**07 42 65**

# Short Form Guide Specification

**THERMAL, WATER, AND AIR RESISTANCE**

**BARRIER**

**WALL SYSTEM**

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THERMAL, WATER,AND AIR RESITANCE BARRIER WALL SYSTEM

 (Masterspec Format)

 May 2015

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SECTION 07 21 13.15

RIGID FOAM BOARD INSULATION

PART 1 – GENERAL

1.1 SUMMARY

A. Provide a thermal, water and air resistance barrier wall system for exterior cold-formed metal wall assemblies. Work includes:

* 1. Provide continuous exterior wall insulation.
	2. [Provide interior spray polyurethane foam.] B. Related Sections:
	3. Section 05 40 00 Cold-Formed Metal Framing: Non Load-bearing, metal exterior wall framing assemblies.
	4. Section 09 21 16 Gypsum Board Assemblies: Interior gypsum board wall finish.

1.2 REFERENCES

A. Reference standards:

1. ASTM International (ASTM):

* + 1. ASTM C203: Test Methods for Breaking Load and Flexural Properties of Block-type Thermal Insulation.
		2. ASTM C209: Test Method for Cellulosic Fiber Insulating Board.
		3. ASTM C518: Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
		4. ASTM C1029: Specification for Spray-Applied rigid Cellular Polyurethane thermal Insulation.
		5. ASTM C1289: Specification for Faced Rigid Cellular Polyisocyanurate thermal Insulation Board.
		6. ASTM D1621: Test Method for Compressive Properties of Rigid Cellular Plastics.
		7. ASTM D1622: Test Method for Apparent Density of Rigid Cellular Plastics.
		8. ASTM D2126: Test Method for Response of Rigid Cellular Plastics to thermal and Humid Aging.
		9. ASTM E84: Test Method for Surface Burning Characteristics of Building Materials.
		10. ASTM E96/E96M: Test Method for Water Vapor Transmission of Materials.
		11. ASTM E331: Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
		12. ASTM E2357: Test Method for Determining Air leakage of Air Barrier Assemblies.
		13. ASTM E283: Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors under Specific Pressure Differences Across the Specimen.

2. Factory Mutual (FM):

a. FM 4880: Class 1 Fire Rating of Insulated Wall or Wall and Roof /Ceiling Panels Interior Finish Materials (Room Corner Fire Test).

3. Underwriters Laboratories Inc. (UL):

a. UL 723: Surface Burning characteristics of Building Materials.

4. National Fire Protection Association (NFPA):

* + 1. NFPA 285 [2006]: Standard Method of Test for the evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test apparatus.
		2. NFPA 259 (2008) Standard Test Method for Potential Heat of Burning Materials.

1.3 SYSTEM DESCRIPTION

1. Furnish and install an exterior wall system that effectively controls thermal, air, vapor and water performance and provides continuity of the building envelope enclosure. The system shall include the following:
	* 1. Insulated sheathing secure to the exterior of the metal wall framing assembly.
		2. Joint, penetration and gap sealing material for sealing component joints, penetrations through the wall system and gaps between the building envelope enclosure components and wall opening frames.
		3. [Spray polyurethane foam applied to the interior wall cavity]

1. Performance Characteristics:

1. Thermal performance:

* + - 1. Exterior insulation: ASTM C518, Stabilized R-value of 6.5 at one inch of thickness with a maximum six month exposure capability to outdoor elements [and 15 year thermal warranty].
			2. [Interior spray polyurethane foam: ASTM C518, 140degreeF/90day Aged R-value (measured at 75degreeF mean Temp.), for product with a minimum 45 degree F ambient and substrate application temperature is R6.4/inch and 140 degree F/90day Aged r-value (measured at 75 degree F Mean Temp.), for product with a minimum 30 degree F ambient and substrate application temperature is R6.0/inch.
				1. Core density: ASTM D1622, Minimum 2.0 pcf.
				2. Acceptable adhesion to substrate based on specific minimum application temperature and proper substrate conditions.]
		1. Air barrier performance: When tested in accordance with ASTM E2357, at a test pressure of not less than 6.24 psf, air infiltration shall not exceed 0.04 cfm per square foot (0.2L/\*m2) of fixed wall area. Testing should be conducted at positive and negative sustained wind loading of 12.5psf (600Pa) for one-hour duration in each direction, pressure cycling of the wall at 2000 cycles in both the positive and negative direction, ending with wind gust loading at 25psf.
		2. Water penetration: when tested in accordance with ASTM E331, no uncontrolled water penetration shall occur at a minimum differential pressure of 6.24 psf for minimum test duration of 2hrs.
		3. Mold resistance: Wall system components shall provide non-food source for fungal growth.

1. Code Compliance: Wall system and component materials shall comply with the following requirements:

 1. Exterior Insulation:

* + - 1. Class A (<and/or= 25 Flame spread Index and <450 Smoke Developed Index) classified at Max. thickness per UL 723 criteria or ASTM E84 criteria.
			2. Fire Performance Evaluation as a component of an NFPA 285 approved wall assembly per the requirements of the International Building Code.

2. [Spray Polyurethane foam:

* + - 1. Class A (<and/or= 25 Flame Spread Index and < 450 smoke Developed Index) Classified at Max. thickness per UL 723 criteria or ASTM E84 criteria.
			2. Fire Performance Evaluation as a component of an NFPA 285 approved wall assembly per the requirements of the International Building Code.]
		1. System complies with ASTM E2357: Test Method for determining Air Leakage of Air Barrier Assemblies.
		2. System complies with NFPA 285: Standard method of Testing for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies containing Combustible components using the Intermediate Scale, Multi-Story Test Apparatus.

1. All joints, penetrations and gaps of the wall system shall be made water and air resistive.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data and installation instructions for each wall system component product required. B. Reports:

1. Submit summarized documentation, from ICC-ES or Manufacturer of material(s), verifying qualities of wall system components meet or exceed specified requirements.

1. Include summarized results of ASTM E2357 air barrier system testing and ASTM E331 water penetration tests.
2. [Submit Field Inspection and Test Reports for Interior Spray Foam in accordance with Field Quality control requirements per manufacturer’s installers certification program.] C. Samples: Submit following material samples.
3. Insulation panel, 8” square.
4. Insulation fasteners/washers and joint flashing , one each.
5. Submit Material Safety Data sheets (MSDS) for wall system components.
6. [Spray Foam Contractor MUST submit at the time of BID a written certification from the wall system manufacturer.

1. At bid submission, provide the following evidence to the Architect:

a. Wall System Manufacturer Installer Certification. 1) Acceptable Certification Program.

i. STYROFOAM-CM Certification Program. ii. FROTH PAK Ultra Certification Program]

1.5 QUALITY ASSURANCE

A. [Spray Polyurethane Foam Installation: Spray polyurethane foam installer shall be certified by wall system manufacturer at the time of bid. The spray foam installer shall be the certified individual that submitted certification at time of bid.] B. [Installer Qualifications:

1. The air barrier Installer shall be, during the award period as well as for the duration of the installation, officially recognized as a Certified Installer by the wall system Manufacturer (Certified Installer). The Certified Installer shall carry liability insurance and bonding.
2. Each worker who is installing air barriers must be a, or accompanied by a, Certified Installer.
3. Each Certified Installer can supervise a maximum of five workers. The Certified Installer shall be thoroughly trained and experienced in the installation of air barrier of the types being applied. Certified Installers shall perform or directly supervise all air/vapor barrier work on the project.
4. Certified Installers shall have their wall system Manufacturer Certification in their possession and available on the project site, for inspection upon request.]

C. Pre-installation Meeting: Prior to commencement of application of wall system, review and document methods and procedures related to installation, including the following:

* 1. Participants: Authorized representatives of the Contractor, [Construction Manager,] [Owner,] Architect, [Engineer,] Applicator, [Independent Inspector] and [Manufacturer].
	2. Review metal wall framing assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing work.
	3. Review insulated sheathing, flashing and [spray polyurethane foam] methods and procedures related to application including manufacturer’s installation guidelines.
	4. Review construction schedule and confirm availability of products, applicator personnel, equipment and facilities.
	5. Review governing regulatory requirements, and requirements for insurance and certificates as applicable.
	6. Review field quality control procedures.

1.6 DELIEVERY, STORAGE AND HANDLING

1. Deliver wall system materials in Manufacturer’s unopened containers or bundles, fully identified by name, brand, type and grade. Exercise care to avoid damage during unloading, storing and installation.
2. Store, protect and handle wall system materials in accordance with the Manufacturer’s recommendations to prevent damage, contamination and deterioration. Keep materials free of dirt and other foreign matter.

1.7 PROJECT CONDITIONS

A. Environmental Requirements: Install wall system work only when weather conditions are in compliance with Manufacturer’s specific environmental requirements and condition will permit work to be performed in accordance with Manufacturer’s recommendations and warranty requirements.

1. [Spray polyurethane foam:

* + 1. Do not proceed with installation of spray polyurethane foam until sheathing substrate construction is complete and openings and penetrating items have been installed and sealed.
		2. Do not proceed with installation of spray polyurethane foam until substrate temperatures accepting the spray polyurethane are above the manufacturer’s recommended minimum surface temperatures.
		3. Verify that substrate surfaces to receive spray polyurethane foam are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond.
		4. Do not apply spray polyurethane after the 6 months expiry date printed on the label of each container.
		5. Ventilate area to receive spray polyurethane foam by introducing fresh air and exhausting air continuously during and 24 hour after application to maintain non-toxic, unpolluted, safe working conditions.
		6. Provide protection for workers as recommended by spray polyurethane foam manufacturer.
		7. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
		8. Dispose of waste foam daily in location designated by Architect [Engineer] and empty drums in accordance with foam manufacturer’s instructions.]

1.8 WARRANTY

A. Submit the following warranties: Follow all Manufacture’s requirements for acquiring warranty.

* 1. Exterior insulation warranty: Six month exposure and [15] [10]year thermal warranty.
	2. Liquid sprayed flashing: Six month exposure and [15] [10] year water resistance warranty
	3. Flashing Tape: Six month exposure
	4. Spray Polyurethane Foam: Limited Warranty

PART 2- PRODUCTS

2.1 INSULATION

1. Continuous Exterior Insulation: Glass-fiber-reinforced enhanced polyisocyanurate foam core sheathing faced with nominal 4 mil embossed blue acrylic-coated aluminum on one side and 1.25 mil embossed aluminum on the other side, complying with ASTM C1289 and meeting the following physical properties:

* + 1. ASTM C1289 type 1, class 2.
		2. Compressive Strength (ASTM D1621): 25 psi, minimum.
		3. Aged thermal Resistance (ASTM C518, measured at Mean Temp of 75F): [F-6.5 at I inch] [RSI

1.06 per 25 mm] of thickness [with 15 year thermal warranty].

* + 1. Flexural Strength (ASTM C203): Minimum 55 psi .
		2. Water Absorption (ASTM C209 ): Minimum 0.1 percent by volume.
		3. Water Vapor Permeance (ASTM E96): <0.03 perms.
		4. Maximum Use Temperature: 250 degrees F.
		5. Class A (<and/or= 25 Flame spread Index and <450 Smoke Developed Index) classified at Max. thickness per UL 723 criteria or ASTM E84 criteria.
		6. Acceptable Products: The Dow Chemical Company “THERMAX™ ci Exterior Insulation.”
			1. Panel Size: 4’-0” wide x 8’-0” [12’-0”] long, square edge, shiplap (shiplap on thickness of 1.55: and greater) panels.
			2. Thickness and Stabilized R-Value: Nominal 0.625 inch thickness, R-4.1 [1.0 inch thickness, R-6.5] [1.55 inch thickness, R-10.1] [2 inch thickness, R-13.0]. For thicknesses greater than 2”, call 1-866-583-BLUE (2583).
1. [ Spray Polyurethane Foam: Two-component spray polyurethane cellular plastic foam, complying with the follow methods and meeting the following physical properties.]
	* 1. Core Density (ASTM D1622): [Minimum 2pcf].
		2. Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F mean Temp: Minimum R6.1/inch.
		3. Flame Spread (ASTM E84, Class A): 25 or less.
		4. Smoke Developed (ASTM E84, Class A): 450 or less.
		5. Compressive Strength minimum (ASTM D1621, 10% parallel to rise): [20 psi] [182 kPa].
		6. Closed Cell Content (ASTM D2856): minimum 90 percent.
		7. Water Absorption by Volume maximum. (ASTM D2842): 5.0 percent.
		8. Water Vapor Permeability maximum. (ASTM E96): [3.0 perm-inches] [4.4 ng/(Pa.s.m)].
		9. Acceptable Products: The Dow Chemical company STYROFOAM™ Spray Polyurethane Foam [CM2030], [CM 2045], [CM 2060]> or FROTH PAK™ Ultra. Formulation required will be upon surface temperature of substrate. Refer to manufacturers recommendations. a. STYROFOAM™ Spray Polyurethane Foam CM2030:

1) Thermal Resistance (ASTM C518): 140degreeF/90day Aged, R-Value, measured at 75F tem: Minimum R6.0/inch.

b. STYROFOAM™ Spray Polyurethane Foam CM2045:

1) Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F Temp: Minimum R6.4/inch.

c. FROTH PAK™ Ultra low pressure spray foam:

1) Thermal Resistance (ASTM C518): 140degreeF/90day Aged R-Value, measured at 75F Temp: Minimum R6.4/inch.

2.2 ACCESSORIES

1. Fasteners: Provide insulated sheathing manufacturer’s recommended polymer or other corrosion protective coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener length and size based on wall sheathing thickness.

1. Acceptable Products:

* + - * 1. Rodenhouse, Inc. 2 inch diameter “THERMAL-GRIP ci Prong washers” plastic washers which can be installed using either bulk Grip-Deck self-drilling screws or collated Grip-Deck screws. [Use the Grip-Lok auto-feed fastening system for high speed application

(recommended for wall assemblies up to 2 inches in thickness).] Contact Rodenhouse Inc. for more information at 616-454-3100.

* + - * 1. Rodenhouse, Inc. “Plasti-Grip PMF” fasteners. Recommended for block, concrete, or masonry substrates. Contact Rodenhouse, Inc. for more information at 616-454-3100. c. Or approved equal

1. Liquid spray flashing: Provide insulation manufacturer’s recommended board joint commercial liquid spray flashing and sealant for sealing joints, seams, window openings, door openings, counter-flashing and penetrations through the insulation layer.

1. Acceptable Products:

a. The Dow Chemical Company “LIQUIDARMOR™- CM” spray flashing and sealant.

Meets ASTM 2357 standard test method for determining air leakage of air barrier assemblies, as part of an approved assembly with continuous foam insulation.

Meets ASTM 331 water penetration of existing windows by uniform static air pressure differences, as part of an approved assembly with continuous foam insulation. 3) Meets ASTM D412 tensile strength- 340 psi.

4) Meets ASTM E96 water transmission- 4 perms at typical application thickness. 5) Density- 11.4 pounds/gallons as liquid.

Application temperature: 35 degrees F to 120 degrees F.

3” ± 1” coverage required at board joints.

UV resistance: 180 days.

Recommended thickness of spray sealant: 50 ± 5 wet mils around screws, veneer anchors and wall penetrations

Passes ASTM D1970/AAMA714 requirements for nail sealing ability.

1. Flashing Tape: Provide insulation manufacturer’s recommended tape for counter-flashing and penetrations through the insulation layer.

1. Acceptable Products:

a. The Dow Chemical Company “WEATHERMATE™” Straight Flashing 4 inch, 6 inch, 9 inch and 18 inch at straight openings at heads, jambs and sills.

Meets ASTM 711for self adhering flashing.

Meets ASTM D5034 standard test method for breaking strength an elongation of textile fabrics.

Meets ASTM D3330 standard test method for peel adhesion for pressure sensitive tape.

Meets ASTM D1970 standard test method for self adhering polymer modified bituminous sheet materials used as steep roofing underlayment for ice dam protection.

Meets ASTM G154 standard practice for operating fluorescent ultraviolet lamp apparatus for exposure of nonmetallic materials.

Water vapor transmission less than 1 perm

Application temperature: 30 degrees F to 120 degrees F. 8) UV resistance: 120 days.

1. Penetration Filler: Provide insulated sheathing manufacturer’s recommended polyurethane foam for sealing penetrations of insulated sheathing.

1. Acceptable Products:

a. The Dow Chemical Company “GREAT STUFF PRO™ Gaps & Cracks” single-component polyurethane low-pressure foam sealant.

Meets ASTM E84 standard test method for surface burning characteristics of building materials.

Meets Modified ASTM E814 standard test method for fire block.

Complies with Underwriters laboratories, Inc. Classification, as a sealant fire block.

Polyurethane based foam is minimal expanding, single component foam.

Cures quickly and has a moisture resistant skin.

Allows for movement/shifting within a structure.

Fills and seals gaps up to 3”.

Flexural strength, ASTM C203, parallel to rise, psi, minimum: 8.8

Compressive strength, ASTM D1621m parallel to rise, psi: 9.3

Tensile strength, ASTM D1623, parallel to rise, psi: 14.4

b. The Dow Chemical Company “GREAT STUFF PRO™ Window & door” single-component polyurethane low-pressure foam sealant.

Meets ASTM E2112 standard practice for installation of exterior windows, door and skylights.

Meets ASTM E84 standard test method for surface burning characteristics of building materials.

Meets ASTM E283 standard test method for determining rate of air leakage through exterior windows, curtain walls and doors under specified pressure difference across the specimen, as part of an approved assembly with continuous foam insulation.

Meets E331 standard test method for water penetration of exterior windows, skylights, doors and curtain walls by uniform static air pressure difference, as part of an approved assembly with continuous foam insulation.

Application temperature: 40 degrees F to 100 degrees F at relative humidity of > 20%..

Meets sealant component air barrier requirements for ABAA Specifications.

Classified per UL 723 as under UL File R13655.

Under ICC-ES ESR-1961 evaluated as an insulating sealant.

Flexural strength, ASTM C203 parallel to rise, psi, min.: 5.2

Compressive strength, ASTM D1621, parallel to rise, psi: 2.8 11) Tensile strength, ASTM D1623, parallel to rise, psi: 5.7 12) Flame spread/Smoke developed, ASTM E84: 10/20.

1. Gap Air Infiltration Filler: Two Component, Quick Cure Polyurethane Foam:

 1. Acceptable Products:

a. The Dow Chemical Company FROTH-PAK™ Ultra Foam Insulation two component, quickcure polyurethane foam.

NFPA 286 approval for Exposed use to the interior of the building without the need for a 15-min thermal barrier at max 6” height, 2” thick and indefinite width.

ASTM E-84 Class A rating- flame spread of 25 or less.

Maximum temperature exposure: 240 degrees F.

Complies with NFPA 286- can be left exposed in non-fire-resistant-rated roof/wall junctures, maximum 6” high and 2” deep with unlimited width.

Flame spread/smoke developed, ASTM E84/UL 723.

Thermal resistance per inch, ASTM C519: 6.0 per inch.

Water Permeance, ASTM E96: 6.4 perms for 1 inch, 3.2 perms for 2” thick material.

Water absorption, ASTM D2942, % by volume: 3.2

Compressive strength, ASTM D1621, lb/sq. in.: 17.2

1. Steel stud veneer attachment: Provide steel stud framed wall attachment through the rigid foam sheathing to the substrate to structural steel stud. Verify anchor size and installation pattern with manufacturer.

1. Masonry

a. Acceptable Products:

Heckmann Building Products Pos-I-Tie masonry veneer anchoring system with THERMAL-GRIP brick-tie washers (washers from Rodenhouse Inc. but also available through Heckmann Building Products). Must use Pos-I-Tie anchors with barrel length equal to sheathing thickness so that compressive loads are transferred directly to the metal wall framing. EPDM gasket and THERMAL-GRIP brick-tie washers must be used with Pos-I-Tie. For enhanced thermal performance use THERMAL-CLIP accessory from Heckmann Building Products to reduce thermal-bridging. Wire ties are available

to accommodate specified air gaps and masonry. Contact Heckmann Building Products at 800-621-4140 or Rodenhouse, Inc. at 616-454-3100 for more information.

Hohmann & Barnard 2-Seal with THERMAL Wing Nut

Hohmann & Barnard 2-Seal with 1.5” diameter washer

2. 3 Coat Stucco and Adhered Stone Veneer

* + - * 1. An additional weather resistive barrier must be installed over the insulation prior to the attachment of the metal lath. Any commercial wrap product can be used.
				2. Corrosion resistant metal lath to be attached back to the steel studs using any fastener which is acceptable to the Masonry institute.
				3. Fastener schedule to be determined using the FSC Tech Matters “Guide to Attaching Exterior Wall Coverings Through Foam Sheathing to Wood or Steel Wall Framing”

3. ACM and Metal Panel

* + - * 1. Any surface mounted Firing system can be used provided it has been engineered to be installed on foamed plastic insulation.
				2. Erect panels level and plumb, in proper alignment in relation to substructure framing and established lines
				3. Panels shall be erected in accordance with approved shop drawings
				4. Panel anchorage shall be structurally sound and per engineering recommendations.
				5. Fastener schedule to be determined using the FSC Tech Matters “Guide to Attaching Exterior Wall Coverings Through Foam Sheathing to Wood or Steel Wall Framing”

4. Terracotta

* + - * 1. Any surface mounted Firing system can be used provided it has been engineered to be installed on foamed plastic insulation.
				2. Panels shall be erected in accordance with approved shop drawings
				3. Panel anchorage shall be structurally sound and per engineering recommendations.
				4. Fastener schedule to be determined using the FSC Tech Matters “Guide to Attaching Exterior Wall Coverings Through Foam Sheathing to Wood or Steel Wall Framing”

5. Cement Board Siding

* + - * 1. Any surface mounted Firing system can be used provided it has been engineered to be installed on foamed plastic insulation.
				2. Fastener schedule to be determined using the FSC Tech Matters “Guide to Attaching Exterior Wall Coverings Through Foam Sheathing to Wood or Steel Wall Framing”
1. Flexible polyethylene foam gasket strip to reduce air infiltration between a concrete foundation and sill plate.

1. Acceptable Products: the Dow chemical Company “STYROFOAM™ Sill Seal Foam Gasket.

2.3 WALL ASSEMBLY PERFORMANCE SPECIFICATIONS SECTION

A. Wall assembly must meet the following performance criteria:

* 1. ASTM 331 Standard test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air pressure Differences.
	2. ASTM E330 Standard test Method for Structural Performance of Exterior Windows, Skylights, Doors and Curtain Walls.
	3. ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
	4. ASTM E283 Standard Test Method for Determining Rate of Air Leakage Through Windows, Curtain Walls, and Door Under Specified Pressure Differences Across the Specimen.
	5. NFPA 285 Standard method of Test for Evaluation of Flammability characteristics of Foam plastic Rigid Insulation.
	6. NFPA 259 Standard test Method for Potential Heat of Building Materials.

a. FM 4880: Class 1 Fire Rating of Insulated Wall or Wall and Roof /Ceiling Panels Interior Finish Materials (Room Corner Fire Test).

* 1. UL 723 Surface burning characteristics of building materials – product must be a Class A.
	2. Compliance to Continuous Insulation in ASHRAE 90.1-2007 energy Standard for buildings except Low Rise Residential.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and installation conditions for compliance with requirements for installation conditions affecting performance of the work.

* 1. Verify that metal wall studs, opening framing, bridging, bracing and other framing support members and anchorage have been installed within wall system alignment tolerances and requirements.
	2. Verify that substrate surfaces to receive spray polyurethane foam are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond.
	3. Verify that items required to penetrate the wall system are place and penetration gaps and cracks are properly sealed before installation of spray polyurethane foam.
	4. Do not proceed with wall system installation until unsatisfactory conditions have been corrected.

3.2 INSULATION INSTALLATION

A. Install insulation in accordance with manufacturer’s recommendations: Fasten to exterior face of exterior metal stud wall framing using sheathing manufacturer’s recommended type and length screw fasteners with washers. Abut panels tightly together and around openings and penetrations.

* 1. Install sheathing panels horizontally with blue aluminum facing to exterior. Use maximum lengths to minimize number of joints. Locate edge joints parallel to and on framing. Center end joints over supports and stagger in each course. Provide additional framing wherever panel joints do not bear against framing plate or sill members.
	2. Fasten panels to each support with fasteners spaced 12 inches on center at perimeter of the wall and 16 inches on center in panel field. Set back perimeter fasteners 3/8” from edges and ends of panel units. Drive fasteners to bear tight and flush with surface of insulation. Do not overdrive fastener causing damage to the insulation board facer. Perimeter fasteners can be detailed to bridge the gap of abutting board joints due to the 2” diameter of the washer used to fasten the board to the studs. Maximum of two board joints may be bridged per fastener.
	3. Install flashing at end and edge joints in accordance with sheathing manufacturer’s joint sealing recommendations.
	4. Install flashing behind wall tie and mechanical fastening assemblies for rain screen claddings according to manufacturer’s recommendations.
	5. Seal sheathing joints and penetrations of sheathing in accordance with sheathing manufacturer’s joint and penetration sealing recommendations.
	6. After base flashing, which may include a termination bar running horizontally along the top edge of the flashing, is installed on exterior of insulated sheathing, install LIQUIDARMOR-CM or

WEATHERMATE™ Flashing 6 inch or 9 inch” to the exterior sheathing and lapped over the top edge of the base. If a termination bar is utilized a flat strap must be included in framing at termination bar height to allow proper fastening of the termination bar.

3.3 [SPRAY POLYURETHANE FOAM INSTALLATION]

1. Preparation
	* 1. Mask and cover adjacent areas to protect from overspray.
		2. Apply primers for special conditions as recommended by manufacturer.
		3. Cover wide joints with transition sheet membrane as specified in Section 07 27 50.
		4. Clean work area prior to application of sprayed insulation.
		5. Verify substrate temperature meets manufacturer’s requirements for specific formulations used.
		6. Ensure that all stud cavity fire-stopping is installed prior to application of spray foam.
2. Application: Spray apply polyurethane foam in accordance with ASTM C1029 and manufacturer’s installation guidelines; complying with preparation methods outlined in 3.3.A.
	* 1. Apply spray polyurethane foam by picture framing around the interior studs at the insulated sheathing- steel stud interface and one pass across all board joints and penetrations.
		2. Finish applying spray polyurethane foam with one pass not exceeding 1.5 inches in thickness. Two passes are acceptable to reach maximum thickness of 1.5 inch.
		3. If more than one layer is being applied, allow the layer applied first o cool to the max. substrate temperature or less recommended for the STYROFOAM™ Spray Polyurethane foam CM Series or FROTH PAK™ Ultra.
		4. Avoid formation of sub-layer air pockets.
		5. Apply spray polyurethane foam in overlapping layers, in a manner to obtain a smooth, uniform surface. Total thickness as indicated.
		6. Maintain [3 inch] [75 mm] clearance around chimneys, heating vents, steam pipes, recessed lighting fixtures and other heat sources.
		7. Do not apply spray polyurethane foam to inside of exit openings or electrical junction boxes.
		8. Maintain a continuous layer of spray foam from floor to floor to roof to complete air barrier.
		9. Site Tolerances: Maximum Variation in Applied thickness – minus [1/4 inch] [6 mm], plus [5/8 inch] [10 mm].
3. Field Quality control. Submit spray polyurethane foam field inspection and test reports for the following:
	* 1. The Certified Installer shall complete the Daily Work Record and record all information required including the results of the testing. The Daily work Record shall be kept on site for routine inspection. Copies of the daily Work Record shall be forwarded to the manufacturer, owner or owner’s representative upon request.
		2. The costs incurred for daily testing and inspection by the Certified Installer and the completion of the Daily work Record shall be done by the Accredited Contractor.
		3. If required by the owner, arrange for site inspections by a qualified third party inspector. The frequency and cost of inspections shall be included in the bid at the owner’s request. If the site inspection reveals any defects, the Accredited Contractor shall immediately rectify all such defects at his cost.
		4. The Certified Installer’s daily work record shall verify conformance with the Thermal and Air Barrier Wall System Manufacturer’s instructions, the standard ULC S705.2-02 Installation standard and this section of the project specification.
			1. Follow Manufacturer guidelines for proper temperature settings regarding spray equipment as stated on Manufacturer product information sheets.
			2. Follow Manufacturer guidelines for proper spray polyurethane foam formulation based on substrate and ambient temperatures product will be applied to.
			3. Test completed application daily for core density and cohesion/adhesion to substrate. Record results daily in test reports.
			4. After product has properly cured, conduct tests to verify adhesion between the spray polyurethane foam and the substrate.
			5. Conduct adhesion tests on all corners and building angles, at wall-to-slab junctions, and at wallto-roof junctions.
			6. Perform one adhesion test for every wall less than [100 feet] [30 meters] in length. Perform two testes for every wall greater than [100 feet] [30 meters] and less than [200 feet] [60 meters in length, with an additional test conducted for every additional [100 feet] [30 meters], or part thereof, in wall length.
			7. Transition membranes shall be pull tested in accordance with the Certified Installer training program requirements before installing the spray polyurethane air barrier material.]

3.4 LIQUIDARMOR™- CM FLASHING AND SEALANT INSTALLATION

A. LIQUIDARMOR™- CM is not a hazardous chemical, and does not pose a respiratory hazard when used according to instructions. It is recommended that when applying the spray to do so in a well ventilated area to ensure optimal product curing.

* 1. Surface and ambient temperatures should be 35 degrees F and rising and below 120 degrees F during the application.
	2. Do not apply product on surfaces with standing water or frost.
	3. LIQUIDARMOR™ -CM tolerates rain shortly after the curing process has begun (typically 1 to 4 hours), avoid installing on days with a high probability of significant rainfall.
	4. Seal any gaps greater than ¼” with GREAT STUFF PRO Window and Door Insulating Foam Sealant or compatible sealant according to manufacturer’s recommendations, prior to applying

LIQUIDARMOR™- CM. If facer on insulation board is damaged note the affected area so that additional spray can be applied appropriately. Damaged insulation can also be replaced or WEATHERMATE Straight Flashing Tape can be used to tape down facer flaws.

* 1. Flash board joints, penetrations and other fenestration openings as required with a minimum50 wet mils (+/-5). Spray can be applied on one or two passes depending on site conditions.
	2. Apply 3 inches (+/-1”) over the board joints. Make sure that a minimum of 1” of spray covers each side of the joint. Fasteners and washers along the board joints should also be completely covered with LIQUIDARMOR™- CM. Brick anchors can be installed after the application of LIQUIDARMOR™- CM.
	3. For rough openings apply LIQUIDARMOR™- CM a minimum of 3 inches onto the sheathing face, completely covering the sheathing board edge. In turn extend spray a minimum of 3 inches back onto the rough opening substrate. It is recommended to cover a distance back onto the rough opening equal to what is covered by traditional flashing materials
	4. For penetrations through the rigid insulation or substrate apply LIQUIDARMOR™- CM a minimum of 2 inches onto the sheathing face and a minimum of 2 inches onto the penetration substrate or primary flashing substrate..
	5. Use wet mil thickness gauge to ensure proper installation thickness. A paint brush can be used to even out product application thickness. If product is consistently below minimum thickness spray another pass to achieve proper thickness requirements.
	6. LIQUIDARMOR™- CM typically cures to touch within 1 to 4 hours after application. Depending on humidity, temperature, sun exposure and wind direction this time can be longer. Application will dry to an approximate 30 mil thickness when completely cured.

PART 4- PRODUCT DATA SHEET 1 – Cleaning

1.1 Remove overspray from non-prescribed surfaces without causing damage to surfaces.

1.2 Remove protective covers from adjacent surfaces.

END OF SECTION 07 42 65

**NOTICE:** No freedom from any patent owned by Dow or others is to be inferred. Because use conditions and applicable laws may differ from one location to another and may change with time, Customer is responsible for determining whether products and the information in this document are appropriate for Customer's use and for ensuring that Customer's workplace and disposal practices are in compliance with applicable laws and other government enactments. The product shown in this literature may not be available for sale and/or available in all geographies where Dow is represented. The claims made may not have been approved for use in all countries or regions. Dow assumes no obligation or liability for the information in this document. References to "Dow" or the

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WARRANTIES SPECIFICALLY PROVIDED BY DOW. ALL IMPLIED WARRANTIES INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

**Dow Polyisocyanurate Insulation**

**CAUTION:** This product is combustible and shall only be used as specified by the local building code with respect to flame spread classification and to the use of a suitable thermal barrier. For more information, consult MSDS, call Dow at 1-866-583-BLUE (2583) or contact your local building inspector. In an emergency, call 1-989-636-4400.

**WARNING:** Rigid foam insulation does not constitute a working walkable surface or qualify as a fall protection product

**Dow Polyurethane Foam Insulation and Sealants**

**CAUTION:** When cured, these products are combustible and will burn if exposed to open flame or sparks from high-energy sources. Do not expose to temperatures above 240ºF (116ºC). For more information, consult MSDS, call Dow at 1-866-583-BLUE (2583) or contact your local building inspector. In an emergency, call 1-989-636-4400 in the U.S. or 1-519-339-3711 in Canada.

**GREAT STUFF PRO™** sealant and adhesive products contain isocyanate and a flammable blowing agent. Read the label and Material Safety Data Sheet carefully before use. Eliminate all sources of ignition before use. Wear long sleeves, gloves, and safety glasses or goggles. Provide adequate ventilation or wear proper respiratory protection. Contents under pressure..

**FROTH-PAK™ Spray Polyurethane Foam** contains isocyanate, hydrofluorocarbon blowing agent and polyol. Read the instructions and Material Safety Data Sheets carefully before use. Wear protective clothing (including long sleeves), gloves, goggles or safety glasses, and proper respiratory protection.Do not breathe vapor or mist. Use only with adequate ventilation. It is recommended that applicators and those working in the spray area wear respiratory protection. Increased ventilation significantly reduces the potential for isocyanate exposure, however, supplied air or an approved air-purifying respirator equipped with an organic vapor sorbent and a particulate filter may still be required to maintain exposure levels below ACGIH, OSHA, WEEL or other applicable limits. For situations where the atmospheric levels may exceed the level for which an air-purifying respirator is effective, use a positive-pressure, air-supplying respirator (air line or self-contained breathing apparatus). Spraying large amounts of foam indoors may require the use of a positive pressure, air-supplying respirator. Contents under pressure.**STYROFOAM™ Brand Spray Polyurethane Foam** contains isocyanate, hydrofluorocarbon blowing agent and polyol. Read the instructions and Material Safety Data Sheets carefully before use. Wear protective clothing (including long sleeves), gloves, goggles and proper respiratory protection. Supplied air or an approved air-purifying respirator equipped with an organic vapor sorbent and a P100 particulate filter is required to maintain exposure levels below ACGIH, OSHA, WEEL or other applicable limits. Provide adequate ventilation. Contents under pressure. STYROFOAM™ Brand SPF should be installed by a trained SPF applicator.

Building and/or construction practices unrelated to building materials could greatly affect moisture and the potential for mold formation. No material supplier including Dow can give assurance that mold will not develop in any specific system.

179-00017-0515DOW

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