NATIONAL BUREAU OF STANDARDS REPORT

5414

WATER PERMEABILITY TESTS OF THREE TRANSPARENT WATERPROOFING MATERIALS APPLIED TO CONCRETE MASONRY WALLS

by

James O. Bryson

Report to

Department of the Air Force

NBS

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

THE NATIONAL BUREAU OF STANDARDS

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NBS PROJECT		NBS REPORT
1000-30-4801	July 29, 1957	5414

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Abstract

Three transparent waterproofing materials were tested for water permeability as coatings applied to concrete masonry walls. These materials were Shure-Ceel No. 5, Porr-Kloz, and S. K. Laboratories Acrylates. The three concrete masonry walls tested prior to application of the coatings were rated as "Very Poor". They were retested after application of coatings and were given a rating of "Very Poor" based on the following criteria: time to failure as indicated by appearance of first damp spot, first visible water and maximum rate of leakage during the first 24 hr of test.

1. INTRODUCTION

At the request of the U. S. Air Force, three samples of transparent waterproofing materials were tested to determine their effectiveness when applied to permeable masonry walls in resisting the penetration of wind-driven rain.

The transparent waterproofing materials tested were Shure-Ceel No. 5, manufactured by Erlen Chemical Company, Philadelphia, Pennsylvania, Porr-Kloz, manufactured by Maintcorr, Inc., Wash., D. C., and S. K. Invisible Clear Primer and Invisible Top Coat, manufactured by S. K. Laboratories, Inc., Baltimore, Maryland. The three samples were donated for testing by the respective manufacturers.

The samples were tested by applying them to the faces of test walls of known permeability. After the coatings were

applied the permeability of each test wall was again measured. The performances of the walls before and after treatment were compared to measure the ability of the coatings to resist the penetration of wind-driven rain. Each sample was applied to a wall in accordance with the procedure recommended by the manufacturer.

The testing procedure and the performance ratings are described in Building Materials and Structures Report BMS95.

2. TRANSPARENT WATERPROOFING COATINGS

A sample of each waterproofing material was subjected to a laboratory examination to determine its density, non-volatile content and vapor permeance.

The density was determined by weighing a known volume of the material at a temperature of 84° ± 1°F. The non-volatile contents were determined by drying the material to a constant weight at 108°C. The vapor permeance determinations were made at 73°F and 50 percent R.H. and in accordance with ASTM Specification C355-54T, desiccant method.

2.1 Shure-Ceel No. 5

A one gallon can of Shure-Ceel No. 5 was received for testing. The laboratory examination showed that the material had a density of 6.7 lb/gal, a non-volatile content of 22.51 percent and a vapor permeance of 0.31 perms.

2.2 Porr-Kloz

A one gallon can of Porr-Kloz was received for testing. The laboratory examination showed that the material had a density of 6.4 lb/gal, a non-volatile content of 14.94 percent and a vapor permeance of 0.09 perms.

2.3 S. K. Primer and S. K. Top Coat

A one gallon can of S. K. Primer and a one gallon can of S. K. Top Coat materials were received for testing. The laboratory examination showed that the S. K. Primer, and S. K. Top Coat had densities of 8.8 lb/gal and 7.5 lb/gal, and non-volatile contents of 44.57 percent and 23.69 percent, respectively. The vapor permeance of both the primer and the top coat coating was 0.05 perms.

3. MASONRY WALL SPECIMENS

Three concrete masonry test walls were constructed to test the waterproofing materials. The concrete masonry units used in constructing these walls were nominal 8- by 8- by 16-in. units and were supplied by the McGuire Air Force Base.

The test walls were approximately 8-in. thick, 40-in. long and 50-in. high. They were constructed by an experienced mason and were similar to the concrete masonry test walls described in Report BMS95, "Test of Cement-Water Paints and Other Waterproofings for Unit-Masonry Walls." The mortar contained 1:3 parts by volume of type II masonry cement and masonry sand.

3.1 Application of the Coatings

The waterproofing materials were applied to the walls in accordance with the manufacturers' recommendations. The faces of the walls were clean and dry before the materials were applied. Wool rollers 7-in. wide were used in spreading the materials over the wall faces. Each coat was allowed to dry for 24 hr before applying the next coat.

The Shure-Ceel No. 5 material was applied to wall CW-1 in two coats. The first coat was applied at a rate of approximately 86 sq ft/gal and the second coat at a rate of approximately 134 sq ft/gal. The Porr-Kloz material was applied to wall CW-2 in three coats. The rates of applications for the first, second and third coats were approximately 160 sq ft/gal, 260 sq ft/gal, and 261 sq ft/gal, respectively. The S. K. Primer material was applied to wall CW-3 as a first coat and the S. K. Top Coat material was applied as the second coat. The rates of application for the two coats were approximately 147 sq ft/gal for the first coat and 176 sq ft/gal for the second coat. The treated walls were stored indoors in a well ventilated room for a minimum of six days before they were tested for permeability.

4. WATER PERMEABILITY TESTS

The test exposures were as described in Report BMS95 and simulated an exposure to a heavy rain driven by a 50 mph wind. The walls were tested before and after they were treated with the waterproofing materials.

4.1 Test Apparatus and Use

The exposed face of the test wall formed one side of a pressure chamber. Water at the rate of 40 gal/hr was applied to the top of the exposed wall face from a tube containing a line of small perforations spaced 1 in. apart. The air pressure on the exposed wall face was maintained at 10 lb/ft^2 above atmospheric pressure, which is equivalent to a hydrostatic head of 2 in. The tests were continued for a minimum of one day.

4.2 Ratings of Wall and Coating Permeability

The water permeability test ratings are listed below and are similar to those described in Report BMS95.

Excellent (E).--No water visible on back of the wall (above the flashings) at the end of 1 day. Not more than 25 percent of the wall area damp at the end of 3 days. No leaks[1] through the wall in 3 days.

Good (G).--No water visible on the back of the wall at the end of 1 day. Less than 50 percent of the wall area damp at the end of 1 day. No leaks through the wall at the end of 1 day.

Fair (F).--No water visible on back of the wall during first 3 hours, but visible at end of 1 day. The rate of leakage through the wall less than 1 liter/hr at the end of 1 day.

Poor (P).--Water visible on back of the wall in 3 hr or less and at the end of 1 day. Rate of leakage less than 5 liters/hr at the end of 1 day.

Very Poor (VP).--Rate of leakage through the wall equal to or greater than 5 liters/hr at the end of 1 day.

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[1] Leaks are defined as follows: A leak is a flow of water from one or both flashings, the total rate of flow being equal to or greater than 0.05 liter/hr.

5. RESULTS

The test data and ratings for the three walls, both before and after they were treated with the waterproofing materials, are given in Table 1. The three test walls, untreated, received ratings of Very Poor and performed similarly under test except that wall CW-2 had a lower maximum rate of leakage than both wall CW-1 and wall CW-3. However, the "time to failure" for all three walls, as indicated by dampness on back, visible water on back and flashing leak, was about 2 min.

The treatment of Shure-Ceel No. 5 on wall CW-1 made the wall highly repellent at the start of the test and the water ran down the exposed face in separate streams. However, dampness appeared on the back of the wall in about 33 min and visible water was observed shortly thereafter. The maximum rate of leakage for this wall after treatment was 26.2 liters/hr. The Shure-Ceel No. 5 coating was rated Very Poor.

The Porr-Kloz treatment on wall CW-2 allowed the wall to become damp in 3 min after the start of the test with visible water appearing in 9 min. The maximum rate of leakage for this wall after treatment was 7.2 liters/hr. The Porr-Kloz coating was rated Very Poor.

The treatment of S. K. Primer and S. K. Top Coat on wall CW-3 caused the water to run down the face of the wall in separate streams at the start of the test; however, a rapid break down of this repellency was observed and the back of the wall became damp with visible water in 8 min. The maximum rate of leakage for this wall after treatment was 15.3 liters/hr. The combined coating of S. K. Primer and Top Coat was rated Very Poor.

All three waterproofing materials failed to prevent the leakage of water through the walls, although in each case the treatment reduced the maximum rate of leakage. All test walls were rated Very Poor before and after they were coated.

Table 1. Water Permeability Test Data.

Wall No.	Condition of wall	Duration of test	Time to failure as indicated by			Maximum rate of leakage	Area damp at end of test	Rating
			Damp on back	Visible water on back	Flashing leak			
		day	hr	hr	hr	liter/hr	percent	
CW-1	Before treatment	1	0.03	0.03	0.03	60.0	62	Very Poor
	Treated with Shure-Ceel No.5 (NBS Lab.No.8126)	1	0.55	0.57	1.02	26.2	50	Very Poor
CW-2	Before treatment	1	0.03	0.03	0.05	19.8	70	Very Poor
	Treated with Porr-Kloz (NBS Lab.No.8127)	1	0.05	0.15	0.60	7.2	64	Very Poor
CW-3	Before treatment	1	0.03	0.03	0.03	57.6	83	Very Poor
	Treated with S. K. Clear Primer and S. K. Clear Top Coat (NBS Lab. No. 8128)	1	0.13	0.13	0.20	15.3	66.6	Very Poor

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THE NATIONAL BUREAU OF STANDARDS

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WASHINGTON, D. C.

Electricity and Electronics. Resistance and Reactance. Electron Tubes. Electrical Instruments. Magnetic Measurements. Dielectrics. Engineering Electronics. Electronic Instrumentation. Electrochemistry.

Optics and Metrology. Photometry and Colorimetry. Optical Instruments. Photographic Technology. Length. Engineering Metrology.

Heat and Power. Temperature Physics. Thermodynamics. Cryogenic Physics. Rheology and Lubrication. Engine Fuels.

Atomic and Radiation Physics. Spectroscopy. Radiometry. Mass Spectrometry. Solid State Physics. Electron Physics. Atomic Physics. Nuclear Physics. Radioactivity. X-rays. Betatron. Nucleonic Instrumentation. Radiological Equipment. AEC Radiation Instruments.

Chemistry. Organic Coatings. Surface Chemistry. Organic Chemistry. Analytical Chemistry. Inorganic Chemistry. Electrodeposition. Gas Chemistry. Physical Chemistry. Thermochemistry. Spectrochemistry. Pure Substances.

Mechanics. Sound. Mechanical Instruments. Fluid Mechanics. Engineering Mechanics. Mass and Scale. Capacity. Density, and Fluid Meters. Combustion Controls.

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Mineral Products. Engineering Ceramics. Glass. Refractories. Enameled Metals. Concreting Materials. Constitution and Microstructure.

Building Technology. Structural Engineering. Fire Protection. Heating and Air Conditioning. Floor, Roof, and Wall Coverings. Codes and Specifications.

Applied Mathematics. Numerical Analysis. Computation. Statistical Engineering. Mathematical Physics.

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- Office of Basic Instrumentation
- Office of Weights and Measures

BOULDER, COLORADO

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