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Design & Use of Epoxy Resin Laboratory Work Surfaces

An American Institute of Architects (AIA) Continuing Education program

Credit for this course is 1 AIA/CES Learning Unit

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Course Title:
Design and Use of Epoxy Resin Laboratory Work Surfaces

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Design & Use of Epoxy Resin Laboratory Work Surfaces

- Lab Environments
- Material Options
- Design Options
- Design Standards
- Installation Criteria

What are the Course Learning Objectives?

Learning Objectives

Upon Completion of this course you will have a better understanding of the following:

1. Characteristics of environments where industrial grade work surfaces are typically specified.
2. Recognize the characteristics and attributes of Epoxy Resin and be able to compare and contrast it with other materials such as: Solid Surface, Stainless Steel, Chemically Resistant Composite Resin, Chemically Resistant High Pressure Laminate, and Resin Impregnated Natural Stone.

Learning Objectives

3. How all the materials compare in performance. Look in depth at: Physical Durability, Chemical Resistance, Heat Resistance, Moisture Resistance, Flammability.

4. Learn and be able to apply specific design criteria and/or standard guidelines for designing with Epoxy Resin such as: material thickness, color, edge finish, backsplash type, sink type and accessories.

5. Gain an understanding of material handling, storage and basic installation requirements for Epoxy Resin.

Laboratory Environments

- **Education**
- **Academic**

  Research
- **Government**
- **Corporate**

1. Which environments may require industrial strength work tops?

Education

Laboratories in educational settings are designed to facilitate teaching/learning in any of the science disciplines such as: chemistry, biology, medicine, bio-medicine, physics, bio-chemistry, geology, paleontology, etc.

Academic Research and Development

The laboratories found in these settings are designed for the advance of scientific discovery through research in such disciplines as: bio-science, bio-engineering, bio-medicine, chemistry, bio-chemistry, etc. They are primarily associated with major universities or other institutions of higher learning.

Government

Governmental laboratories can encompass a broad spectrum such as: chemistry labs, diagnostic testing and analysis labs, medical labs, forensic labs, research labs, etc. These labs can be found in all levels of government, serving functions such as: environmental protection, water treatment, disease control and prevention, health administration, etc.

Corporate

Just as in the governmental sector, corporate laboratories can also serve a broad spectrum of applications. These labs, however, are distinguished from all others by being in the private sector. End uses of these labs may be: petrochemical, medical, food processing, bio-engineering, pharmacological, etc.

Material Options

2. What material options are commonly considered for use as a laboratory work surface?

- **Epoxy Resin**
- **Solid Surface**
- **Stainless Steel**
- **Composite Resin**
- **High Pressure Laminate**
- **Resin Impregnated Stone**

Epoxy Resin

Epoxy resin tops and sinks are produced from a composite of epoxy resin, silica, inert fillers, and organic hardeners. Material is cast and cured in ovens at elevated temperatures. Epoxy resin is homogeneous throughout and non-absorbent.

Solid Surface

Solid Surface work tops are produced by combining unsaturated polyester resin with a combination of fillers, pigments and catalysts/or polyester resin, free from internal strengthening fibers and pigment. The resulting product is homogenous throughout, renewable, and non-porous. An invisible seam is the most well known feature of Solid Surface.

Stainless Steel

Stainless steel tops and sinks are usually fabricated from 14 to 18 gauge type 304 or 316 series stainless steel. Surfaces are integrally formed with all seams fully welded with stainless steel fillers, ground smooth, and blended to a #4 mill finish (solder or compounded fillers not acceptable).

High Pressure Laminate

High pressure plastic laminate tops are made from melamine-impregnated surface papers pressed over phenolic-impregnated craft paper layers. The back is sanded to facilitate bonding to the top of suitable substrates. Laminate tops are available in a variety of colors.

Composite Resin

Composite resin (or phenolic resin) work surfaces are very similar to high pressure plastic laminates with the exception that craft paper backers are saturated with phenolic resin and built up to a finished thickness. Surface resins may vary according to product, intended application, or manufacturer.

Resin Impregnated Stone

Impregnated natural sand stone tops are produced from stone, free of veins or seams and impregnated with a resin. Additional surface coatings are baked at a high temperature to polymerize the resins and harden the stone.

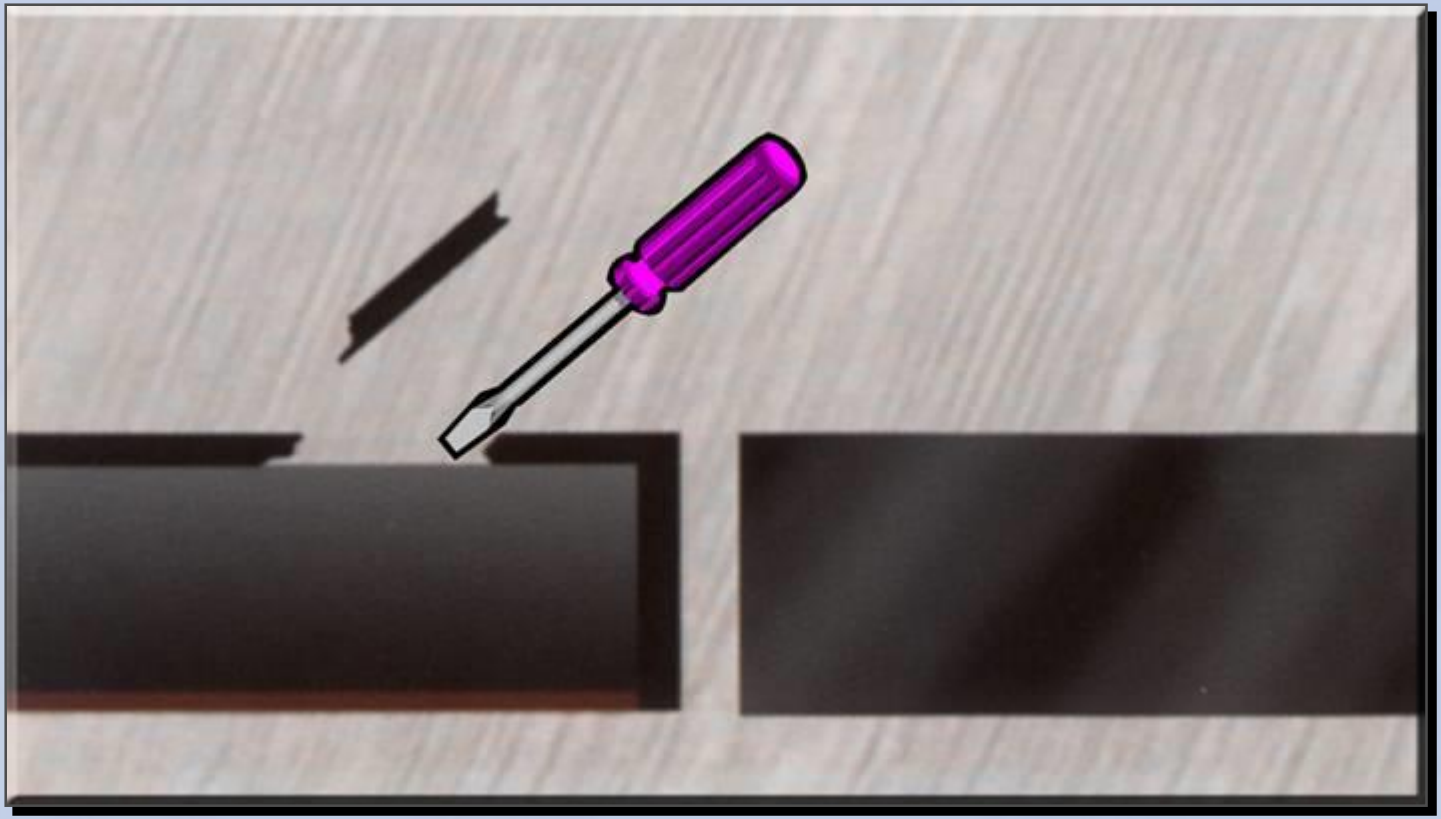
Material Performance

3. How do the Materials Compare in Performance?

An in-Depth look at:

- **Physical Durability**
- **Chemical Resistance**
- **Heat Resistance**
- **Moisture Resistance**
- **Flammability**
- **Useful Life**

Physical Durability



Physical Durability

- **This refers to the ability of a material to withstand not only the wear of normal use, but also withstand attempts to misuse or deface countertops using sharp objects such as: ink pens, pencils, scissors, screw drivers, knives, etc.**

- **The durability of a work surface is often related to how *monolithic* a material is. A monolithic countertop is one in which consists of the same material throughout its entire thickness.**

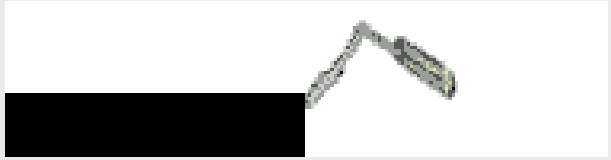
- **Materials which are non-monolithic (i.e. those which are manufactured by a lamination process) may exhibit a tendency to be easily pried apart and may de-laminate over time if abused or subjected to moisture.**

Comparative Monolithic Properties

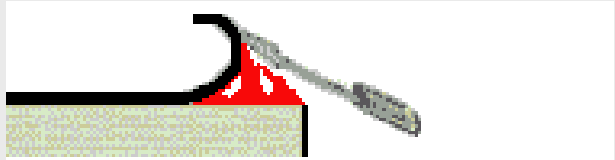
Material	Monolithic
Epoxy Resin	Yes
Solid Surface	Yes
Stainless Steel	Yes
High Pressure Laminate	No
Composite Resin	No
Resin Impregnated Stone	No

A monolithic countertop is one in which consists of the same material throughout its entire thickness.

Monolithic Surface

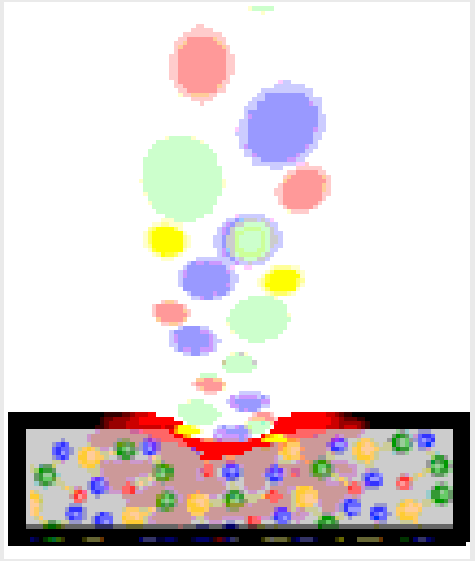


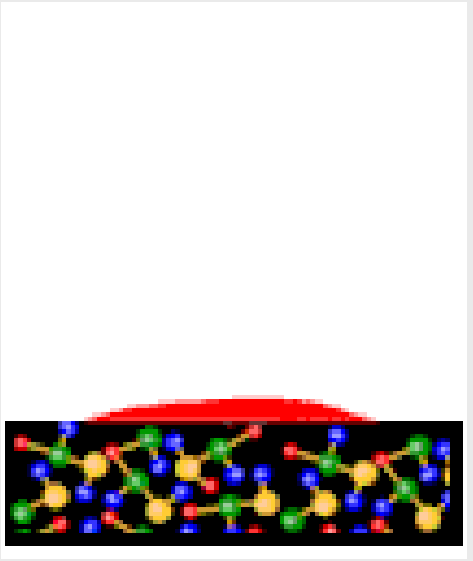
Laminated Surface



Material Performance

Chemical Resistance





Chemical Resistance

- The chemical resistance of a material is measured by performing tests which determine how well it withstands sustained exposure to a wide array of acids, alkalies (or bases) and solvents.

- After exposure for a ***24 hour period,*** the countertop material is rated on a scale from 1 to 5 (1 – being equivalent to “No Effect” or no detectable change in the material surface and 5 – being equivalent to “Failure” or pitting/erosion of the work surface material; obvious and significant deterioration).

Comparative Chemical Resistance

Material	Acid	Base	Solvent
Epoxy Resin	Yes	Yes	Yes
Solid Surface	No	No	Yes
Stainless Steel	No	Yes	Yes
High Pressure Laminate	Yes	No	Yes
Composite Resin	Yes	Yes	Yes
Resin Impregnated Stone	Yes	Yes	Yes

Material Performance

Heat Resistance

The heat resistance of a countertop material refers to its ability to perform after withstanding high temperatures. Two different tests are used to assess the material's susceptibility to high heat conditions:

a. First, a porcelain crucible, heated to a dull red color is placed on the specimen and allowed to cool to ambient temperature. If there are no resulting cracks or blisters, the outcome is considered good. Some slight dulling or color change in the material is acceptable and still considered to be a good result.

Heat Resistance

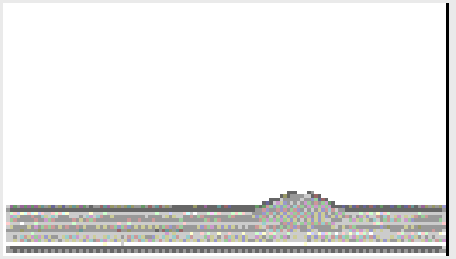
b. Secondly, in a procedure commonly called the Bunsen Burner Test, a 3/8” Bunsen burner is adjusted to a quite flame with a 1-1/2” inner blue cone and then overturned on the test material, exposing it to the flame for 5 minutes. If there are no resulting blisters or cracks on the work surface, the outcome is considered good.

Comparative Heat Resistance

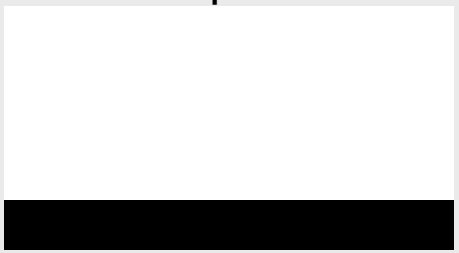
Material Performance

Material	Hot Crucible	Bunsen Burner
Epoxy Resin	Good	Good
Solid Surface	Bad	Bad
Stainless Steel	Good	Good
High Pressure Laminate	Bad	Bad
Composite Resin	Bad	Bad
Resin Impregnated Stone	Good	Good

Heat Blister



Not Compromised

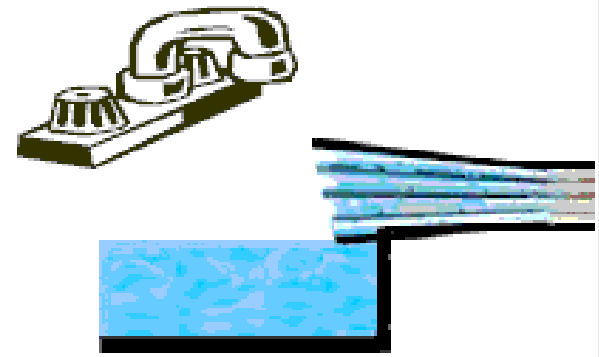


Moisture Resistance

A countertop's resistance to the effects of moisture is usually related to its water absorption as measured under the controlled testing conditions of ASTM D570. *Monolithic* materials tend to have greater resistance to the effects of prolonged exposure to liquids. The three most serious problems associated with the use of absorbent materials in laboratory environments are:

De-lamination - Swelling - Warping

Laminate



Monolithic Surface

Comparative Moisture Resistance

Low moisture resistance leads to de-lamination, swelling and warping.

Material	Moisture Resistant
Epoxy Resin	Yes
Solid Surface	No
Stainless Steel	Yes
High Pressure Laminate	No
Composite Resin	Yes
Resin Impregnated Stone	No

Flammability

Tests have shown that US epoxy resin worksurfaces are self extinguishing. This adds to the safety of the lab environment if accidents occur.

Fume Hoods After A Fire

Material Performance

Useful Life

With good housekeeping practices and proper maintenance, epoxy resin worksurfaces should remain functional for the useful life of the lab.

Material Performance

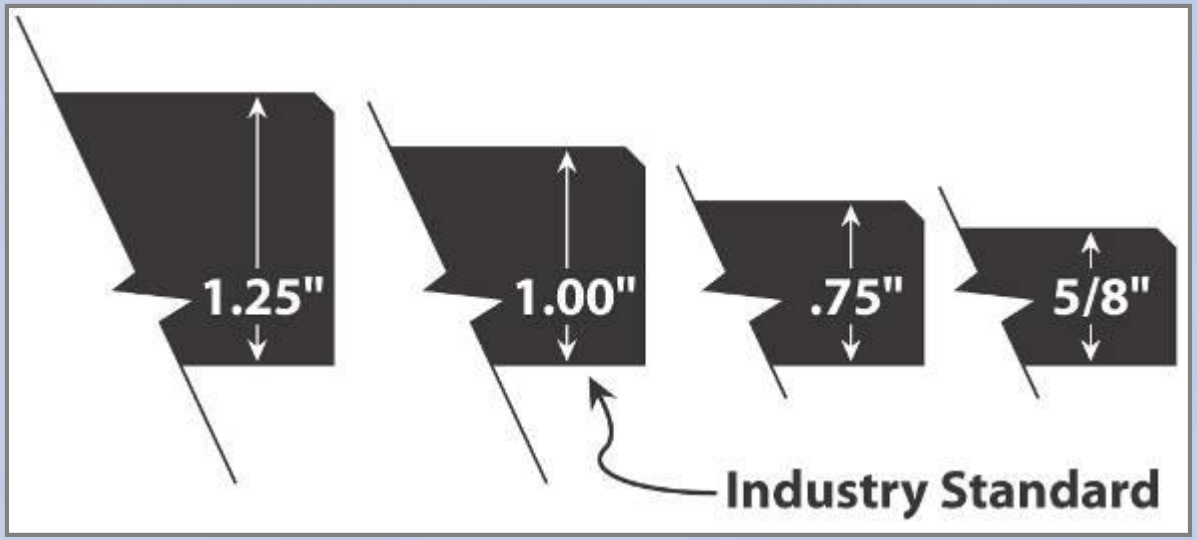
Design Options

- **Shapes & Sizes**
- **Material Thickness**
- **Colors**
- **Edge Profile**
- **Surface Types**
- **Curb Types**
- **Sink Types**
- **Drain Tops**
- **Accessories**

4. What are the options when designing with Epoxy Resin?

Material Thickness

Epoxy Resin is normally manufactured in one of three thicknesses: ¾”, 1” or 1 ¼”. Tops of 1” are the industry standard.



Solid Colored Epoxy

Epoxy resin can be produced in an array of colors. The most common and traditional color is black. Other available colors include: white, green and gray. Some manufacturer offer custom color options. As in any industry, custom colors add to lead times and expense. For example, white can cost up to 30% more than black.

Granite Filled Epoxy

These epoxy tops incorporate granite aggregate and are produced in colors gray and red.

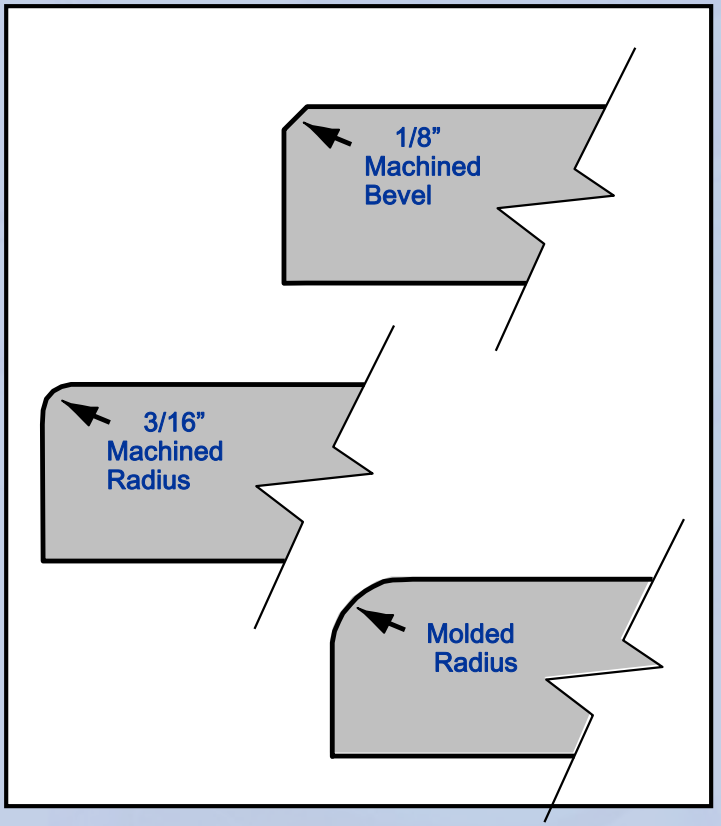
Design Options

Edge Styles

There are two basic epoxy resin edge styles:

- *Machined edge* tops are available with either 3/16” radius or 1/8” beveled edge. Machined edge tops are available with a Drip Groove (a groove cut along the underside edge to prevent liquid from flowing back to the cabinet).

- *Molded edge* tops have molded radius. The dimension of its radius varies by manufacturer.



Surface Types

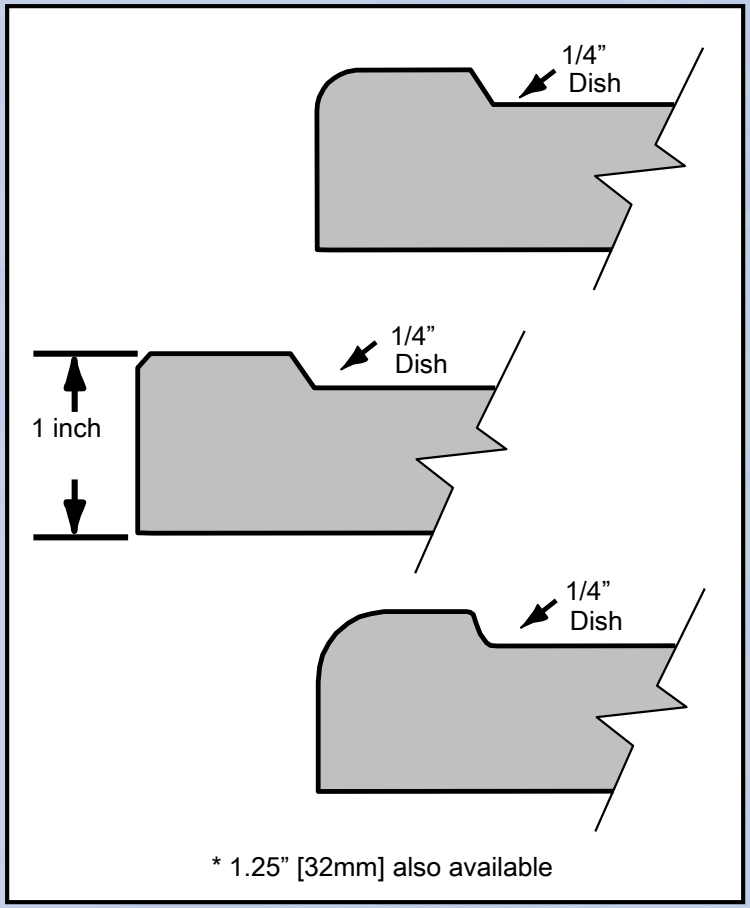
There are three basic epoxy resin surface types: Flat Tops, Marine Tops and Fume Hood Bases.

Surface Types

Flat Tops maximize workspace and can be based in conjunction with any of the three edge profiles.

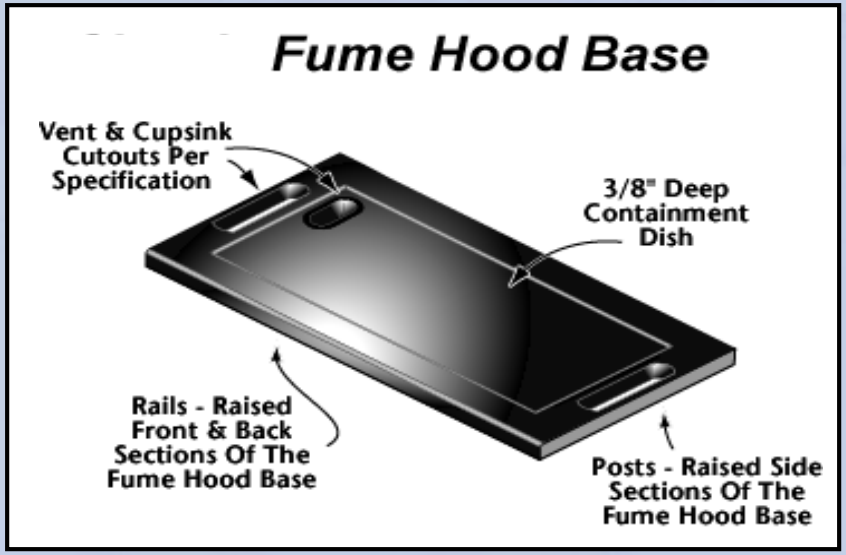
Surface Types

Marine Tops have a raised liquid containment rim around their perimeter and are designed for use in wet areas. The rim is integrally molded wherever possible. If the room's layout precludes the use of molded pieces, the raised edges are applied or cut and seamed to the top.



Surface Types

Fume Hood Bases are molded in a variety of sizes to fit most fume hood cabinets. They have a built-in 3/8” deep liquid containment area.

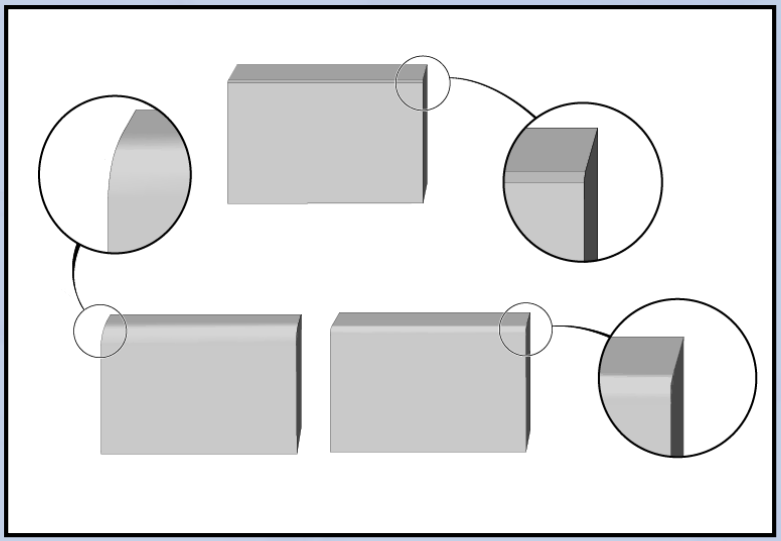


Design Options

Curb Types

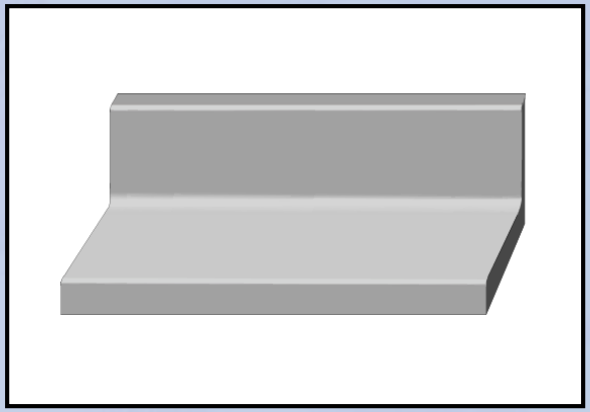
There are two types of curbs (backsplashes):

Loose Curbs are fabricated and shipped “loose” for installation in the field. The top edge of loose curbs can be finished with a 1/8” machined bevel, a 3/16” machined radius or a 1/2” molded radius.



Curb Types

Integral (Coved) Curbs are specialty surfaces cast using “L” shaped molds to eliminate seams between the surface and the backsplash. Integral curbs are 1” thick at the work surface and taper to ¾” at the top edge. Since jobsite wall tolerances are difficult to maintain, these types of curbs are generally recommended only when minimizing joints is of highest priority.



Sink Types

There are two types of epoxy resin sinks:

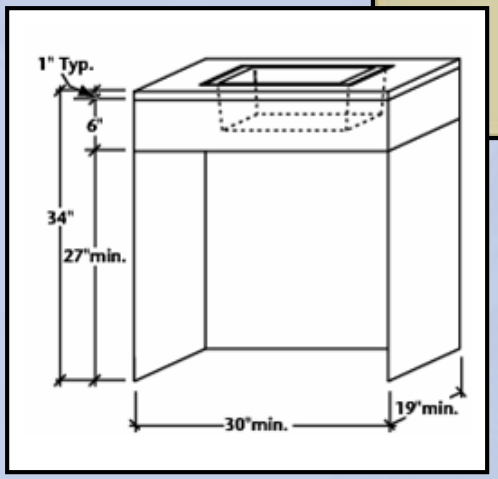
Drop-In Sinks feature basins supported by the countertop and require no under sink support. Standard installation requires a beveled rabbet cut through the worksurface so that the sink rim rests on the lip of the cutout.

Sink Types

Undermount Sinks are mounted below the countertop surface requiring support, (supplied by the casework manufacturer). The required under-sink support often limits the amount of usable cabinet space; so, these sinks are seldom used today.

Sink Types

Drop-In sinks are available in ADA models which have an inside depth of 5”. Graduated or Step-Sinks are also available. These sinks have an inside depth of 5” which steps-down to 11”.



Drain Grooves or DrainTops

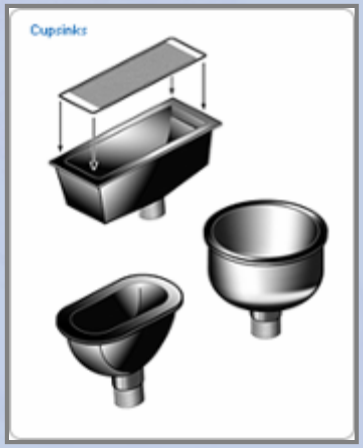
When a work surface is used in a sink (wet) area, there is the option of providing drain grooves in the work top to drain liquids towards the sink. These grooves may either be cut into the surface during manufacturing or molded into the surface in the form of raised ribs. Molded drain tops perform better than those with machine routed grooves.

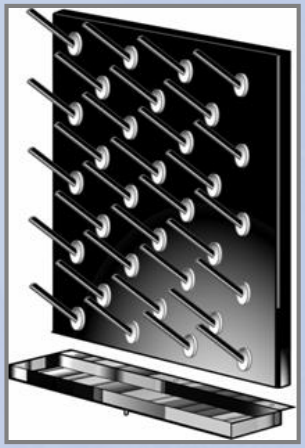
Epoxy Resin Accessories

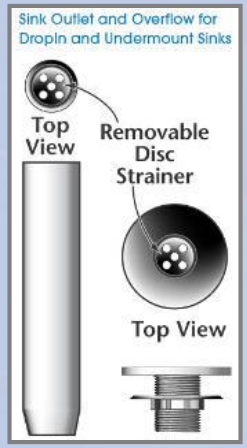
Accessories are also available in Epoxy Resin such as:

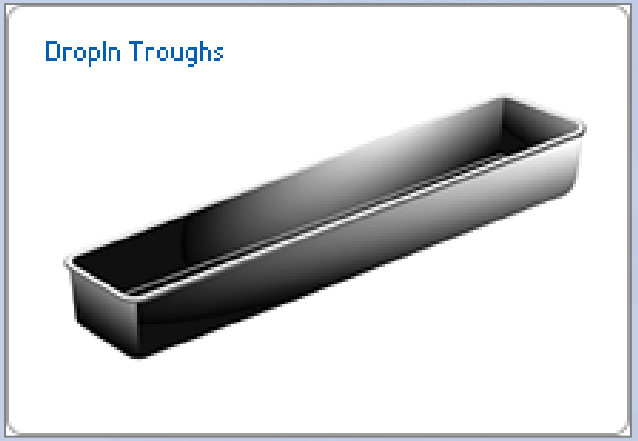
- Troughs
- Cup sinks (waste funnels)
- Sink overflows
- Peg boards.

Black polypropylene sink outlets, overflows, and cup sinks are typically supplied unless a color is specified.









Design Options

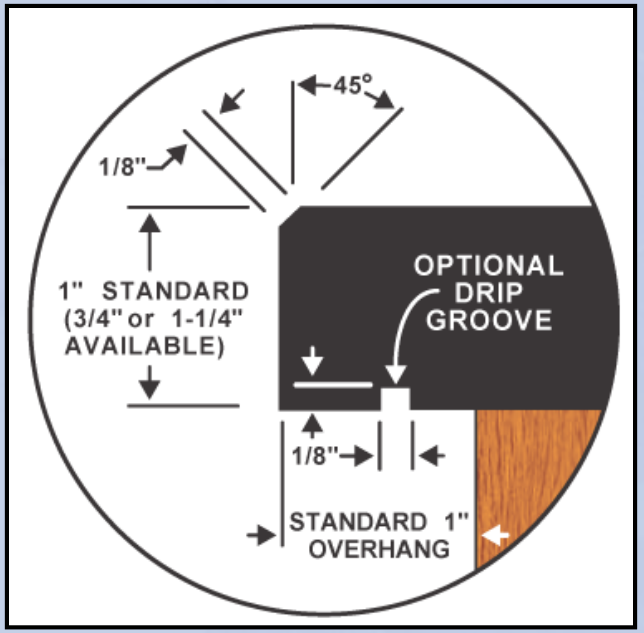
Design Standards

- **Countertop Overhang**
- **Countertop Size**
- **Location of Sinks**
- **Curb Height**

5. What are the basic design standards for Epoxy Resin?

Countertop Overhang

Standard laboratory countertop overhang is 1”. Drip grooves underneath the top are optional and should be specified if desired.



Countertop Sizes

Design Standards

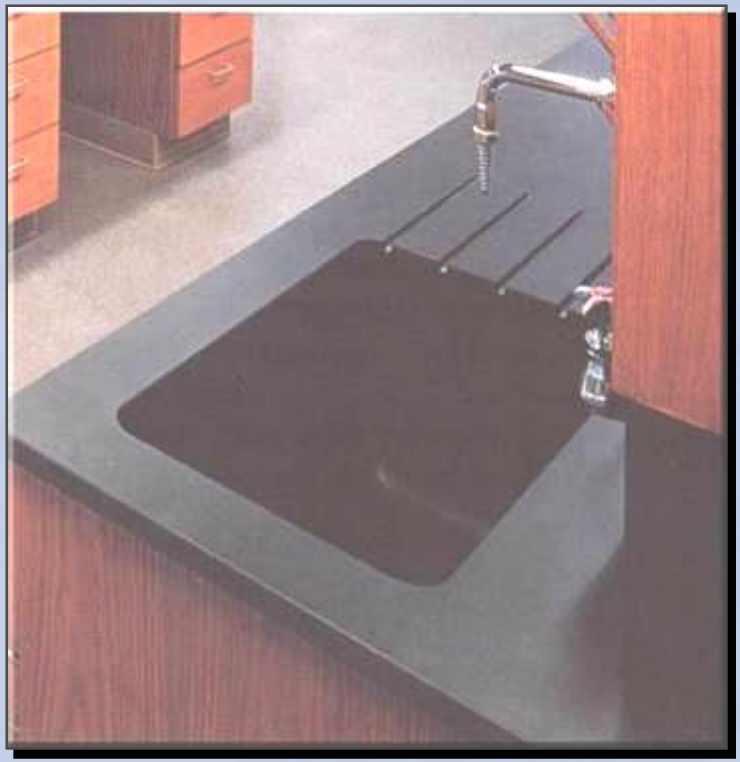
Counter tops should be as long as possible to minimize seams. Tops can be produced in lengths up to 96”.

Avoid placing seams in wet areas and knee spaces.

Location of Sinks

Drop-In sinks must be located at a minimum of 3.5” from the edges of the countertop.

Undermount sinks must be located at a minimum of 4.5” from the edges of a countertop.

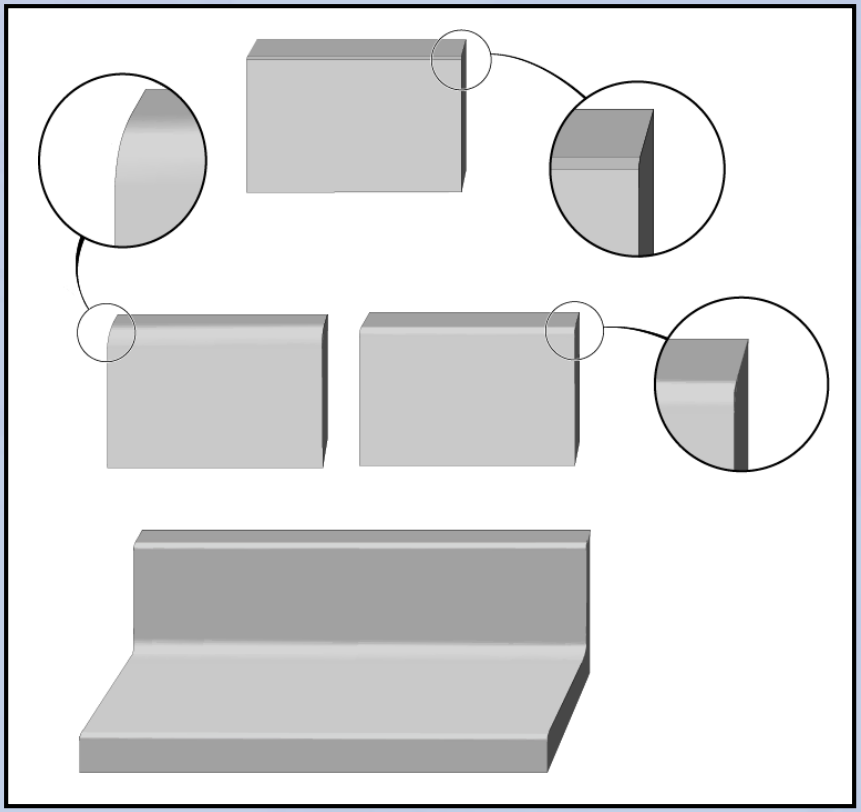


Curb Height

The standard height for epoxy resin curbs, whether loose or integral (coved), is 4”.

Loose Curbs can be specified to any height.

Integral Curbs can be trimmed or custom molded to 6” or 8”.



Design Standards

Installation Criteria

- **Job Site Storage and Handling**
- **Installation of Tops**
- **Protection After Installation**

6. What is the basic criteria for quality installation of Epoxy Resin tops?

Jobsite Storage and Handling

When epoxy resin tops arrive at a jobsite they should always be stored laying flat in a safe place until ready for installation. Tops should never be stored leaning against walls as this could cause some work surface deflection.

Good

Not Good

Jobsite Storage and Handling

Tops should be scheduled to arrive at the jobsite just prior to installation and stored indoors.

They should also remain covered for surface protection. If the tops must be stored outside, they should be covered to prevent damage from the elements.

Installation of Tops

Epoxy resin tops require an experienced epoxy resin installer.

Installation of Tops

Epoxy resin tops should be installed when temperatures in the space or room where they are to be installed are at least *77º Fahrenheit*. The epoxy adhesive used to bond the tops may not cure properly when tops are installed when temperatures are outside of this norm.

Installation of Tops

The installer should insure that the tops are installed such that they are flat and level.

It is appropriate and expected that an installer will use shims and clamps to achieve a flat and level installation.

Installation of Tops

The joints between epoxy resin pieces should be uniform throughout the job. Normal joint width should be between 1/8” and 1/16”. Tops should be dry fit prior to application of epoxy adhesive.

Installation Criteria

Protection After Installation

The surface of epoxy resin should be protected by covering the tops once they are installed.

Protection After Installation

Workers from other trades should be instructed to not place tool boxes, tools or any hardware directly on the surface of the tops. Workers should also be instructed to not stand on the tops, but to use ladders or scaffolding instead.

Course Summary

By now you should have a better understanding of the following:

1. The characteristic environments where industrial grade work surfaces are typically specified.
2. The characteristics and attributes of Epoxy Resin and be able to compare and contrast it with other materials such as: Solid Surface, Stainless Steel, Chemically Resistant Composite Resin, Chemically Resistant High Pressure Laminate, and Resin Impregnated Natural Stone.

Course Summary

3. How all the materials compare in performance. Look in depth at: Physical Durability, Chemical Resistance, Heat Resistance, Moisture Resistance, Flammability.

4. The specific design criteria and/or standard guidelines for designing with Epoxy Resin such as: material thickness, color, edge finish, backsplash type, sink type and accessories.

5. Material handling, storage and basic installation requirements for Epoxy Resin.

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