ENGINEERING EVALUATION

Intertek

REPORT NUMBER: 3146117COQ-001b
ORIGINAL ISSUE DATE: March 27, 2008
REVISED DATE: March 27, 2008

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RENDERED TO

LOGIX INSULATED CONCRETE FORMS LTD.
2755 Columbia St.
Vancouver, BC
V5Y 3G4

PRODUCT EVALUATED: Logix Insulated Concrete Forms
with Dryvit Cladding System
EVALUATION PROPERTY: CAN/ULC S101-04

Engineering Evaluation of Logix Insulated Concrete Forms with Dryvit Cladding System for compliance with the applicable requirements of the following criteria: CAN/ULC S101-04, Fire Endurance Tests of Building Construction and Materials

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1 Introduction

Intertek Testing Services NA (Intertek) has conducted an engineering evaluation for Logix, on Insulating Concrete Forms (ICF), to evaluate fire resistance. The evaluation was conducted to determine if the Dryvit Intertek Listed cladding product will maintain compliance with CAN/ULC S101-04, "*Fire Endurance Tests of Building Construction and Materials*" when installed on the Logix ICF product.

2 Sample and Assembly Description

The ICFs are used as pour-in-place formwork for structural concrete which consist of expanded polystyrene (EPS) foam plastic panels and plastic webs. The ICF consists of rigid interlocking expanded polystyrene (EPS) foam plastic boards that serve as permanent formwork for reinforced concrete, exterior and interior walls, and foundation and retaining walls. The polypropylene webs are spaced at 8 inches apart and maintain the EPS board facings at a fixed distance of 4 inches, 6.25 inches, 8 inches or 10 inches. The standard forms are 16 inches high by 48 inches long. The expanded polystyrene foam plastic complies with ASTM C578-05 as Type II product.

3 Reference Documents

- CAN/ULC S101-04, "*Fire Endurance Tests of Building Construction and Materials*"
- Intertek Design Listing – Dryvit "Wall Exterior Insulation & Finish Systems (EIFS)"
- Intertek Design Listing – Dryvit "EIFS Category 2"

4 Evaluation Method

The Logix ICFs are 2-3/4" in thickness with a density of 1.45 pcf and are classified as a Type II material in accordance with ASTM C578-08.

When evaluating an EIFS product installed over a foam insulation board, the property of concern is its contribution to fuel loading. Since polystyrene is a highly flammable material, by increasing the amount of polystyrene in the wall system there is a higher chance the polystyrene will ignite and cause the EIFS system to fall off and fail the 15 minute stay-in-place test.

By calculation, a 1 foot by 1 foot square of EPS has the following fuel contribution:

$$1.45\frac{lb}{ft^3}\times 2.75in\times\frac{1ft}{12in}\times 1ft^2 = 0.333lb$$

This calculation multiplied the EPS density by the thickness for a 1 foot by 1 foot square. In order for the Logix material to be eligible for installation with the Dryvit cladding product, the fuel loading for the Logix ICF must be lower than the insulation board the EIFS is currently listed for on the Intertek directory of listed products.

insulation board:

Dryvit (EIFS Category 1)

- Ultralation 2000 System
  - 1" to 2" 1.0 pcf density Type I Insulation Board
- Exsulation 2000 System
  - 1" to 5" 1.0 pcf density Type I Insulation Board
- Infinity System
  - 2" to 5" 1.0 pcf density Type I Insulation Board
- Exsulation MD System
  - 2" to 5" 1.0 pcf density Type I Insulation Board
- Fedderlite 2000 System
  - 2" to 4" 1.0 pcf density Type I Insulation Board

Dryvit (EIFS Category 2)

- Outsulation System
  - 3/4" to 4" 1.0 pcf density Type I Insulation Board
- Outsulation MD System
  - 2" to 4" 1.0 pcf density Type I Insulation Board

The maximum fuel loading for these products has been calculated and reported in the below Table:

Table 1: Dryvit Maximum Fuel Contribution

EIFS Category	Product Name	Max Fuel Contribution per 1 ft² (lb)
1	Ultralation 2000 System	0.167
1	Exsulation 2000 System	0.416
1	Infinity System	0.416
1	Exsulation MD System	0.416
1	Fedderlite 2000 System	0.333
2	Outsulation System	0.333
2	Outsulation MD System	0.333

The Dryvit Intertek Listings has a minimum fuel loading of 0.167 lbs. The Logix ICF with a fuel loading of 0.333 lbs will increase the fuel loading of the Ultralation 2000 System assembly; but will not increase the fuel loading for the Exsulation 2000 System, Infinity System, Exsulation MD System, Fedderlite 2000 System, Outsulation System, and Outsulation MD System. The Ultralation 2000 System is not eligible to be used with the Logix ICF system as it will increase the fuel loading and increase the chance of EPS ignition during the 15 minute stay-in-place test. Excluding the Ultralation 2000 System, all other products have an equivalent or greater fuel loading than the Logix ICF product. Since these products contribute equal or greater fuel loading, the Dryvit EIFS systems (excluding Ultralation 2000) is eligible to be installed on the Logix ICF while maintaining compliance to the 15 minute stay-in-place test of CAN/ULC S101-04. Installation must be as per the instructions in the Appendix to maintain compliance to CAN/ULC S101-04. The Logix ICF must be maximum 1.45 pcf in density and must be compliant as a Type II material in accordance with ASTM C578-08 and CAN/ULC S701-05. Additionally, the EIFS Basecoat/Mesh shall be bonded to the concrete substrate at all openings and at the perimeter of all wall sections and control joints.

5 Conclusion

Intertek has conducted an engineering evaluation for Logix, on Insulating Concrete Forms, to evaluate fire resistance. The evaluation was conducted to determine if the Dryvit Intertek Listed cladding product will maintain compliance with CAN/ULC S101-04, "*Fire Endurance Tests of Building Construction and Materials*" when installed on the Logix ICF product.

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ATTACHMENTS:
Manufacturers Installation Instructions

ATTACHMENTS

<Manufacturers Installation Instructions>

adexICI-ICF

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This document replaces any specification issued prior to August 2007

PART 1 GENERAL

1.1 Work Included

Provide all labour, materials and equipment necessary to install the ADEX-ICF system.

1.2 Related Sections

1. Insulated Concrete Forms: Section 03 11 19
2. Joint Sealers: Section 07 92 10
3. Sheet Metal Flashing and Trim: Section 07 62 00

1.3 Description

The ADEX-ICF system is a direct-applied coating system installed over insulated concrete form (ICF) construction. The system consists of the following components:

- Insulated concrete forms (ICF), by others;
- Flexible membranes around all openings;
- 100% acrylic base coat;
- Fibreglass mesh;
- 100% polymer acrylic finish coat (and primer coat).

1.4 Design Requirements

1. All work undertaken must comply with current codes, norms, construction best practices, as well as the manufacturer's installation instructions.
2. On horizontal surfaces, the minimum slope of the system shall be a 6:12 pitch with a maximum length of 250mm (10").
3. Acrylic coatings shall not be installed directly over wood blocking, framing or plastic fastening strips.
4. Expansion joints that allow for building movement shall be installed in the following locations:
   a) At floor levels of all buildings;
   b) At expansion joints in the substrate;
   c) Where dissimilar materials or substrates meet;
   d) At inside corners and major openings;
   e) Anywhere specified on the plans;
   f) At a maximum distance of 9m (30ft), to counter thermal expansion.

1.5 Quality Assurance

1. System manufacturer shall be ADEX Systems Inc.
2. The applicator shall have a sufficient amount of experience and enough qualified labour at his disposal to install the specified system.
3. The applicator shall follow all professional's directions when installing system components.

1.6 Delivery, Storage and Handling

1. All materials supplied by ADEX Systems Inc. shall be delivered in their sealed, original packaging with legible labels intact.
2. All materials supplied by ADEX Systems Inc. shall be stored in a cool, dry location at temperatures above 5°C (41°F) and protected from weather and other damage.
3. Store materials way from direct sunlight and protect from temperatures in excess of 32°C (90° F).
4. Materials suspected of having been frozen or damaged must not be used.

1.7 Job Conditions

1. Ambient and substrate temperatures shall be minimum 5°C (41°F) during installation.
2. When installing in temperatures below 5°C (41°F), tarping, heating and ventilation shall be provided to maintain proper installation temperatures.
3. Ambient temperatures shall be maintained above 5°C (41°F) for a minimum of 24 hours after installation to ensure that drying is complete.
4. Installation of ADEX materials shall be co-ordinated with other construction trades.

1.8 Alternatives

Systems considered equivalent to the ADEX-ICF system shall be approved by the architect, in writing, at least ten (10) working days prior to the project bid date.

1.9 Warranty

Upon request, the manufacturer shall provide a five-year limited warranty, stating that materials conform to specifications and are free of manufacturing defects.

PART 2 PRODUCTS

2.1 Manufacturer

All components of the system shall be obtained from ADEX Systems Inc. or its authorised distributors. No substitution or addition of other materials is permitted without written consent from the manufacturer.

2.2 Products

1. EPS insulation board (if necessary):
   a) Shall be made by a manufacturer approved by ADEX Systems Inc.;

b) Shall conform to CAN-ULC S701-97, Type 1 and be made from virgin material with a nominal density of 16Kg/m^3 (1Lb/ft^3);
c) Minimum board thickness shall be 25mm (1") and maximum board size shall be 600mm x 1200mm (24" x 48");
d) Shall be sold by ADEX Systems Inc. or by one of its authorised distributors.

2. PVC mouldings (if necessary):
   Shall meet ASTM-D1784 standards for exterior use.
   (See models in ADEX CATALOGUE).
3. Acrylic base coat:
   Shall be a 100% acrylic-based, asbestos-free product, made by ADEX Systems Inc., such as ADEX BASE coat.
4. Fibreglass mesh:
   a) Hall be alkali-resistant according to ANSI 99-A-2001;
   b) Shall be sold by ADEX Systems or by one of its authorised distributors;
   c) Shall meet ASTM E-2098, ASTM D-5035 standards;
   d) Shall have different weights according to specific needs:

1. Starter mesh:	150g/m^2	(4.5 oz/yd^2)
2. Design mesh:	150g/m^2	(4.5 oz/yd^2)
3. Standard mesh:	190g/m^2	(6 oz/yd^2)
4. Intermediate mesh:	375g/m^2	(11 oz/yd^2)
5. Armour mesh:	500g/m^2	(15 oz/yd^2)
6. Extra mesh:	675g/m^2	(20 oz/yd^2)

5. Primer:
   Shall be an acrylic and silica mix that can be applied by roller, such as PRIMEX, manufactured by ADEX Systems Inc.
6. Finish coat:
   a) Shall be factory-mixed, 100% acrylic-based, ready-to-use and shall contain integral colour and texture;
   b) The texture shall be [see ADEX CATALOGUE].

2.3 Other materials

1. Cement:
   Shall be lump-free, Type GU cement meeting CSA A3001 standards.
2. Water:
   Shall be clean, potable and free of sediment.
3. Flexible membrane:
   Shall be a self-adhesive composite membrane, such as EIFS Tape, Red Zone or Blue-Skin.

2.4 Tests

1. Tests performed by an independent laboratory on the specified materials can be requested.
2. Properties shall meet or exceed the following values when tested by the methods listed:

Test Method	Result
1) Accelerated Weather Resistance: ASTM D822 (exposed 2500 hours):	No deleterious effect.

2) Salt Spray Resistance: ASTM-B117 (exposed 300 hrs):	No deleterious effect.
3) Freeze-Thaw Resistance : ASTM C-666 (50 cycles)	No cracks, delamination or crazing.
4) Mildew and Fungus Resistance: Mil.Std.810 E:	No mildew or fungal growth.
5) Water Permeability: UEAtc "Directives for EIFS", article 3.3.1.1:	$\geq$ 2 hours.
6) Water Absorption: UEAtc "Directives for EIFS", article 3.3.1.2:	$\leq$ 20%.
7) Bond Test: UEAtc "Directives for EIFS", article 3.3.2.1:	After 2 hrs drying: $\geq$ 100 kPa. After 7 days drying: $\geq$ 300 kPa.
8) Water vapour transmission: ASTM E96-95:	$\geq$ 170 ng/Pa.s.m^2.

PART 3 EXECUTION

3.1 Inspection

1. Inspect the ICF substrate to verify that it is structurally sound and solid, ensuring there are not any irregular voids or projections.
2. Ensure a flexible waterproofing membrane is installed, continuous and sealed at all junctions and around all wall openings.
3. Inspect all metal flashing to ensure that it is properly installed, making certain that moisture will be deflected to the exterior of the system.
4. The architect and general contractor shall be advised of any discrepancies. Work shall not proceed until unsatisfactory conditions are corrected.

3.2 Mixing

1. ADEX BASE coat:
   a) In a clean container, mix ADEX BASE coat and Type GU cement at a ratio (by weight) of one-to-one;
   b) Allow mixture to set up for 5 minutes and mix again to break the initial set;
   c) All other additives (such as rapid binder, anti-freeze, accelerator or others) are strictly prohibited.

3.3 Installation

1. Insulation Boards:
   a) Remove 150mm (6") of EPS around all openings in order to gain access to the ICF concrete;
   b) Install a flexible membrane (such as EIFS Tape, Red Zone or Blue Skin) around all openings so as to seal the junction between the concrete and the wall openings;

c) Cut and install tight-fitting pieces of EPS insulation to replace those pieces that were removed;
d) Wrap the insulation boards edges around all wall openings with Starter mesh and ADEX BASE coat and fasten securely into place:
   The following section describes the procedure to be followed when the ICF fastening strips are visible:
   1. Cover the entire ICF wall surface with EPS boards (minimum 25mm (1") thick).
   2. Apply Starter mesh around the perimeter of all ICF walls to wrap the thickness of the ADEX insulation boards (this includes system terminations, where dissimilar substrates meet, at expansion joints, at doors and windows, etc.).
   3. A minimum of 50mm (2") of fibreglass mesh shall be present behind the insulation boards at all the edges.
   4. Using a notched trowel, apply ADEX BASE adhesive in vertical ribbon orientation (10mm (3/8") wide by 5mm (3/16") thick, spaced 50mm (2")) to the backside of the insulation boards.
   5. Install insulation boards onto the ICF substrate, starting at the bottom of the wall. The long edge of the insulation board shall be horizontal. Apply firm pressure to the board surface to ensure complete contact of the ADEX BASE adhesive to the substrate. Ensure the ADEX BASE adhesive does not dry prior to installation of the insulation board.
   6. Stagger the vertical joints of insulation boards and interlock insulation boards at all corners.
   7. The insulation board joints and those of the substrate shall be spaced out by at least 150 mm (6").
   8. Ensure insulation board joints are not aligned with the corners of any wall openings (such as windows, door openings, etc).
   9. Abut all insulation boards tightly.
e) If gaps occur in either the ICF insulation blocks or the EPS insulation boards, insert slivers of insulation (without using BASE adhesive), or fill the void with expanding polyurethane such as Wind-lock's Foam2Foam.
f) Insulation boards shall be sanded until even and plane;
g) Reveals/V-Grooves shall be installed where required (using a hot-wire knife or router). The minimum thickness of the insulation board at any point shall be no less than 19mm (3/4");
h) Reveals/V-Grooves shall not be in alignment with insulation board joints or at the corners of openings;
i) The entire surface of the insulation boards shall be clean prior to application of the ADEX BASE coat.

2. Battens & Foam Shapes:
   a) All battens made of expanded polystyrene shall be installed by bonding them with ADEX BASE adhesive or with spray polyurethane such as Wind-lock's Foam 2 Foam or by mechanically fastening them to the structure;
   b) All battens and grooves shall have an outward-facing slope to prevent moisture from accumulating on them.
3. Base Coat and Reinforcing Mesh:

a) Apply ADEX BASE coat mixture to the surface ends and edges of the insulation boards and fully embed the Starter mesh into the BASE coat;
b) Install an additional 300mm (12") long piece of Starter mesh (at a 45º angle) at the corners of all wall openings;
c) (Optional) Armour Mesh reinforcement:
   1. Apply ADEX BASE Coat mixture to the surface of the insulation boards to a thickness of 2.4mm (3/32") to embed the "Armour" glass fibre mesh.
   2. The surface shall be smoothed until the mesh is fully embedded.
   3. Armour mesh shall be abutted and not lapped.
   4. The Armour mesh shall be installed to heights indicated in the plans.
   5. All layers of Armour mesh shall be covered with a layer of Standard Mesh. (See below)
d) ADEX BASE coat mixture shall be applied over the surface of the insulation boards to a uniform thickness of 1.6mm (1/16"). Immediately embed ADEX Standard mesh into the wet ADEX BASE coat. The base coat shall be smoothed until the mesh is fully embedded;
e) The mesh shall be lapped a minimum of 63mm (2-1/2") on all sides;
f) The mesh shall be completely embedded in the ADEX BASE coat mixture over the entire surface of the insulation;
g) A second coat of ADEX BASE coat mixture may be required if, after drying, there are imperfections or the mesh is not completely embedded;
h) A period of 24 hours shall elapse prior to installation of the finish coat.

4. Finish Coat:
   a) With a roller, apply an even coat of ADEX PRIMEX primer (same colour as the finish coat) prior to installing the finish coat;
   b) Trowel-apply a tight coat of ADEX Finish, texture [see ADEX CATALOGUE] to a thickness not greater than the largest aggregate. Apply the finish coat in a continuous fashion, maintaining a wet edge. Levelling and texturing shall take place in one operation to give the ADEX Finish a uniform appearance;
   c) Avoid applications in direct sunlight;
   d) Finish coat shall not be used where caulking will be applied;
   e) Ensure all PVC moulding connections are properly sealed.

3.4 Clean-Up

1. Remove waste and left over materials (used in this Section) from the job site.
2. Clean all adjacent materials and surfaces, and repair any defects caused to this application or any other work.

3.5 Protection

1. Ensure that the general contractor protects all work against moisture infiltration and other damages by installing the necessary flashing and caulking in a timely manner.
2. Provide protection against dirt, moisture, high humidity, and freezing temperatures until materials are fully dry.

Information in this document contains the current recommendations for the installation of the ADEX ICI-ICF system. It is only provided as a guide and is subject to modifications at any time without notice. ADEX Systems Inc. reserves the right to make any modification according to technological progress. Specialised designers, architects, engineers or other professionals that choose to make any use of this information bear the complete responsibility, whatever it be, direct or indirect, that could follow from such use. ADEX Systems Inc. does not bear any responsibility that could give way to damages, defaults, defects, deficiencies, prejudices, loss or decrease of profit, be they direct or indirect, resulting from such use of this information by specialised designers, architects, engineers or other professional.

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August 2007

REVISION SUMMARY

DATE	SUMMARY
March 27, 2008	Report issued to client