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Certification and Regulatory Acceptance of Electrical Conduit Products

At first glance, electrical conduit may not seem like the most impressive or complex product, but its simple nature disguises its critical importance. Conduit is used to safely route electrical wiring through a building, protecting wires from damage and preventing mishaps caused by accidental encounters with live wires. Conduit systems vary in material and design depending on the needs of the installation, and may be either plastic or metal and either rigid or coiled.

Because conduit plays such an important part in an electrical system, there are strict requirements for electrical conduit certification in both the U.S. and Canada.

Regulatory Requirements in the U.S.

In the U.S., the Occupational Safety and Hazard Administration (OSHA) oversees the Nationally Recognized Testing Laboratory, or NRTL, program to approve laboratories for the listing and labeling of electrical products. To be eligible to approve electrical products, an organization must be

designated as a NRTL by OSHA, which is a formal recognition that the lab meets the requisite qualifications to test and certify electrical conduit. Products listed and labeled by a NRTL meet the requirements of the National Electrical Code.

It is a misconception that a UL certification mark is required for electrical conduit to be accepted in the U.S. The only requirement is that the certification agency be recognized as a NRTL.

NSF International is designated as a Nationally Recognized Testing Laboratory by OSHA.

Regulatory Requirements in Canada

To certify electrical conduit in Canada, an agency must be accredited by the Standards Council of Canada, also known as the SCC.

NSF International is accredited by the SCC to approve electrical conduit products in Canada.

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Rigorous Certification Process

Over the last decade, NSF International has been steadily testing and certifying nonmetallic electrical conduit products, including pipe, fittings, bends and solvent cements to industry standards such as:

- UL 651
- CSA C22.2 No. 211.1
- CSA C22.2 No. 211.2
- NEMA TC 2

Following the success of this certification program, NSF has now added PVC foam core pipe and high density polyethylene pipe and tubing to its original listing offering of PVC solid wall conduit and fittings. To date, the program has grown to over 200 certified products, with widespread acceptance among utilities, regulators and engineers.

To be certified by NSF, electrical conduit products must meet the following requirements:

- Initial and annual performance testing to an applicable standard (see table below), many of which require qualification testing on every size of conduit produced by the manufacturer
- Initial and regular unannounced inspections of the production facility
- Verification that manufacturers are following an appropriate quality control program that includes rigorous and frequent in-plant QC testing

NSF certification may also include evaluations such as resistance to sunlight and use with 90° C wire, at the option of the manufacturer.

Examples of Products and Applicable Standards

STANDARD	TITLE OF STANDARD
CSA C22.2 No. 327	HDPE conduit, conductors-in-conduit, and fittings
CSA C22.2 No. 211.1	Rigid types EB1 and DB2/ES2 PVC conduit
CSA C22.2 No. 211.2	Rigid PVC (unplasticized) conduit
NEMA TC 2	Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
NEMA TC 6 and 8	Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installations
UL 651	Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 651A	Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit

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Finding Products That Meet the Requirements

Products certified by NSF for electrical conduit end use in the U.S. are marked with either the **NSF NRTL <product standard>** or **NSF electrical <product standard>** mark. For example, a product certified to UL 651 could be marked either:

EXAMPLES

NSF Electrical UL 651

NSF NRTL UL 651

Products certified for both the U.S. and Canada carry the cNSFus mark, as shown below.

NSF C US Electrical UL 651 CSA C22.2 211.2

All products certified by NSF for electrical conduit end use are listed at www.nsf.org/certified-products-systems.

Article by Elizabeth Kelley, Senior Account Manager – Plastics

Cured-In Place Pipe Liners: A Cure for an Aging Infrastructure

Much of the United States' more than one million miles of pipe is coming to the end of its useful life. The deteriorating condition of the country's water infrastructure cannot be denied, with some cities using water pipe installed before the Civil War and others still using wooden pipe. While these may be extreme examples, the American Water Works Association (AWWA) has called for the U.S. aging water infrastructure to enter a "replacement era."

One option to address the need for replacement is the use of cured-in-place pipe, or CIPP. This is a resin-impregnated tube used to line existing pipe, which can extend the life of the pipe by many years. The lining of existing pipe is performed using trenchless technology, meaning that it can be installed without the need for extensive digging. The main advantage provided by trenchless installation of CIPP liners is that service lines can more quickly be put back into commission at a lower cost than could be achieved by traditional repair methods.

CIPP pipe liners are made from a variety of materials, but are generally installed using similar methods. A felt tube comprised of polyethylene, fiberglass or other material is impregnated with resin at the product manufacturing facility. These resins are typically epoxy, vinyl ester or polyester, and include a chemical catalyst or hardener to facilitate curing. The resin-impregnated liner is then transported to the installation site, often under refrigerated conditions to prevent the resin from curing prematurely. The section of pipe to be repaired will have been taken out of service and thoroughly cleaned in preparation for the installation of the liner.

Most CIPP liners are installed using an inversion method, where a scaffold tower or pressure vessel is used to apply air or water pressure to turn the liner inside out as it is pushed along the length of the host pipe. Alternately, some CIPP liners are installed by winching into place through an access site and then inflated to fill the circumference of the host pipe.

Although the resin-impregnated liner will typically cure at a slow rate under ambient temperature, the cure is usually accelerated by flowing hot water or steam through the liner or by pulling a UV light train through the liner.

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Following the cure, the ends of the liner are trimmed and sealed flush with the pipe ends, and the rehabilitated pipe is inspected before bringing the repaired section of pipe back into service.

CIPP liners may be certified to NSF/ANSI 61: *Drinking Water System Components – Health Effects* for potable water applications or to NSF/ANSI 14: *Plastics Piping System Components and Related Materials* for drain, waste and vent applications. Certification to either standard requires a complete audit of the manufacturing facility and testing of the product prior to certification, followed by regular auditing and testing cycles to ensure continued compliance of the product to the applicable standard(s).

Certification of a CIPP liner to NSF/ANSI 61 entails a complete review of the product's formulation down to the single-chemical level. This information is used to create a specialized test procedure for any contaminants that may leach from the product into the drinking water supply. Once the testing is ready to be performed, the product manufacturer installs and cures its product within a short section of host pipe, using the same methods that would be used in a field installation. This test section of pipe is shipped to NSF International laboratories, where it undergoes leachate testing according to the requirements of NSF/ANSI 61. The resulting test water is analyzed for contaminants that may have leached from the CIPP liner and the level of each contaminant is quantified.

All contaminants must be present at levels below the health effects criteria set forth in NSF/ANSI 61 in order to pass the test required to achieve certification.

NSF/ANSI 14 certifies CIPP liners to the performance requirements of ASTM F1216: *Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube* for drain, waste and vent applications. Performance tests include flex modulus, flexural strength and gravity pipe leakage. Flex modulus and flexural strength tests determine the ability of the CIPP liner to withstand the pressure and external load experienced by buried pipe. Gravity pipe leakage testing is an exfiltration test that measures water penetration from the CIPP liner.

CIPP liners listed to NSF/ANSI 14 are tested to these performance requirements for initial certification and on an annual basis, ensuring continued compliance to ASTM F1216.

CIPP liners that meet the requirements of NSF/ANSI 61 or NSF/ANSI 14 bear the NSF mark and can be found in NSF's public listings at www.nsf.org/certified-products-systems.

Perma-Liner Industries LLC

Article by Katie Foster, Technical Operations Manager – Municipal Water Products and Liza Nero, Senior Account Manager – Distribution System Components

NSF CERTIFICATION OPTIONS FOR CURED-IN PLACE PIPE [CIPP]		
STANDARD	NSF/ANSI 61	ASTM F1216
APPLICABLE END USE	Repair of potable water pipe	Repair of drain, waste, vent pipe
REQUIRED TESTING	Health Effects - Leachate testing	Performance - Flex modulus, flexural strength, gravity pipe leakage

Ensuring the Quality Compliance of Plastic Pipe and System Components

Producing quality plastic piping systems is highly dependent on the quality of raw materials, precise monitoring of the manufacturing process and frequent quality control testing. Manufacturers know that the one consistent aspect of manufacturing is change. In order to stay competitive, meet production needs, reduce costs and fulfill quality goals, successful manufacturers are constantly having to implement change in their operations, suppliers, equipment, raw materials and processing parameters. Each member of their supply chain also is doing the same. Any one of these changes has the potential to affect the quality of a plastic piping product. Regular, impartial testing and auditing by NSF International confirms pipe, fittings and components are consistently meeting or exceeding quality requirements over time.

NSF/ANSI 14: *Plastics Piping Components and Related Materials* is an industry standard created in 1965 to establish rigorous criteria for evaluating the public health and safety requirements of plastic piping.

Today, it is the most widely accepted and specified standard for plastic piping systems, raising the bar on quality for these products. When plumbing codes and engineered specifications require NSF/ANSI 14, you can be assured each of the following requirements has been met:

- ☑ Initial and annual performance testing to the applicable pipe or fitting standards
- ☑ Initial and annual NSF/ANSI 61 health effects testing to ensure pipe is suitable for drinking water
- ☑ Verification of the pipe material's long-term strength rating
- ☑ Testing three times per year for residual vinyl chloride monomer (RVCM) (vinyls only)
- ☑ Initial and annual physical properties testing on ABS, PE, PERT, PVC, and CPVC materials
- ☑ Regular unannounced inspections of the manufacturing location
- ☑ Verification that manufacturers are following an appropriate quality control program

Required QC Testing for Manufacturers

In addition to the extensive testing performed at NSF's laboratories, quality-control tests are required to be performed by manufacturers. These tests ensure raw materials and finished products meet the minimum requirements found in the product standards. QC tests are meant as a quick screening tool used at the point of manufacture. Raw materials or products that pass the tests may be used for production and those that don't are scrapped or reprocessed. Examples of this include:

- > Critical dimensions
- > Burst pressure
- > Impact
- > Crush
- > Flattening
- > Stiffness
- > Density
- > Tensile strength

Most in the plumbing industry understand the critical nature of rigorous testing, inspection and certification. Still, some third-party certifiers may not enforce QC requirements or require ongoing monitoring testing. This creates a somewhat uneven playing field among certifiers. Fortunately, the major model plumbing codes and many engineering specifications require NSF/ANSI 14 to keep the bar high for the plastics plumbing industry. Looking for the NSF mark ensures the most rigorous requirements are being met.

Article by Jeremy Brown, Senior Technical Reviewer – Plastics NSF

Certification vs. Compliance: What Is the Difference?

Although the terms certification and compliance sound similar, they are, in fact, quite different. When a company makes the claim that it is compliant with an NSF standard, it is stating that the product adheres to the requirements of the standard but it does not communicate how or by whom compliance was determined. Certification means that an independent third party has physically evaluated, tested and certified the product to be in conformance with all the requirements of the standard.

Compliance

When a company claims compliance, it is more than likely a self-claim and it may or may not be valid. A product certified by NSF International, on the other hand, provides proof of compliance and lets you know the company adheres to the strict standards and procedures imposed by NSF and its accreditation organizations. Compliance is rarely accepted by authorities having jurisdiction. This is because plumbing codes and most waterworks regulations require products to be third party certified.

Certification

From extensive product testing and material analyses to plant inspections, every aspect of a product's development is thoroughly evaluated before it can earn NSF certification. Most importantly, NSF certification is not a one-time event, but involves regular on-site audits of manufacturing facilities and regular surveillance of products to ensure that they continue to meet the same high standards required to maintain certification over time. If for any reason a product fails to meet one or more certification criteria, NSF requires that the identified issue is resolved within a specified timeframe in order to maintain certification.

Products that earn NSF certification may claim to be "NSF certified" or "NSF listed" and will display the applicable NSF certification mark to show that they have been certified by one of today's most respected independent product testing and certification organizations.

NSF CERTIFICATION LANGUAGE

- ☑ "NSF certified/NSF listed"
- ☑ "Certified by NSF"
- ☑ "Tested and certified by NSF"
- ☑ "Tested and certified by NSF International"
- ☑ "ABC company's product is certified by NSF to NSF/ANSI #"

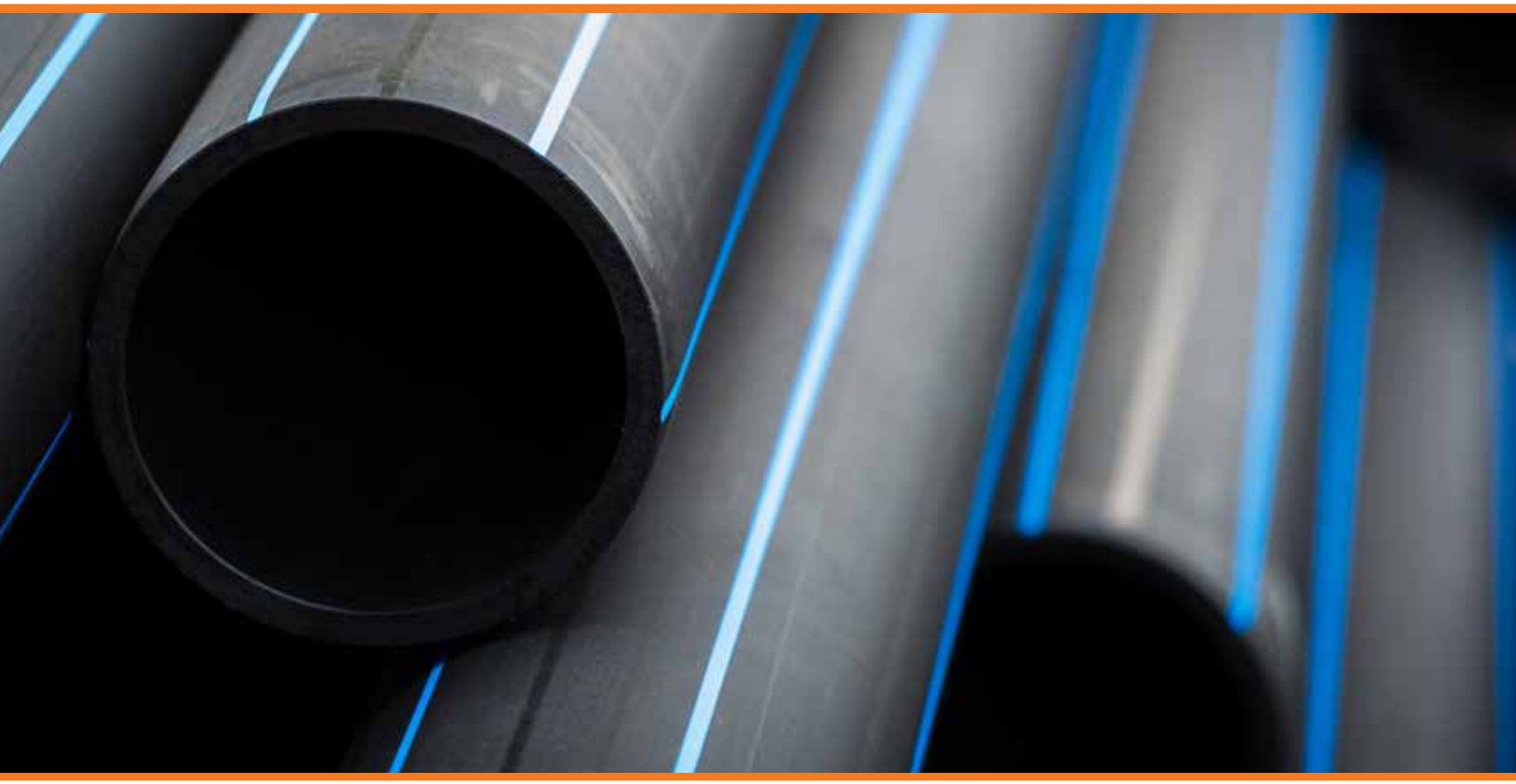
COMPLIANCE LANGUAGE

- ☑ "Compliant with NSF/ANSI #"
- ☑ "Tested to the requirements of NSF/ANSI #"
- ☑ "Meets the requirements of NSF/ANSI #"
- ☑ "ABC company's products x has been evaluated against NSF/ANSI #"

To verify a product has been certified by NSF, visit the official listings: www.nsf.org/certified-products-systems.

Did you know?

Use of the NSF mark, or claims of NSF certification or listing, are opportunities exclusive to those companies certified by NSF International.



QUESTIONS? CALL THE NSF HOTLINE

The NSF Regulatory and Consumer Information Hotline is a valuable resource for plumbing officials, inspectors, consumers and manufacturers who have questions about product certification. The hotline, which fields more than 15,000 inquiries each year, can help with your questions about NSF certification marks, the certification process and where to find certified products. If you have a question or comment, call us at **+1.800.673.8010** or **info@nsf.org**.

NSF STANDARDS AVAILABLE FOR REVIEW

Contact us for a complimentary version of any NSF water-related standard.

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