

APPROVAL REPORT

Hilti CP 678
FIRE RETARDANT CABLE COATING
FOR GROUPED ELECTRICAL CABLES

Prepared For:

Hilti AG
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Fuerstentum
Liechtenstein

3005329
Class 3971
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Factory Mutual Research



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from

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I INTRODUCTION

1.1 Hilti AG requested Factory Mutual Research Corporation (FMRC) Approval of their Hilti CP 678 Fire Retardant Cable Coating for use as a protective coating for grouped electrical cables.

1.2 Hilti CP 678 Cable Coating is a fire retardant, asbestos-free, non-toxic, flexible, intumescent coating. It is white in appearance before and after curing.

1.3 The product contains water, and therefore precautions should be taken to ensure that any storage, transportation, or application of the material is done at temperatures above freezing and in accord with the manufacturer's instructions.

1.4 These coatings prevent flame spread in conductors when exposed to a moderate fire source that might occur from arcs or sparks falling or occurring in the cable tray, or from fire exposure of combustible trash or foreign material around the cable(s) in grouped or trayed conditions. These coatings were not tested to maintain cable protection under severe and extended fire exposure conditions.

When applied according to the manufacturer's instructions, the protective coating does not of itself require electrical derating.

Observe any special instructions listed with the product.

II DESCRIPTION

2.1 Appendix 1 reproduces the manufacturer's data sheet.

2.2 Surfaces to be coated with Hilti CP 678 Cable Coating must be clean and free from oil, grease, and dirt. Cleanup is accomplished with water before the material cures.

2.3 The most effective application of this coating is by airless equipment or brush. The coating dries to the touch in 6 to 8 hours and cures thoroughly in 24 to 48 hours, depending on cable temperature, ambient temperature, and relative humidity. Minimum required thickness for dry coating is 1/16 in. (1.59 mm).

2.4 After curing, the coating remains sufficiently pliable so that individual cables may be removed from a grouping if necessary, and damaged portions of the protective coating may be repaired by spraying.

The coating has good adhesive properties and will stick readily to vertical and overhead surfaces. When exposed to flame, it does not melt or drip, but merely intumesces.

III MARKINGS

Hilti CP 678 Cable Coating is available in 20 kg resealable plastic buckets with special packaging available upon request. The manufacturer's name and address, product name, batch number, application instructions and the Factory Mutual Approval mark are shown on the container label.

IV TESTS

4.1 Four strips of Hilti CP 678 Cable Coating, 18 in. (457 mm), 3 in. (76 mm) wide and 1/16 in. (1.59 mm) thick were prepared and conditioned at room temperature. Two specimens were clamped vertically and parallel 1/2 in. (13 mm) apart to expose 17 in. (432 mm) from the free (lower) end. A Bunsen burner with a 2 in. (51 mm) total flame height with a 1 in. (25 mm) inner core was then positioned vertically under the free end of one specimen for a two minute period with the flame cone just touching the specimen. Examination at the end of the fire exposure period showed flames did impinge and scorch the specimens up to 5 in. (127 mm) above the lower gauge mark. There was some disintegration of the specimen below the 3 in. (76 mm) gauge mark when handled by squeezing lightly between the thumb and two fingers. The area above the 3 in. (76 mm) gauge mark remained intact. Direct flame impingement did cause some loss of flexibility, but this area was considered structurally sound.

4.2 The test outlined in paragraph 4.1 was repeated with the second set of specimens and the results were similar. These test results satisfy Approval requirements which allow no degradation of specimen above the 3 in. (76 mm) gauge mark and no scorching or burning above the 17 in. (432 mm) gauge mark.

4.3 Ten 3 ft (0.9 m) long samples of 2/0, 600 V, 90°C, 285 ampere rated (National Electrical Code) copper cables were given a high potential check of 1000 V, plus 200 percent of rated voltage for one minute. The cables were wrapped tightly in aluminum foil and the potential applied between the foil and the copper conductor and any leakage current in milliamperes was recorded for each cable sample. Cables were then coated according to the manufacturer's instructions and, after the recommended curing time, this high potential test was repeated to ensure no change or damage occurred to the cable insulation prior or during coating. (This test is also repeated after the fire tests described below as a means of determining any coating breakdown).

4.4 Three 3 ft (0.9 m) long coated cables were individually heated electrically with 150 percent of rated current (428 A) until the copper conductor stabilized at 190°F (88°C). A flame from a Meeker gas burner was adjusted to give an overall flame height of 5 in. (127 mm) with a 3 in. (76 mm) inner cone (natural gas) and applied to the horizontally positioned cable for two minutes with the tip of the inner cone touching the bottom of the coated cable. At the end of a two minute flame exposure, there was simultaneous burner flame cutoff and electrical shutdown. All flaming extinguished immediately. After cooling, the charred and scorched area exposed to the burner flame was measured and found to be 3 to 4 in. (76 to 102 mm) in length. This satisfies Approval requirements that burning shall not continue longer than one minute after flame cutoff and the burned (exposed area) shall not exceed 9 in. (228 mm) in length.

4.5 Results on the second and third cables exposed to the test described in paragraph 4.4 were similar. These three cables were then given a repeat of the high potential test described in paragraph 4.3 and current leakage averaged 0.72 milliamperes. This satisfies the Approval requirement that leakage current shall not exceed 5.0 milliamperes when measured between the conductor and the outer jacket during this high potential test.

4.6 A 3 ft (0.9 m) length of cable coated with Hilti CP 678 Cable Coating was subjected to a saltwater test consisting of 8 hours submerged alternating with 16 hours drying in a 24 hours span in a 1 percent saltwater solution over a 30 day period with the water temperature at 150°F (66°C). At the end of this period, the sample was allowed to dry for 36 hours. There was no disintegration or deterioration of the coating. The cable sample was then subject to the fire tests described in paragraph 4.4 and the required high potential test; the results of these test were satisfactory.

4.7 Two 3 ft (0.9 m) lengths of cable coated with Hilti CP 678 Cable Coating were subjected to alternating temperatures of 160°F (71°C) and -40°F (-40°C) for 24 hours over a two week duration. At the end of this accelerated aging test period, the cables were subjected to the test described in paragraph 4.4 and the high potential test. The results of these tests were satisfactory.

4.8 A coated cable section was subjected to an ampacity test prior to which a No. 28 gauge chromel-alumel thermocouple was imbedded in the bare copper conductor. The cable was then subjected to its rated current carrying capacity of 285 A (according to the National Electrical Code) until the temperature indicated by the thermocouple had stabilized, in approximately one hour at 140°F (60°C). This is well below the 90°C maximum temperature rating of the cable insulation; therefore, no electrical derating is necessary when a cable is sprayed with Hilti CP 678 Cable Coating according to the manufacturer's recommendations.

4.9 A sample cable length coated with Hilti CP 678 Cable Coating has been under actual weather exposure test conditions for approximately ten months. The coated cable sample appears satisfactory at this time; however, continued observation of this sample is planned to supplement present field experience.

V FACILITIES AND PROCEDURES AUDIT

The plant manufacturing this product has been subjected to a FMRC Facilities and Procedures Audit with satisfactory results.

VI CONCLUSIONS

Hilti AG's CP 678 Cable Coating meets Factory Mutual Approval requirements.

ORIGINAL TEST DATA: Project Data Record 3001128

ATTACHMENTS: Appendix 1, Manufacturer's Product Data Information

EXAMINATION AND TESTS BY: C.R. Ribak

REPORT BY:



C. R. Ribak
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REVIEWED BY:



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Appendix 1**Hilti CP 678 CABLE COATING**

Product Description	<p>Hilti CP 678 is a single component expandable fire resistant coating for grouped cables with combustible insulation.</p> <p>Hilti CP 678 expands approximately 50 times its original size when exposed to heat. The expanded material forms a char which insulates against the heat of the fire.</p> <p>Hilti CP 678 is a water base compound and has excellent adhesion properties.</p>
Advantages	
Fire Resistance	Will not burn in liquid or solid state. Under fire conditions, forms a char and prevents spread of flames along cables in cable trays, vertical and horizontal.
Application	Single component, water base material. Equipment, tools, and spills easily cleaned with water.
Non-toxic	Contains no abestos, harmful solvents, or dangerous chemicals.
Typical Usage	<p>Hilti CP 678 is suitable as a coating for grouped electrical cables or individual cables having combustible insulation.</p> <p>Hilti CP 678 provides a low cost fire protection for cables and can be applied by brush or airless spraying equipment.</p>

Appendix 1, continued**Typical properties**

Appearance:	White
Tack Free Time:	6 - 8 Hours
Specific Gravity:	1.32 gm/cc \pm 0.03 gm/cc
Solids by Volume:	75% \pm 1%
Flash Point:	None determined
Solvent:	Water
Storage Limits:	Keep from freezing
Shelf Life:	Approximately 18 month
Application and Hazard: Class:	All ingredients of Hilti CP 678 are physiologically and not subject to identification.
Packaging:	Hilti CP 678 is packaged in 20 kg quantities in resealable plastic buckets. Special packaging is available upon request.

Recommendations for the use of our products are based on tests we believe to be reliable. Manufacturer and seller are not responsible for results where the product is used under conditions beyond our control. Under no circumstances will Hilti be liable for consequential damages or damages to anyone in excess of the purchase price of the product or services. Specifications are subject to change without notice.

The information given above is correct to the best of our knowledge. We reserve the right to change the information without prior notice.