“Better by Design”

PVC Coated Conduit System
Overview

Ocal® Blue PVC coated conduit and fittings represent a complete corrosion protection package for your entire conduit system. This extensive product line includes the largest number of items in stock along with corrosion-resistant supports and patching compounds. With Ocal PVC coated conduit and fittings, you get corrosion protection that will extend the life of your electrical raceway system for years and years.

Only Ocal offers these advantages
• Only Ocal Blue Conduit is UL Listed with both the zinc coating and the PVC coating investigated and listed per UL 6.
• Only T&B supplies Ocal PVC coated conduit with hot dipped galvanized threads. Hot dip galvanizing is the process through which the steel shell is dipped in molten zinc, causing the zinc to penetrate the steel.
• Only T&B supplies Ocal PVC coated conduit with a full-undisturbed zinc coating under the PVC coating. This fulfills the requirement of NEMA RN-1 regarding undisturbed zinc coating over the conduit.
• Only Ocal PVC coated conduit is UL Listed for UV resistance.
• Only Ocal supplies “Double-Coat” coated fittings, enhancing the corrosion protection by applying urethane to the interior and exterior of the fittings before PVC coating.
• Only Ocal offers custom colors.
• Only Ocal offers local installation training and certification.

Standards met
• ANSI C80.1
• Federal Specification WW-C-581
• NEMA RN.1
• UL6
What is corrosion?
Corrosive elements cause millions of dollars in damage through lost time, materials and labor.

- Examples of corrosion

Corrosion protection of electrical conduit systems

Corrosion Protection Options

<table>
<thead>
<tr>
<th>Chemical Category</th>
<th>Chemical Examples</th>
<th>PVC</th>
<th>Urethane</th>
<th>304 Stainless Steel</th>
<th>316 Stainless Steel</th>
<th>Poly-carbonate</th>
<th>Cast Iron</th>
<th>Brass</th>
<th>Aluminum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solvents (excluding alcohols and aliphatic)</td>
<td>Acetone, toluene, ketones, etc.</td>
<td>NR</td>
<td>NR</td>
<td>L</td>
<td>L</td>
<td>NR</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Fuels</td>
<td>Jet fuel (alcohol based and aliphatic solvent based)</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Plating Solutions</td>
<td>Chrome, nickel, copper, brass, gold, zinc, etc.</td>
<td>L</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Salts and Alkaline Materials</td>
<td>Caustic soda, caustic potash, alkaline cleaners, etc.</td>
<td>L</td>
<td>F</td>
<td>L</td>
<td>F</td>
<td>NR</td>
<td>NR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild Acids</td>
<td>Low-concentration hydrochloric, sulfuric, fruit acids, glycolic, etc.</td>
<td>L</td>
<td>S</td>
<td>L</td>
<td>L</td>
<td>S</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Strong or High-Purity Acids</td>
<td>Nitric, hydrofluoric, etc.</td>
<td>S</td>
<td>S</td>
<td>F</td>
<td>F</td>
<td>S</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Oxidizing Agents</td>
<td>Bleach, chlorine, hydrogen peroxide, etc.</td>
<td>L</td>
<td>S</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>S</td>
<td>NR</td>
<td>NR</td>
</tr>
</tbody>
</table>

Chemical Compatibility Legend

Suitability Description | Compatibility Rating
--- | ---
Rated for all Fumes, Splash & Liquid | L
Rated only for Fumes & Splash | S
Rated for Fumes only | F
Not Recommended | NR

The chart above provides a general guide for the end-user to choose the most suitable material for his corrosion protection needs.

As you can see, PVC coated conduit and fittings are suitable for almost all applications. When it comes to PVC coated conduit systems, there is no higher quality than Ocal®.
“Better by Design”

Ocal manufacturing process

Introduction:
Ocal is the only PVC coated conduit system in the industry to fully comply with all standards for proper use and protection in corrosive environments mandated by UL6, NEMA RN-1 and ANSI C80.1. It is manufactured right here in the United States by Thomas & Betts in our Jonesboro, TN manufacturing facility.

The Process of manufacturing PVC Coated Conduit
- The process begins with 20-foot sticks of raw steel shell.
- The steel shell is then cut and threaded — before galvanizing.
- The cut and threaded conduit is then prepared for the hot-dipped galvanizing process.
- The threaded shell is immersed in a molten zinc bath. This hot-dipped galvanizing process enables the zinc to penetrate the steel, providing the best possible protection. After the conduit is extracted from the zinc bath, super-heated steam is blown through the interior and over the outside of the conduit to remove any slag.
- The ends of the conduit are then heated enough to blow excess zinc out of the thread cavities. Thomas & Betts is the only manufacturer of steel conduit that provides hot-dipped galvanized threads in addition to the conduit itself. Other methods such as “Hot-Galvanizing” provide only a “sprayed-on” zinc coating.
- Prior to the PVC application, the inside diameter of each conduit has 2 mils of blue urethane applied to the inside as well as the threads.
- After priming, the conduit is heated then rolled through liquid plastisol; achieving complete coverage of 40 mils in thickness.

The Process of manufacturing PVC Coated Fittings
- Fittings are cleaned and then sprayed on the inside and the outside with 2 mils of Blue Urethane. This gives the fittings corrosion protection on the exterior as well as the interior — the fittings are “double-coated”
- 40 mils of PVC is then applied to the exterior of the fitting.
- Covers are coated with a molded flange and conduit bodies are molded with a flat surface to ensure a superior seal.

Thomas & Betts works hard to provide the only standard-compliant PVC coated conduit on the market today. It is this dedication to superior quality that makes Ocal “Better by Design.”
Evaluating corrosion protection of PVC coated conduit

When evaluating any electrical raceway conduit or fittings, applicable standards should be referenced. The three standards that address the design and performance of PVC coated rigid steel conduit are ANSI C80.1, UL6 and NEMA RN-1. ANSI C80.1, UL and NEMA have determined the appropriate ASTM standards and test methods that apply.

Hot-Dip Galvanized Threads

Since electrical conduit systems “breathe,” the threads will be exposed to the corrosive environment for the duration of the installation. NEMA RN-1-1989 is the Electrical Industry’s standard for PVC externally coated galvanized rigid steel conduit. Section 2.1 of this standard states, “Where unusually corrosive environments are encountered, it is recommended that threads be given additional protection suitable for the intended application.” Hot Dipped Galvanizing is the process through which the steel shell is dipped in molten zinc, causing the zinc to penetrate the steel. Only Ocal hot dip galvanizes the threads of the conduit, in addition to the conduit itself. This gives the threads the corrosion protection necessary in corrosive environments.

A compelling demonstration of the protection that Hot-Dip Galvanizing provides is shown below, using a common corrosive agent, salt, on hot-dipped galvanized threads versus threads that are not. UL 6, the standard for rigid metal conduit, references ASTM B117 for evaluating protective coatings. Below are the results of a salt-fog test using the standard test method ASTM B 117.

Examples of Spray Galvanized (Hot-Galvanized) Threads after 42-day salt-fog test

![Examples of Spray Galvanized (Hot-Galvanized) Threads after 42-day salt-fog test](image)

Examples of Hot-Dip Galvanized Threads after 42-day salt-fog test

![Examples of Hot-Dip Galvanized Threads after 42-day salt-fog test](image)
Evaluating corrosion protection of PVC coated conduit (cont.)

Galvanized conduit underneath the PVC coating — Preece Test

With so much riding on the integrity of their electrical conduit systems, facilities need the superior protection offered by the Thomas & Betts Ocal PVC Coated Conduit Systems. The simple fact is that Ocal is the only PVC coated conduit system to comply fully with the design and performance standards for PVC Coated Conduit set forth by UL6, NEMA RN-1 and ANSI C80.1.

ANSI C80.1, UL6 and NEMA RN-1 have determined the appropriate ASTM standards and test methods that apply, and the Preece test is one test that must be passed in order to be in full compliance.

Why is the Preece test relevant to PVC coated conduit?

In cases where the PVC protection is accidentally breached, resulting from cuts, scrapes, etc, it is important to have a second line of defense – a zinc or “galvanized” coating. The zinc coating will significantly slow the corrosion and give more time for repairs. Conduit systems without adequate zinc protection underneath the PVC coating are most likely to suffer catastrophic corrosion damage in such cases. This is why NEMA RN-1, section 3.1.1 requires the proper and correct treatment of galvanized conduit before it is PVC coated. It states “The surface shall be cleaned in such a manner that the galvanized surface of the conduit is not harmed or eroded.”

The purpose of the Preece test is to evaluate the zinc coating on galvanized rigid conduit to ensure adequate protection from corrosion per UL 6.2.2. The test will also determine if the surface of the conduit has been damaged as a result of the preparation for PVC coating.

In evaluating the test results, the conduit receives a “passing grade” when the sample does not show a bright, adherent deposit of copper after four 60-second immersions in the Copper Sulfate solution. The conduit showing the bright, firmly adhering copper has failed to provide adequate zinc protection against corrosion.

The Preece test follows procedures set forth by UL 6.2.2 and ASTM A239 and is the test recognized by UL6, NEMA RN-1 and ANSI C80.1 to adequately assess zinc protection for rigid steel conduit. Only the Ocal line of PVC coated conduit systems, manufactured by Thomas & Betts, complies with UL6, NEMA RN-1 and ANSI C80.1 without exception.
Evaluating adhesion of PVC coating

The evaluation process for adhesion of PVC coating on conduit is governed by NEMA RN-1, section 3.8; Adhesion, which states that, “The adhesion of the PVC coating to the conduit shall be greater than the strength of the coating itself.” This adhesion test is straightforward and simple. There are no specialized conditions necessary to perform this test. Ocal routinely performs quality control testing that includes the adhesion test, on conduit as it rolls off the line. Conduit that passes this test demonstrates that the adhesion will provide years of trouble-free service.

The following demonstration shows Ocal PVC coated conduit being subjected to the Adhesion test.

**Step 1** consists of two cuts through the plastic to the substrate along the length of the conduit at approximately ¼” apart, three to four inches in length. A third perpendicular cut crosses the lengthwise cuts.

**Step 2** calls for the edge of the PVC that was cut on the perpendicular to be carefully lifted to form a plastic tab.

**Step 4** is the evaluation of the test, which in this case, results in a passing grade for Ocal. This result is more testimony to the fact that Ocal is “Better by Design.”

**Step 3** is the evaluation of the test, which in this case, results in a passing grade for Ocal. This result is more testimony to the fact that Ocal is “Better by Design.”

**Results**

With Ocal PVC coated conduit and fittings, you get corrosion protection that will extend the life of your electrical raceway systems for years and years.
For U.S. Customer Service and Order Inquiries, call 1-800-816-7809 or fax 1-800-816-7810.

For International Service and Order Inquiries, call (U.S.) 901-252-5400 or fax 901-252-1330.

For Canadian Customer Service and Order Inquiries, call 450-347-5318 or fax 450-347-1976.

For U.S. Technical Support, call 1-888-862-3289 or fax 901-252-1321.

For International Technical Support, call (U.S.) 901-252-5000, enter 1, 6672.

For Tool Service and Repair, call 1-800-284-TOOL (8665).

Call 1-800-858-6022 for our toll-free 24-hour Fax-On-Demand service for technical documentation, brochures and product literature, or contact our Internet site at www.tnb.com.

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Printed in U.S.A. 07/06/10M Order No. GM-2006