



UV40-SOLAR Dual Cure Acrylated Urethane Conformal Coating Technical Data Sheet

System Description

HumiSeal UV40-SOLAR is a one-part, low viscosity, high solids Conformal Coating material that is especially formulated for solar and related applications. The conformal coating has been developed for use under prolonged exposure to sunlight so that it does not discolour or degrade over time. It is designed to meet SAE-J-1960 standard (QUV accelerated age testing).

HumiSeal UV40-SOLAR is a dual cure acrylated polyurethane conformal coating possessing excellent chemical resistance, surface hardness, flexibility and moisture resistance. The material is tack free after exposure to UV light and the secondary moisture cure mechanism will fully cure in any unexposed shadow areas within 2-3 days at ambient conditions. The secondary cure can be accelerated by baking at 60-80 °C at elevated humidity. The coating fluoresces under UV light to allow coating inspection and can be applied by all selective coating equipment. HumiSeal UV40-SOLAR is in full compliance with the RoHS Directive (Directive 2002/95/EC).

Properties of Liquid HumiSeal UV40-SOLAR

| | |
|---|---|
| Density | 1.06 g/cm ³ |
| Solids Content | 100% |
| Viscosity (max) | 500 cps |
| Flashpoint, °C | 84 |
| Recommended Coating Thickness | 1-5 mils |
| Lamp type for UV curing | Fusion H bulb, Mercury doped, 120W/cm |
| Secondary Cure (for shadow areas) (*Place open pan of water in oven during curing) | 2-3 days at ambient or 2-4 hrs at 60-80 °C* |
| Recommended Removal Method | Thermal burn-through and mechanical |
| Shelf Life at Room Temperature | 6 months from date of manufacture |

Properties of Cured HumiSeal UV40-SOLAR

Thermal Properties

| | |
|-----------------------------------|-------------------|
| Continuous Use Operating Range | -65 °C to +150 °C |
| Thermal Shock, per MIL-I-46058C | -65 °C to +125 °C |
| Solder Through for Rework? | Yes |
| Glass Transition Temperature, DSC | 45°C |
| Coefficient of Thermal Expansion | |
| Below T _g | 85 ppm/°C |
| Above T _g | 197 ppm/°C |

Physical Properties

| | |
|------------------------------------|--------------------|
| Clarity | Transparent |
| Flexibility, per MIL-I-46058C | Excellent |
| Adhesion, per ASTM, Meth. D2197 | Excellent |
| Flammability, per ASTM, Meth. D635 | Self-Extinguishing |
| Flammability, per UL-94 | 94V-0 |
| Weather Resistance | Very Good |

Electrical Properties

| | |
|---|-------------------------------|
| Dielectric Withstand Voltage, volts per MIL-I-46058C | >7,500 |
| Dielectric Constant, at 1MHz and 25 ^o C, per ASTM-D150-65T | 2.5 |
| Dissipation Factor, at 1MHz and 25 ^o C, per ASTM-D150-65T | 0.01 |
| Insulation Resistance, ohms, per MIL-I-46058C | 8.0 x 10 ¹⁴ (800T) |
| Moisture Resistance, ohms, per MIL-I-46058C | 6.0 x 10 ¹⁰ (60G) |

Chemical Properties

| | |
|---------------------------------|--|
| Main Constituents | Urethane, Acrylic |
| Fungus Resistance, per ASTM-G21 | Pass |
| Resistance to Chemicals | Excellent |
| Recommended Stripper | Stripper 1072 (or solder through for rework) |

Values are not intended for use in preparation of specifications.

APPLICATION

Cleanliness of the substrate is of extreme importance for the successful application and performance of a conformal coating. Surfaces must be free of moisture, dirt, wax, grease and all other contaminants. Contamination under the coating will cause problems that may lead to assembly failures.

Dipping

HumiSeal UV40-SOLAR is not suitable for dipping due to ambient light curing the material.

UV40-SOLAR - Spraying

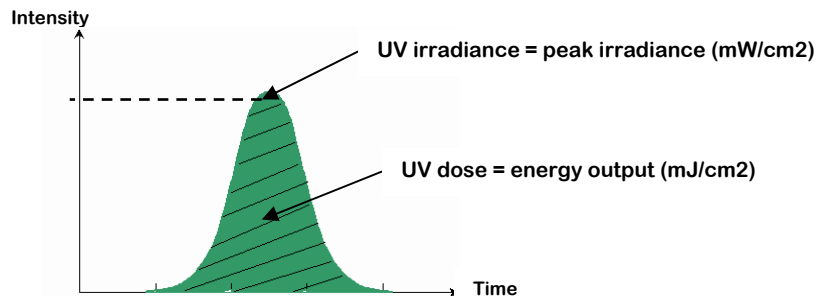
HumiSeal UV40 SOLAR can be applied via standard selective coating equipment or by conventional hand spray equipment. The source air used for spraying must be dry (a dry inert gas is highly recommended) to prevent premature curing of UV40 SOLAR's effective secondary cure mechanism. Spraying should be done with adequate ventilation so that the vapor and mist are carried away from the operator.

Brushing – UV40-SOLAR

HumiSeal UV40 SOLAR may be applied by brush. The actual uniformity of the finished coating will depend on component density and operator technique. Brushed may be cleaned promptly using solvent.

Curing- UV40 SOLAR

Dose and irradiance are key concepts when curing UV coatings. Those concepts are different but closely related together and defined as below:



Lamp intensity versus time

- UV irradiance (mW/cm²): is the power or the intensity of the UV energy, which is delivered to a surface per unit area. It is a characteristic of the lamp and geometry of the reflector and does not vary with the speed. The intense focused peak directed under the lamp is referred to as "peak irradiance".

- UV dose (mJ/cm²): is the total energy delivered to a surface per unit area, passes under a UV light source. It is inversely proportional to the speed under the light source and proportional to the number of exposures or rows of lamps.

Energy is the product of power and time. A low irradiance for a long time does not give the same cure results as a higher irradiance for a proportionally shorter time, due to the differing kinetics of the curing reaction that take place under the 2 conditions.

Process control of a UV curing material

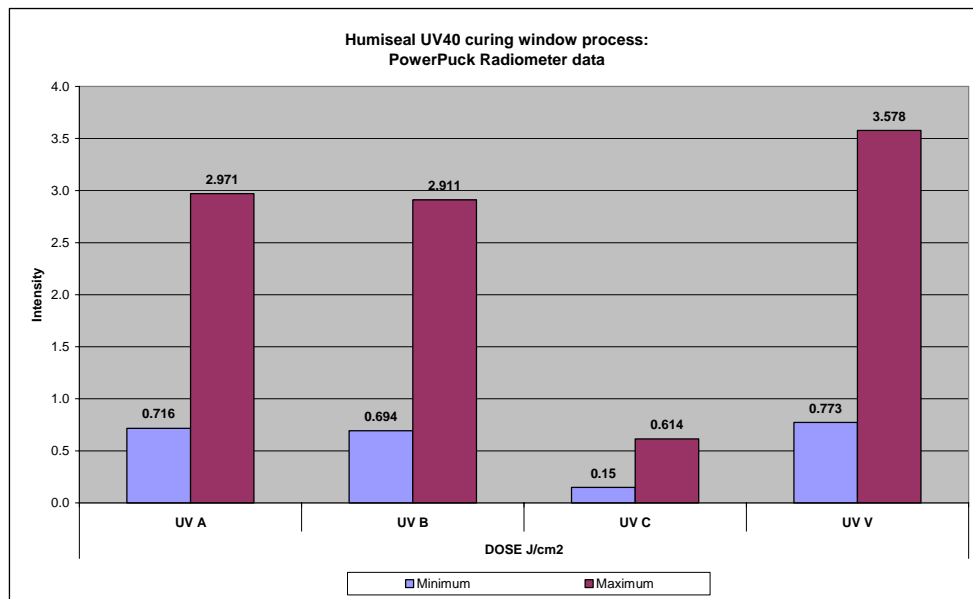
Controlling curing window process is easily quantifiable with a sensing system called a radiometer. This instrument measures the total UV dose and irradiance on 4 different channels (UV-A, UV-B, UV-C and UV-V) simultaneously, thus ensuring a repeatable and controlled curing process, while monitoring the output of the UV lamps. The procedure is as simple and fast as passing the instrument through the tunnel and removing it at the end while the radiometer is logging UV dose and energy.



Power Puck radiometer

UV40-SOLAR will exhibit different responses to spectral distribution, dose and irradiance. Curing a coating without sufficient energy results in a sticky film; too much energy results in residual stress, cracking, excess shrinkage. Use of an inappropriate wavelength will give a softer film than when cure with the appropriate bulb type.

In the graph below is the window curing process (maximum and minimum UV dose) under which UV40-SOLAR cures at a tack free stage and provide sufficient hardness to enable the boards to be handled. Conveyor speed can vary between 1m/min to 3m/min depending on height of lamp, power output of the lamp, shape of the reflector, height of components, etc....



Curing Window Process of UV40 SOLAR

Trying to increase production throughput by increasing the intensity of light while decreasing the duration of exposure may not always be successful since it must be ensured that sufficient UV dose has been applied to the coating. It is extremely important to cure a UV coating within the adequate recommended process window in order to obtain maximum reliability and performance of the coating. It is therefore

essential to choose the correct UV curing equipment that will enable you to work adequately within this window process.

Clean Up

To flush equipment and clean uncured UV40-SOLAR, organic solvents such as methyl ethyl ketone, t-butylacetate, xylene etc. can be used. Do not use alcohol based solvents such as isopropyl alcohol as it will react with UV40-SOLAR.

Rework

HumiSeal UV40-SOLAR is a highly crosslinked UV cured coating. The cured film has a high degree of environmental and chemical resistance and will be more difficult to remove than traditional conformal coatings. The following options are available for rework of UV40-SOLAR.

Thermal Removal: The most effective method for removal of UV40-SOLAR for selective rework applications is to burn through the coating directly using a hot soldering iron. The high temperature of the soldering iron (typically 300-400 °C) softens and decomposes the coating and allows it to be easily displaced from the substrate. This allows access to the underlying solder connections for component removal and replacement. A hot air desoldering tool may also be used also. Apply heat to the desired area and the coating can be removed mechanically after it softens. Care should be taken to avoid damage to any heat sensitive components.

Mechanical Removal: This method involves the use of "micro-abrasion" equipment that safely removes the cured coating by using a pressurised abrasive system. After coating removal, the abrasive can be removed from the assembly surface without damage to the components. HumiSeal UV40-SOLAR has been successfully removed using Powder Abrasion System. For more information please contact Humiseal.

Chemical Removal: If the UV40-SOLAR coating has been UV cured only and not allowed to undergo any further moisture curing, HumiSeal Stripper 1072 could be used to remove the UV-cured film. Extended dwell times and periodic mechanical agitation could be required. Warming the 1072 solution can increase its effectiveness.

Storage

Refer to MSDS to insure proper storage conditions. HumiSeal UV40-SOLAR should be stored at 5-25C, away from excessive heat, in tightly closed opaque containers. Prior to use allow the product to equilibrate for 24 hours at room temperature. Since UV40-SOLAR is photosensitive, the product should not be exposed to direct sunlight or full spectrum fluorescent lighting. UV40-SOLAR is a moisture curing material and care should be taken to protect process vessels and partial containers from moisture. Partial, opened containers should be purged with a dry, inert gas such as dry air, nitrogen or argon before closure, otherwise premature polymerization by atmospheric moisture will occur.

Technical support coatings: Europetechsupport@humiseal.com

Sales: Europeansales@humiseal.com



Humiseal Europe
2C Albany Park, Frimley Road,
Camberley, Surrey,
GU16 7PH
Phone +44 (0) 1276 691100
Fax +44 (0) 1276 691227
Web: www.humiseal.com

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