relatively easy to achieve, because contamination cannot penetrate into the surface; it stays on top. This enables the surface to be positively cleaned, but it does not mean that proper cleaning techniques can be compromised.

4.02 TYPICAL CLEANING METHODS

4.02.1 - HAND OR MECHANICAL SCRUBBING UNIT

A. Broom sweep area for debris and heavy buildup.

B. Utilize proper cleaning agent - detergent (liquid or powder), sanitizing agent, deodorizing agent degreaser, fatty ester emulsifier, etc., or combination of agents.

C. Spread cleaning agent (or combination of agents) and allow it to react on surface.

D. Agitate with mechanical scrubbing device or by hand.

E. Flood with clean water and agitate.

F. Pick up solution with wet vacuum or squeegee to floor drains. Observe all federal, state and local regulations which prohibit introducing certain chemical cleaners, solvents & wastes into municipal sewer systems, open bodies of water or into the soil.

G. Rinse again and remove.

4.02.2 - HIGH PRESSURE WATER OR STEAM EQUIPMENT

A.- C. Follow same procedures as in **4.02.1** above.

D. Utilizing high pressure water or steam equipment, work over entire surface. This phase will agitate & loosen tough-to-remove contamination.

E. Flood with clean water or switch to clean water mode on equipment and work over surface again.

F. Pick up solution with wet vacuum or squeegee to floor drains. Observe all federal, state and local regulations which prohibit introducing certain chemical cleaners, solvents & wastes into municipal sewer systems, open bodies of water or into the soil.

G. Rinse again and remove.

4.02.3 - MOPPING

A. Mopping may be employed if sufficient amounts of clean rinsing water are used. Unless meticulous attention is paid to clean water rinsing, conventional mopping will not be effective.

B. Broom sweep area for debris and heavy buildup.

C. Utilize proper cleaning agent - detergent (liquid or powder), sanitizing agent, deodorizing agent, degreaser, fatty ester emulsifier, etc., or combination of agents.

D. Spread cleaning agent with mop.

E. Agitate with mop by wiping & swirling, applying pressure to excessive buildups.

F. Flood with clean water - spread with mop.

G. Use mop to soak up solution and wring out into empty bucket. Keep clean rinsing water in separate bucket and keep clean rinsing water clean, replacing with fresh water when required. Continue process until floor is totally rinsed.

H. Rinse again with more clean water.

4.03 ADDITIONAL COMMENTS & SUGGESTIONS

4.03.1
It is suggested to employ an acrylic type coating or finish at six (6) month intervals (in lieu of waxing periodically). Epoxy quartz composition flooring does not require this, but it will even further extend service life of the floor.

4.03.2
Depending on degree of traffic, a new finish coating may be required every three to five years.

4.03.3
It is important to promptly repair any damages or irregularities that may develop, such as cracking due to building movement at expansion joints, gouges or indentations that may occur from extreme abuse or impact, or blisters or swelling that may occur as a result of certain solvent or other chemical attacks. These damages or irregularities can occur in industrial situations. They must be addressed promptly in order to properly and economically mitigate and correct them.

4.03.4
Recommended cleaning agents can be furnished upon request and determination of type of soil or contamination.

4.03.5
For containment & secondary containment applications, it is important to inspect the integrity of the system periodically for cracks, gouges, or other damage that may have been imposed upon the surface.

COVERAGE FOR COATINGS, TOPPINGS OR MEMBRANES

THICKNESS OF COATING APPLIED (1000 MILS = 1")			COVERAGE PER U. S. GALLON 100% SOLIDS SYSTEM
INCHES		**MILS**	**SQ. FT.**
1/4	=	250.000	6.4
3/16	=	187.500	8.5
1/8	=	125.000	12.8
		100.000	16.0
1/16	=	62.500	25.5
		50.000	32.0
1/32	=	31.250	51.0
		20.000	80.0
1/64	=	15.625	102.0
		10.000	160.0
		5.000	320.0
		1.000	1600.0

IF COATING CONTAINS A SOLVENT WHICH WILL EVAPORATE,

THICKNESS OF COATING WILL BE REDUCED

BY SAME PERCENTAGE AS SOLVENT LOSS.