

TEST REPORT



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PRODUCT EVALUATED: Polycrete Big Block Insulating Concrete Forms

EVALUATION PROPERTY: Testing of Webs for Fastener Strength (Lateral Shear and Withdrawal Resistance)

Report of Testing Polycrete Big Block Insulating Concrete Forms for compliance with the applicable requirements of the following criteria: ICC Evaluation Services' AC 353 *Acceptance Criteria for Stay-in-Place, Foam Plastic Insulating Concrete Form (ICF) System for Solid Concrete Walls* dated October 2007.

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2 Introduction

Intertek Testing Services NA Ltd. (Intertek) has conducted testing for Polycrete Incorporated / 6958150 Canada Incorporated (Polycrete) on Polycrete Big Block Insulating Concrete Forms (ICF) to evaluate fastener strength. Samples were tested for fastener withdrawal and lateral shear resistance. Testing was conducted in accordance with ICC Evaluation Services AC 353 *Acceptance Criteria for Stay-in-Place, Foam Plastic Insulating Concrete Form (ICF) System for Solid Concrete Walls* dated October 2007 following the standard methods of ASTM D1761-06 modified *Standard Test Method for Mechanical Fasteners in Wood*. This evaluation began November 2009 and was completed December 17, 2009.

3 Test Samples

3.1. SAMPLE SELECTION

The subject test specimens are traceable samples selected from the manufacturers Quebec facility located at 2450 rue Jules Vachon in Trois-Riviere Quebec, Canada. The products were witnessed and verified of normal manufacturing procedures by Intertek representative Jean-Philippe Plourde on October 19, 2009. The sample selection was conducted in compliance with Section 3.1 of ICC-ES AC 85.

3.2. SAMPLE AND ASSEMBLY DESCRIPTION

<u>Material:</u>	Polycrete Big Block Insulating Concrete Forms composed of Type II EPS foam plastic insulation panels linked with steel web ties.
<u>Panel Material:</u>	Type II EPS foam.
<u>Foam Panel Dimensions:</u>	610 mm (24 in) high by 2438 mm (96 in) wide by 67 mm thick each side
<u>Color:</u>	White
<u>Web Description:</u>	Linked steel wire mesh 4.1 mm (0.160") diameter webs are cast into EPS foam to create a positive connection between interior and exterior EPS walls with 2438 mm (96") long 13 mm (0.5") wide 0.7 mm (0.028") thick steel strips welded the wire mesh to serve as an anchor point for surface finishing materials.

The following table outlines the fasteners used for both withdrawal resistance and lateral shear testing.

Table 1. Fastener Description

#8 x 3 Inch Corrosion Resistant Construction Screws

The fastener withdrawal and lateral shear tests were both performed on specimens where the fasteners were inserted into the webs of the insulated concrete forms filled with concrete. Concrete was 3/8" pea gravel 2900 psi (20 MPa) strength.

4 Testing and Evaluation Methods

Testing was conducted in accordance with ICC-ES AC 353 *Acceptance Criteria for Stay-in-Place, Foam Plastic Insulating Concrete Form (ICF) System for Solid Concrete Walls* dated October 2007, referencing ASTM D 1761-06.

4.1. WITHDRAWAL LOAD STRENGTH

Fastener withdrawal testing was conducted on ten (10) of each type of fastener submitted per Table 1 of this report. Each fastener was driven into the centre of the width of the web specimens without pre-drilling pilot holes. This left a 1/2" length of each fastener head exposed. Fasteners were inserted a minimum of 4" apart and from any end of a web specimen. Concrete filled ICF test specimen panels cut to 16" wide and containing two webs in the specimen blocks were prepared for the testing. The ICF test block specimens were restrained from movement, and the exposed fastener head connected to a universal test machine. Each fastener test specimen was loaded using a cross head speed of 0.1 in / min movement until ultimate load (deemed the test specimen failure) was reached. Further details of the test setup can be found in Appendix A.

Allowable fastener withdrawal loads were determined by dividing the average ultimate load for all fastener withdrawal tests for the fastener type in question, by a safety factor of 5. The Allowable Loads are outlined in Table 2 of this report.

4.2. LATERAL LOAD STRENGTH

Lateral load resistance testing was conducted on ten (10) of each type of fastener submitted per Table 1 of this report. Each test fastener was driven into the centre of the width of the web specimens without pre-drilling pilot holes. The lateral resistance test samples used a 150 mm (6") long by 150 mm (6") by 1/2" plywood with one (1) fastener. Fasteners were inserted a minimum of 4" apart and from any end of a web specimen. Concrete filled Insulated concrete form test specimen panels 16" wide with two webs in the specimen panels were used for the test. The fasteners went through the 1/2" plywood, and penetrated through the web. Concrete filled ICF test specimen panels cut to 16" wide and containing two webs in the specimen blocks were prepared for the testing. The ICF test block specimens were restrained from movement, and the exposed fastener head connected to a universal test machine with the plywood panel aligned with the compression direction for the cross head. A load was applied to the top edge of the plywood at a cross head speed of 2.5 mm/min (0.10 in/min), causing shear in the fastener specimen. The downward movement of the plywood panel was measured with a linear transducer to determine the load strain relationship. Further details of the test setup can be found in Appendix A.

The conservative value between 75% of the average Proportional Limit Load or the average Ultimate Load divided by a safety factor was selected as the allowable shear resistance.

Where the coefficient of variation (COV) for the ultimate shear load for all test samples of a given fastener type was less than 15%, a safety factor of 3.2 was applied.

Where the COV for the ultimate shear load for all test samples of a given fastener type was greater than 15%, the allowable shear load was calculated using the following equation:

$$F_{all} = F(1 - 2 * COV / 2.24) \quad \text{Where}$$

F_{all} = Allowable Load, pounds (N).

COV = Coefficient of variation in a test series.

F = Average Ultimate Load in test series, pounds (N)

4.3. DEVIATION FROM STANDARD

ASTM D 1761-06 is for testing mechanical fasteners in wood and specifies the dimensions and pre-conditioning of the wood materials to be used. This test method was modified to be used for testing of plastic ICF webs cast into EPS foam insulation. The method specifies that pilot holes be drilled prior to inserting the fasteners. Since this not normally part of the installation procedure we did not pre-drill pilot holes prior to installing the fasteners.

5 Testing and Evaluation Results

5.1. RESULTS AND OBSERVATIONS

The fastener withdrawal values achieved by the noted fastener from Table 1 for Polycrete Big Block ICF are shown in Table 2 below.

Table 2. Fastener Withdrawal Test Results

Test Result		
Fastener Type	Ultimate Load, lbs (N)	Allowable Load, lbs (N)
#8 x 3 Inch Construction Screws	311 (1385)	62 (277)

Note: The allowable withdrawal load is determined as the ultimate load divided by a safety factor of 5.

The fastener lateral shear values achieved by the noted fastener from Table 1 for Polycrete Big Block ICF are shown in Table 3 below.

Table 3. Fastener Lateral Shear

Test Result					
Fastener Type	Ultimate Load, lbs (N)	Ultimate Load / 3.2, lbs (N)	Proportional Limit lbs (N)	Proportional Limit x 75%, lbs (N)	Allowable Load, lbs (N)
#8 x 3 Inch Construction Screws	375 (1668)	117 (520)	120 (534)	90 (400)	90 (400)

Note: The allowable lateral strength of the average connection shall not exceed the 75% of the average proportional limit, or the average ultimate load divided by 3.2 whichever is lower. Based on the COV < 15% the factor of safety of 3.2 was used as shown in Table 3. As 75% of the proportional limit was conservative to the ultimate load with the applied 3.2 factor of safety, 75% the proportional load was selected as the allowable lateral shear value.

6 Conclusions

Intertek has conducted testing for Polycrete on Polycrete Big Block ICF to evaluate Fastener Strength. Samples were tested for fastener withdrawal and lateral shear resistance. Testing was conducted in accordance with ICC Evaluation Services AC 308 *Acceptance Criteria for Stay-in-Place, Foam Plastic Insulating Concrete Form (ICF) System for Solid Concrete Walls* dated October 2007 following the standard methods of ASTM D1761-06 modified *Standard Test Method for Mechanical Fasteners in Wood*.

The fastener withdrawal and lateral shear values for the fasteners noted in Table 1 used with Polycrete Big Block ICF are as noted in Section 5 of this report.

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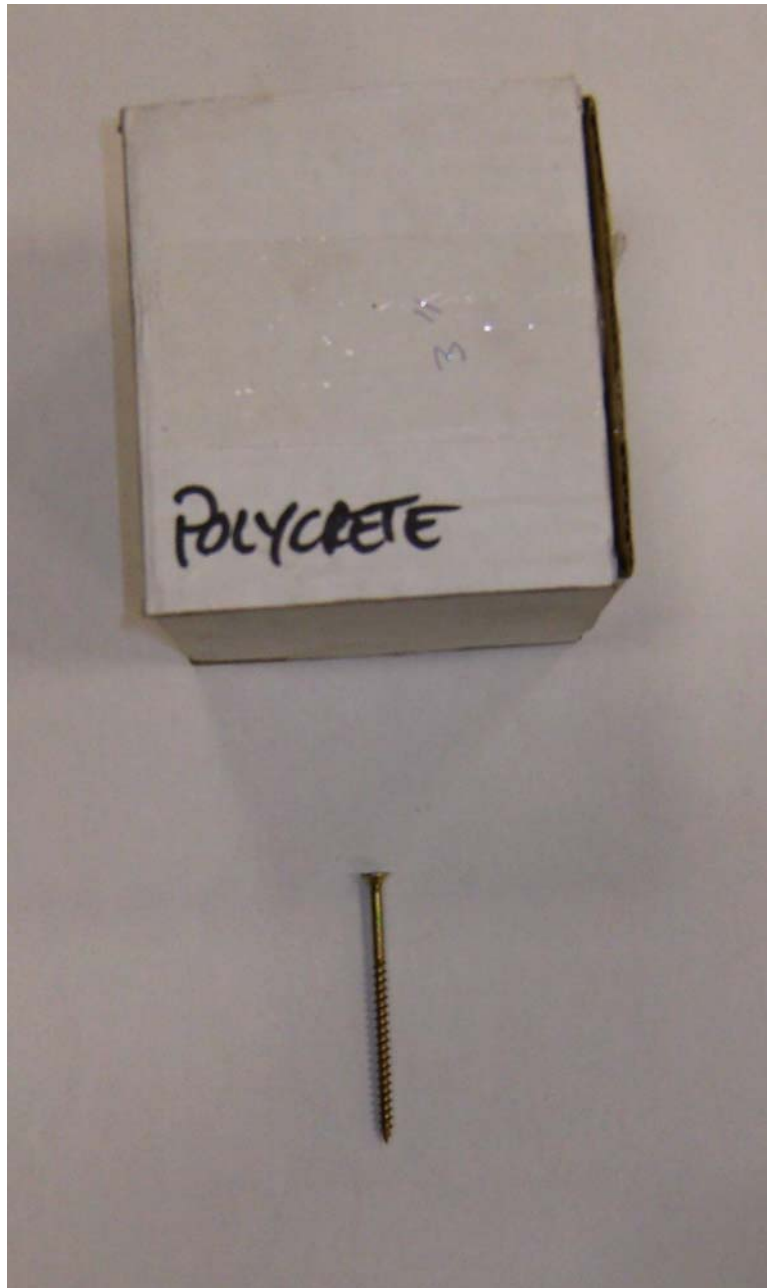
APPENDIX A
Photographs (4 Pages)



Photograph No. 1: Showing a typical insulated concrete form sample.



Photograph No. 2: Showing a linked wire mesh web of an insulated concrete form sample.



Photograph No. 1: Showing Fasteners 8 x 3 Construction Screw



Photograph No. 3: Showing test set-up for screw and nail withdrawal test using Satec Unidrive Testing Machine.



Photograph No. 4: Showing set-up for lateral fastener resistance tests.

APPENDIX B
Test Results (2 Pages)

RESULTS AND OBSERVATIONS

Lateral Shear Resistance for #8 3 Inch Construction Screws

Spec. No.	Load lb (N) at 0.01 in (0.25 mm)	Load lb (N) at 0.015 in (0.38 mm)	Load lb (N) at 0.05 in (1.27 mm)	Load lb (N) at 0.1 in (2.5 mm)	Load lb (N) at 0.125 in (3.2 mm)	Load lb (N) at 0.2 in (5.2 mm)	Load lb (N) at 0.3 in (7.6 mm)	Max. Load lb (N)	Proportional Limit lb (N)	Mode of Failure
1	101 (449)	99 (440)	105 (467)	113 (503)	118 (525)	131 (583)	152 (676)	390 (1735)	106 (472)	Screw head pulled through wood
2	66 (294)	76 (338)	75 (334)	78 (347)	80 (356)	87 (387)	99 (440)	310 (1379)	78 (347)	Screw pulled out
3	86 (383)	87 (387)	89 (396)	90 (400)	92 (409)	100 (445)	116 (516)	381 (1695)	94 (418)	Screw head pulled through wood
4	127 (565)	129 (574)	138 (614)	141 (627)	142 (632)	152 (676)	165 (734)	422 (1877)	136 (605)	Screw pulled out
5	77 (343)	82 (365)	89 (396)	95 (423)	99 (440)	109 (485)	120 (534)	380 (1690)	91 (304)	Screw head pulled through wood
6	112 (498)	116 (516)	125 (556)	131 (583)	129 (574)	135 (601)	145 (645)	340 (1512)	131 (583)	Screw pulled out
7	113 (503)	114 (507)	121 (538)	127 (565)	131 (583)	145 (645)	163 (725)	420 (1868)	130 (578)	Screw head pulled through wood
8	64 (285)	79 (351)	84 (374)	92 (409)	96 (427)	107 (476)	122 (543)	354 (15745)	99 (440)	Screw pulled out
9	83 (369)	106 (472)	148 (658)	165 (734)	171 (761)	185 (823)	201 (894)	406 (1806)	170 (756)	Screw pulled out
10	145 (645)	160 (712)	153 (681)	159 (707)	160 (712)	168 (747)	188 (836)	350 (1557)	162 (721)	Screw pulled out
Ave.	97 (431)	105 (467)	113 (503)	119 (529)	122 (543)	132 (587)	147 (654)	375 (1668)	120 (534)	
COV %	28%	25%	25%	25%	25%	25%	24%	10%	26%	

Note: COV for Ultimate load < 15%, as such, safety factor of 3.2 is applied.

RESULTS AND OBSERVATIONS

Fastener Withdrawal Values for #8 x 3 Inch Construction Screws

Specimen No.	Maximum Load lb	Mode of Failure
1	292 (1299)	Screw pulled out
2	351 (1561)	Screw pulled out
3	350 (1557)	Screw pulled out
4	269 (1197)	Screw pulled out
5	359 (1597)	Screw pulled out
6	312 (1388)	Screw pulled out
7	261 (1161)	Screw pulled out
8	304 (1352)	Screw pulled out
9	352 (1566)	Screw pulled out
10	264 (1174)	Screw pulled out
Average	311 (1385)	
COV (%)	13%	
