



ARPRO[®] Expanded Polypropylene (EPP) Foam Manhole Grade Adjustment Ring

Infiltration and Exfiltration Acceptance Testing
September 1, 2009

A handwritten signature in black ink, appearing to read "K. Boegner", is written over a horizontal line.

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Introduction

The following is a summary report of the evaluation of the ARPRO® EPP Manhole Grade Adjustment Ring application for water infiltration and exfiltration.

Sanitary sewer systems necessitate watertight joints and construction materials to ensure the transfer of wastewater to treatment plants without infiltration or exfiltration. Infiltration of ground or storm water is particularly detrimental to treatment plant efficiency, while exfiltration of wastewater can lead to ground water contamination.

Standard Testing Methods

There are a number of established ASTM test procedures for water infiltration and exfiltration testing on manholes and grade adjustment rings. Furthermore, a specifying agency or municipality may have established its own procedure that might differ from an ASTM specification. All of these methods require applying either internal or external water or air pressure to the manhole and then measuring the rate of leakage or pressure drop.

ASTM C969 Results

Exfiltration was tested by JSP in accordance with the industry standard ASTM C969. ASTM C969 was originally developed as the standard practice for infiltration and exfiltration acceptance testing of installed precast concrete pipe sewer lines, but the method can also be applied to ARPRO® Expanded Polypropylene (EPP) manhole grade adjustment rings. This method uses the application of water pressure to the grade rings and the measurement of water leakage to determine acceptance. This is not considered a routine test and the results recorded are applicable only to the grade rings being tested and at the time of testing.

JSP tested a stack of two (2) standard 36-24G-600 grade rings. Each ARPRO® Expanded Polypropylene (EPP) ring has an outer diameter of 36 inches, an inner diameter of 24 inches, and a height of 6 inches. The rings were set between a sheet of clear Plexiglas and an East Jordan Iron Works 1045Z cast iron manhole frame. A watertight seal was made between the Plexiglas, the two rings, and the cast iron frame using M-1, a structural joint adhesive/sealant (Appendix A). The M-1 adhesive/sealant was allowed to dry for 24hrs and then the test assembly was filled with water to the inner lip of the cast iron frame (Figure 1) and observed for leakage.



Figure 1 – Test Assembly Set-up

Time Interval	Measurable Leakage	Remarks
1 hr	0.0 gal	no visible leakage
24 hr	0.0 gal	no visible leakage
36 hr	0.0 gal	no visible leakage
48 hr	0.0 gal	no visible leakage
60 hr	0.0 gal	no visible leakage
72 hr	0.0 gal	no visible leakage

Per the ASTM 969C test specification for exfiltration testing, the allowable leakage limit for a manhole is 0.1 gal/ (ft of diameter) (ft of head) (hour). Using these specific ring

dimensions and the general allowable leakage limits set forth in ASTM C969 allowable leakage of the test specimen can be calculated as follows:

$$\begin{aligned}\text{Allowable Leakage} &= \frac{0.1 \text{ gal} \times 2 \text{ ft diameter} \times 1.5 \text{ ft head}}{1 \text{ ft diameter} \times 1 \text{ ft head} \times 1 \text{ hr}} \\ &= 0.3 \text{ gal/hr}\end{aligned}$$

Per the procedures set forth in ASTM C969, the measured rate of leakage was determined to be less than the allowable leakage and this ARPRO[®] Expanded Polypropylene (EPP) manhole grade ring tested as acceptable.

ASTM C1244 Results

Infiltration was tested by JSP in accordance with the industry standard ASTM C1244. ASTM C1244 was originally developed as the standard test method for demonstrating integrity of the installed materials and construction procedures of concrete sewer manholes by the negative air pressure (vacuum) test, but the method can also be applied to ARPRO[®] Expanded Polypropylene (EPP) manhole grade adjustment rings. This method uses the application of 10 in. Hg negative air pressure (vacuum) to the interior of a manhole and the measurement of the time it takes for the vacuum to drop to 9 in. of Hg to determine acceptance. This is not considered a routine test and the results recorded are applicable only to the grade rings being tested and at the time of testing.

JSP tested standard 36-24G-600 ARPRO[®] Expanded Polypropylene (EPP) grade rings. Each ring has an outer diameter of 36 inches, an inner diameter of 24 inches, and a height of 6 inches. The bottom section of the grade rings were sealed with a sheet of clear Plexiglas. A test head was constructed of reinforced Plexiglas and an East Jordan Iron Works 1045Z cast iron manhole frame (Figure 2). A watertight seal was made between all joints using M-1(Appendix A), a structural joint adhesive/sealant.



Figure 2 – Test Assembly Set-up

A vacuum of 10 inches Hg was drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time was measured for the vacuum to drop to 9 inches Hg.

Test Configuration	Target Duration	Test Duration
1 Ring	7 sec	14.0 sec
2 Rings	7 sec	18.0 sec

Per the procedures set forth in ASTM C1244, the manhole is acceptable if the time for the vacuum reading to drop meets or exceeds the target duration values derived from Table 1, as reprinted from ASTM C1244.

**TABLE 1 Minimum Test Times for Various Manhole Diameters
(30 – 120 in.) in Seconds**

Depth (ft)	Diameter, in.								
	30	33	36	42	48	54	60	66	72
	Time, in seconds								
<4	6	7	7	9	10	12	13	15	16
6	9	10	11	13	15	18	20	22	25
8	11	12	14	17	20	23	26	29	33

The JSP measured rate of vacuum drop, for each test configuration, was determined to be less than the allowable vacuum drop, indicating that the ARPRO[®] Expanded Polypropylene (EPP) manhole grade rings tested as acceptable.



Appendix A

**Polyether Moisture Cure
Technology by
Chem Link**

M-1®

**Structural
Adhesive/Sealant**

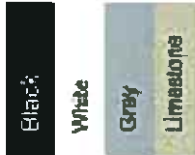
Description:

M-1 is a high performance interior or exterior joint sealant for use in both moving and non-moving joint applications. M-1 provides a long lasting weather tight seal to a variety of building substrates.

Packaging:

10.1oz (300 ml)
16/Field Pack, 48/pallet
24/carton, 60/pallet
2 gallon
5 gallon (special order)

Colors:



Color matching available

Solvent Content:

M-1 contains no solvents or V.O.C.'s.

Proposition 65:

This product contains no Proposition 65 listed materials.

Features	Benefits
100% solids	No shrinkage
Single component	Easy to tool and gun; no mixing
Fast skinning	Resists dirt pickup on construction sites
No solvents	Safe to use indoors or in confined spaces; no odor
Unique polymer	Bonds to damp masonry
Non-slump	Applies vertically as well as overhead
Polyether	Bonds to a variety of substrates w/o priming
Gun grade	No special tools or mixing
Excellent weathering properties	Durable long lasting seal

Use and Application:

Expansion joints
Pre-cast concrete
Block and masonry
Curtain walls
Window and door frames
Siding
Parapets
Roofing details
Cove joints
Details
Weather sealing

Substrates:

Concrete EPDM
Block Foam
Brick Vinyl
Stone Glass
Masonry
Wood
Metal
Aluminum
Galvanized metal
PVC
SBS mod bit



Technical Data:

Composition:

M-1 is a 100% solids, solvent-free formulated silyl-terminated polyether.

Compliances:

- *ASTM C-920, Type S, Grade NS, Class 25, use NT, T, M, G, A and O
- * Federal Specification TT-S-00230-C Type II, Class A
- * Corps of Engineers CRD-C-541, Type II, Class A
- * Canadian Standards Board CAN 19, 13-M82

Test Data:

Hardness Shore A	50-55 +/- 3	ASTM C-661
Shear strength	300 + PSI	ASTM D-1002
Tack free time	35 minutes	ASTM C-679
Slump (sag)	Zero slump	ASTM C-697
Shrinkage	No measurable shrinkage after 14 days	
Low temperature flex	Minus 20 degrees F pass ¼ inch mandrel	
Service temperature	Minus 40 degrees F to 200 degrees F continuous service	
Shelf life	one year	

Physical Properties:

Property	Results
Specific gravity	1.62 (13.5 /gal) depending on color
Viscosity	800,000 + cPs Brookfield RVF, TF spindle, 4 RPM, 70° F
Odor	Mild ester smell

Application:

Joint Preparation:

Joints should be clean, dry, and free from all contamination including dirt, oils, grease, tar, wax, rust and any other substance that may inhibit the sealant's performance.



Joint Width inches (mm)	Joint Depth inches (mm)
1/4-1/2 (6-13)	1/4 (6)
1/2-3/4 (13-19)	1/4-3/8 (6-10)
3/4 -1 (19-25)	3/8-1/2 (10-13)
1-2 (25-50)	1/2 (13)