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Challenges of coating Applications with Plural component Equipment's and Zinc

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ABSTRACT

In today's worlds coatings are being formulated to provide longer durability of the Subtracts be it steel of concrete, Most protective coating have moved towards the 80-100% solids from 40-60% solids and with very lower pot life. Application is a challenge and using the correct equipment is critical to a good coating, Equipment is very critical to manage the higher solids coatings,

Plural component equipment are built to handle the coatings mixing material on demand and applying the coatings, there are many challenges towards mixing this material with plural component equipment's.

Application of Zinc Coatings is also a major challenge, Improper equipment being used for applying Zinc coatings, Most contractors use one sprayer for all the coatings, using the correct applications equipment's is also very critical and applications needs to be managed well.

Keywords: Plural Component, Pot life, Mix Ratio, Proportioners

INTRODUCTION

Handling the high viscosities and very low pot life need very special equipments. This has challenged the applications methods and equipment, Equipment's suppliers are challenged to upgraded equipments to manage the range of coatings applications, handle higher solid contents, lower pot life's. In the last 10 -12 years there have been a huge development of coatings which has challenged the development of plural component applications equipments

What are Plural component materials ?

- Material suppliers produce, package and deliver plural component materials to the work site as two or more different component chemicals.
- The chemical components must be mixed together in a specified ratio, at the work site, for the chemicals to become a usable material.
- After mixing, the material is applied by spraying, dispensing, or extruding..



What happens when the component chemicals are mixed?

A chemical reaction begins spontaneously as soon as the component chemicals are mixed. The component chemicals are transformed into a usable material in a process called **Curing, Cross linking or Polymerization**. The reaction cannot be stopped or reversed. The material increases in viscosity as the reaction continues, and produces heat as a byproduct. Exothermic reactions produce heat as a by-product.

After mixing, the material will provide Good Application Characteristics. The period of time that the material provides good application characteristics is called Working Pot Life. Working pot life is also known as Work Time when working with sealants and adhesives, or Spray Life when working with coatings. Working pot life, spray life, and work time are different words used to describe the same idea.

Working pot life ends when the material stops providing good application characteristics. As viscosity increases, finish quality will no longer be acceptable for coatings, sealants will not seal

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properly, and adhesives will not bond properly. The material is no longer usable and should be purged from the equipment before it hardens.

Viscosity increases until the material hardens. The period of time that starts when the components are mixed and ends when the material hardens is called *Pot Life*. If material hardens in the equipment, the equipment will be ruined. Flush the material from the equipment at the end of working pot life to prevent damage.



What is mix ratio?

• Mix Ratio is the ratio of Component A to Component B that yields the best characteristics of the end product.

- Mix ratio is specified by the material supplier as a function of weight and/or volume.
- The material supplier will specify the mix ratio and a margin of error called Ratio Tolerance.
- Ratio tolerance tells you how far off the prescribed mix ratio you can be before you are off-ratio.
- Mix ratio is the most critical factor that determines the physical properties of the end product.
- Too much catalyst may cause problems
- Too little catalyst may cause different problems.
- Mix ratio affects pot life.
- Off-ratio materials may not cure properly.
- Applying heat will often shorten pot life or speed curing.

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How is mix ratio measured?

• Plural component equipment proportions chemical components by volume. If the material supplier provides the mix ratio by weight, the procedure below can be used to convert it to a volumetric mix ratio.

| Weight to Volumetric Mix Ratio | | | | | | |
|--|---------------------------|----------------|---|--|-----|-----------------------------|
| Volumetric Mix Ratio = | <u>Weight</u> Weight I | <u>A</u> B | x | <u>Weight/Volume B</u> Weight/Volume A | = | <u>Volume A</u> Volume B |
| Note: The weight/Volume of A and B must be expressed in the same units. | | | | | | |
| Example: You are given a weight mix ratio of 16:1 (A:B). You are also given: A = 10 lb./gal. B = 8.5 lb./gal. We can now write the equation as: | | | | | | |
| Weight Mix Ra | ntio = | <u>16</u> 1 | x | $\frac{8.5 \text{ lb./gal.}}{10 \text{ lb./gal.}} = 13.$ | 6:1 | |
| So, the volumetric mix ratio (A:B) = 13.6:1 | | | | | | |

Types of plural component materials and their uses?

Common plural component materials include epoxies, polyurethanes, polyesters, catalyzed lacquers, poly sulphides, and silicones.

Polyesters, Catalyzed Lacquers, Polysulphides and Silicones are other plural component materials that have applications as decorative coatings, protective coatings, foams, sealants, and adhesives.

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| What are the advantages of using plural component materials? | What are the limitations of using plural component materials? |
|---|--|
| Excellent material characteristics when properly blended: | Coating cost is high: |
| Durability Abrasion Resistance Chemical Resistance Flexibility Promotes Adhesion Appearance | Plural component materials are typically more expensive than single component materials. |
| Environmentally Friendly: | Incorrect mix ratios result in costly failures: |
| Low VOC (Volatile Organic Compound) emissions. Lower energy consumption while curing, many materials do not require heat to cure. Mixed cured material can be disposed of as non-hazardous waste. Cost Effective: Ovens may not be required. Cure quickly, reducing time on assembly line. May not require stainless steel equipment. | Material characteristics do not develop properly. Lost production and profits due to need to: Strip the material off the product and re-apply. Dispose of scrapped products. Warranty costs Rework Scrap Many units may be produced because the offratio condition may not be noticeable on the production Line. Production systems are required to monitor and control the mix ratio to assure quality finished Products. |
| | Exceeding pot life causes costly problems: |
| | Equipment fails or becomes clogged when mixed materials exceed pot life before equipment is cleaned. You must clean, replace or repair clogged equipment. Equipment must be cleaned before pot life is exceeded, generating wastes that are expensive to properly dispose of. |

How are plural component materials proportioned?

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How Manual Proportioning Works ("Hot Potting", "Batch Mixing")



The operator measures out the correct amount of each component into a container and mixes the materials until they are blended completely. The mixed chemical is then applied by the operator prior the end of the work time for the material.

How Mechanical Proportioning (Mixing) Works



Two or more pumps or pressure tanks supply a simultaneous flow of fluid to the proportioners. Mechanical proportioners use two or more displacement pumps to measure the component chemicals. The pump strokes are synchronized by a mechanical connection. As the pumps operate, they meter out component chemicals in ratios determined by the displacement of the pumps. Fluid is directed from the pumps to a mixing mechanism, then applied to the end product.

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How Electronic Mixing Works



The fluid supplies deliver the chemicals under pressure to the fluid manifold. On the manifold are all the components to meter and mix the chemicals on demand. The system uses special computer software and other electronics to control the flow of each component material. This system allows proportioning of the materials very accurately, shuts down the system automatically if a problem develops, and can output material usage reports.

What are the advantages and limitations of using Mechanical proportioners to mix plural component materials?



Mechanical proportioners with Remote Mixing

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| Advantages | Limitations |
|--|---|
| Mechanical proportioners efficiently handle large volumes of plural component materials. They are generally reliable. Mechanical proportioners can pump, mix and apply materials with short pot lives, very quickly. They work on demand, mixing only what is needed. The work environment is cleaner and safer when compared to manual mixing. They can be installed in hazardous areas without major modifications. | Mechanical equipment requires regular maintenance and repairs. Mix ratio is affected as mechanical parts wear. Operator error can result in the wrong mix ratio or material left in equipment past its pot life. Limited ratio range. Chemical breakdown of the material called <i>Shearing</i> is caused by mechanical components. Mechanical proportioners can <i>Cavitate</i>, resulting in an off-ratio condition. Cavitation occurs when one or more of the supply pumps do not fully fill with fluid. No inherent ratio verification or process data capability. Generates material waste when changing colors. Slow and complex to change colors. |

What are the advantages and limitations of using electronic proportioners to mix plural component materials?



Electronic Proportioners

| Advantages | Limitations |
|--|--|
| Accurately maintains desired ratio, self correcting. Meters and mixes on demand only what is needed to complete the job. Designed to monitor the process effectively. Provides material usage reports. Cleaner, safer work environment. Handles a wide range of ratios. Dispenses multiple ratios. Automatically self purges if pot life is exceeded. Simpler to maintain than mechanical proportioners. Color change and purging is faster and generates less waste. | They are expensive to purchase Operators may be afraid of operating Computerized equipment. Electronic proportioners must be operated by properly trained operators. Meters must be checked for accuracy on a regular interval. |

Viscosity :

Viscosity varies because of various factors, this has an effect of the mixing , when the two components are of different viscosities, its tough to mix them easily especially in the high production when speed is of importance, the best way to reduce viscosity is by

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- 1 Heating
- 2 Agitation
- 3 adding solvent (last option)



Viscosity Difference

The Use of Heat for Mixing :

Heat is very critical for application of plural component coatings, it assist in controlling the viscosity as well as helps with mixing , induction heaters heat the material in drum with no contact and do not burn the material like band heaters, in line heaters and heated hose help maintain the temperature ,



Induction Heaters

In Line Heaters

Heated Hose

Band Heaters

Mixing Technology:

Mixing is critical to a god coating and using the correct mixer is important, a combination of proportioner, heating system and mixer provides a good plural component system, its important to have a hose of 3-5 mtrs after the static mixer for proper mixing of the paints by friction of the paints especially with electronic proportioning which uses dosing technology.

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Static Mixers

Plural Component Systems:

There are a range of plural component systems available, from basic systems to electronic proportioners used for application of various coatings, the technology systems do cost money and provide features of high production, accurate mixing and data recording, Its important to consider the system which sometimes needs extensive heat as well as a good amount of compressed air, Plural component systems are getting more and more popular and contractors need to upgrade their way of working and employee qualified technicians to operate these equipments, this is a skill that contractors are learning on the job and there is very little skill development to take this business to the next level,



Plural Component Proportioners

Zinc Coating Sprayers :

Zinc coatings help achieve the best protective coatings, Zincs as primers are available in Organic as well as inorganic forms, Zinc Powers are dispensed into a liquid to form the coatings, these powders are abrasive and do not dissolve in the solvents but remain suspended in the solvents.

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Zinc coatings need to be kept agitated continuously to prevent sedimentations, These coatings cannot be also sprayers using very high pressure pumps, There are special Pumps designed for Zinc coatings, these are Low pressure high volume pumps, with a circulating system to keep the material in suspension and prevent sedimentations of the zinc, The equipment needs to also have high volume hose preferably 3/8", 1/4" hose is not ideal for zinc spray as it increases the pressure in the line and causes application issues, The spray gun which feeds paints straight to the gun is ideal which reduced the a special zinc sprayers is ideal for zinc applications which recirculate the material and prevent sedimentation, Alternatively the best equipment is a pressure pot,



This technology of applications will allow an even flow of zinc and prevent patches of zinc which will cause coating failures of mud cracking or corrosion due to no zinc coating, Zinc coatings cannot be repaired and the entire surface would need to be reblasted and coated again which is not economical, Some zinc coatings need moisture to cure unlike other coatings.

CONCLUSIONS

- Understanding the basic terminology of plural components and equipment.
- Awareness of the handling methods and equipment required to apply these materials.
- Ability to define the equipment that meets a customer's application need.

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