

## Storage Conditions for PHOTOCAP<sup>®</sup> PV Encapsulants

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**Author(s):** Ignacio Fidalgo, Ph.D., Technical Manager Europe

**Approval:** Luke Strzegowski  
Global Director, Sales and Technology

This report contains detailed recommendations for storage of PHOTOCAP<sup>®</sup> photovoltaic encapsulant for warehouse conditions, pre-use conditions, and in-process conditions. The recommendations here apply to all encapsulant products manufactured by STR.

Specialized Technology Resources, Inc. • 10 Water Street • Enfield, CT 06082 USA  
Phone +1-860-272-4235  
[www.strsolar.com](http://www.strsolar.com)

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**PHOTOCAP® Encapsulant Storage Conditions:**Background – Justification for Storage Conditions:

PHOTOCAP encapsulant products are typically manufactured and provided as “self-priming”, which is denoted by a suffix “P” on the product name. The term “self-priming” indicates that the active primer ingredient is blended into the encapsulant product to enable chemical bonding to glass and silicon surfaces during module lamination. The only exception to this general rule is the suffix “W”, which stands for “white”. Our white encapsulant PHOTOCAP®15580W is also a “self-priming” product.

The active ingredient which forms the chemical bond with glass and silicon is sensitive to moisture or water vapor. Extended exposure of PHOTOCAP encapsulant to high humidity conditions prior to heat lamination or encapsulation of the module could result in low bond strength between the encapsulant and other surfaces in the module. The storage conditions in this document are provided as a recommendation to protect the active primer in the PHOTOCAP encapsulant prior to lamination.

The activity of the primer can be tested at any time with a coupon to measure the glass adhesion force after thermal lamination. This test method is available from your STR representative.

Warehouse Conditions:

PHOTOCAP encapsulant can be stored in warehouses with the following conditions. The product should remain in the original STR provided sealed packages and should also remain within the shipping boxes:

Temperature less than 35 °C / 95 °F

Humidity: ambient conditions

(Active humidity control is not necessary, provided the rolls are in the original unopened package)

Premium packaging: 9 months, maximum storage time (6 months for any white material)

Standard packaging: 6 months, maximum storage time.

Storage at sub-ambient temperature does not have adverse effects upon product quality. However, care should be taken to prevent moisture condensation from forming on the rolls prior to use (see comments below regarding Staging Prior to Use.)

Staging Prior to Use:

Prior to using PHOTOCAP encapsulant for PV module fabrication, the rolls must be conditioned and at equilibrium temperature with the factory or production environment. Rolls should remain within their original sealed packages during the staging and conditioning period.

When the packages are opened, it is recommended that the first winding of new or partially used rolls be discarded prior to use. This outer winding is in contact with the packaging.

*Conditioning from Hot Storage:*

Boxes containing PHOTOCAP encapsulant rolls should be moved to an environment that is conditioned at the same temperature as the production floor, about 24-48 hours prior to intended use. The specific time required must be determined at the actual facility where the material will be used. The time required depends upon the convective heat transfer between the conditioned air and the boxes and packages of rolls. The sealed packages containing the rolls of encapsulant should remain sealed during this time.

The final location where materials are conditioned prior to use should be at the same temperature as the factory floor and should have humidity-controlled air to less than 75%.

Storage of PHOTOCAP encapsulant at elevated temperatures above 35 °C for extended periods of time (such as many weeks to months) can cause a reduction in the effectiveness of the active primer.

*Conditioning from Cold Storage:*

Cold storage requires more time to condition the rolls prior to use in order to ensure that the full rolls are at ambient temperature when the packages are opened. If the rolls are colder than ambient temperature when opened, then moisture can condense on the rolls, and liquid water may be absorbed by the release paper (if on paper) and by the encapsulant. Short term (that is, hours to days), the condensed moisture on the roll can cause steam formation during PV lamination, which in turn could cause defects, bubbles, and voids within the PV module.

Boxes containing PHOTOCAP encapsulant rolls should be moved to an environment that is conditioned at the same temperature as the production floor, at least 48 hours prior to intended use. The specific time required must be determined at the actual facility as it will depend upon the convective heat transfer between the heated air and the boxes and packages of rolls. More conditioning time may be required if the rolls are stored below 0 °C. If rolls are received at temperatures significantly below 0 °C, then pre-conditioning times as long as 7 days may be required to adequately raise the temperature of the rolls to the factory temperature. The sealed packages containing the rolls of encapsulant should remain sealed during conditioning time to prevent moisture condensation.

The final location where materials are conditioned prior to use should be at the same temperature as the factory floor and should have humidity-controlled air to less than 75%.

Tests have been conducted by STR on PHOTOCAP encapsulant stored at -40 °C for five days. Following the cold storage, the un-sealed roll packages were allowed to come to thermal equilibrium at room temperature (approximately 20 °C) for five days. Fresh PV laminates were tested with coupons for glass adhesion strength after this thermal conditioning and no change was observed relative to the original glass adhesive strength.

Storage of PHOTOCAP Encapsulant Rolls with Open Packages, Material Still in Rolls:

Temperature: 20-30 °C / 65-85 °F

Humidity: < 75% relative humidity desired

Time: Use within 3 days

Re-seal packages when possible in high humidity conditions

Rolls should be protected from sun light, dust, and moisture

The first winding should be discarded when using partial rolls that have been stored

Storage PHOTOCAP Encapsulant Sheets Cut to Dimension:

Temperature: 20-30 °C / 65-85 °F

Humidity: < 75% relative humidity

Time: Use within 24 hours

Protect sheets from sun light, dust and moisture