



211RR049A/a

June 24, 2011

To: Building Officials within the Province of Ontario
c/o NUDURA Corporation
27 Hooper Rd., Unit #10
Barrie, ON, L4N 9S3

Attn: **Keven Rector**

Email: keven@nudura.com

Re: **NUDURA Brand Dampproofing Products for use with NUDURA Insulated Concrete Forms (ICF) Engineering Opinion for Code Compliance with Part 9 of the 2006 OBC**

The NUDURA Brand Dampproofing comprises of modified sheet bituminous self-adhesive membranes (referred to as “peel-and-stick dampproofing” membrane throughout this letter). Halsall Associates Limited has reviewed documentation relevant to this product’s use on below grade insulated foundations (ICF) for buildings in compliance with Part 9, Sub-Section 9.13.2., Dampproofing of the 2006 Ontario Building Code (OBC).

It is our understanding that the Canadian Construction Material Centre (CCMC) has yet to finalize a technical guideline for ICF dampproofing materials. The Ministry of Municipal Affairs and Housing’s Building and Development Branch has indicated that in cases where an evaluation opinion does not yet exist, it is appropriate that a Professional Engineer provide an opinion about whether the material is appropriate for its intended uses relative to the Building Code (refer to the attached memorandum dated Nov. 19, 2010). The Ministry has also given guidance that Division A, Article 1.2.1.1, Alternative Solutions may assist in arriving at such opinion.

Our findings and opinion follow:

1. Building Code Requirements for Dampproofing and Drainage

According to Sub-Section 9.13.2, dampproofing is:

- ▶ Required for below grade portion of foundations where basements and crawlspaces are accessible and/or occupied;
- ▶ Permitted on foundation walls where hydro-static water pressure will not occur; and
- ▶ Required to have a surface free of projections and depression that could lead to detrimental performance.

According to Sub-Section 9.14.2 (unless shown to be unnecessary), foundation walls (more than 900 mm below grade) require drainage when they are dampproofed, consisting of:

- ▶ 19 mm thick mineral fibre insulation; or
- ▶ 100 mm of free draining granular material (defined in Sub-Section 9.14.4); or
- ▶ A drainage medium as defined by A.9.14.2.2 (such as a geotextile drainage mat, or similar).

According to Sub-Section 9.13.4, basement and crawlspace foundation walls in contact with the ground (that are accessible and/or occupied on the interior) shall be constructed to resist soil gas leakage into the building.

Halsall Associates Limited

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2. NUDURA Brand Damproofing Product Relative the Code

In evaluating compliance with the Code, we are relying on Division A, Section 2.1 Alternative Solutions. The relevant Objective and Function Statements relating to the use of your damproofing product are summarized as follows:

Code Reference	Functional Statement	Objective	Summary of "Areas of Performance"
9.13. 2.2	F61		To resist the ingress of precipitation, water or moisture or water from the exterior or from the ground
		OS2.3	Limit probability of injury due to structural failure resulting from deterioration of building elements
	F40		Re: Materials installed to control ingress of Gas To Limit the level of contaminants
		OH1.1	To limit probability of illness due to inadequate indoor air quality (as a result of air contaminants)
	F61	OH1.1	Re: Materials installed to control ingress of moisture: To limit probability of illness due to inadequate indoor air quality (mold)
		OH1.2	Re: Materials installed to control ingress of moisture: To limit probability of illness due to inadequate thermal comfort
		OH1.3	Re: Materials installed to control ingress of moisture: To limit probability of illness due to contact with moisture

3. Engineering Opinion

The Ministry of Municipal Affairs and Housing advises in their memorandum dated November 19, 2010 (copy attached) that "Peel and Stick" membranes have the capacity to perform as damproofing provided the material is compatible with the ICF. We have observed that the NUDURA Brand Damproofing Membrane Product:

- ▶ Is composed of self-adhering polymer modified bitumen. This material has a history of being compatible with expanded polystyrene (EPS) based ICFs (provided solvent based primers are not used);
- ▶ Has lower water vapour transmission than other membranes specified in Sub-Section 9.13.2 of the OBC are expected to be less than 1.0 g/m²/day. The water vapour transmission of the NUDURA Brand Damproofing is reported to be well under this threshold, at around 0.14 g/m²/day, and therefore will adequately resist below grade water vapour; and
- ▶ The collective layers of the NUDURA ICF and NUDURA Brand Damproofing can provide adequate resistance to soil gas, as good or better than the materials already approved by the OBC. This is based on the material's low vapour permeability and the inherent air tightness of the assembly (provided the walls are constructed with reasonable workmanship penetrations are sealed).

When properly installed, it is our opinion the NUDURA Brand Damproofing Membrane Product meets the intent of the 2006 OBC.



Respectfully submitted,
HALSALL ASSOCIATES LIMITED



Kevin Day
Project Manager



Jay Leedale, P.Eng.
Project Principal



Attachments:

1. Appendix A - List of Documents Reviewed
2. Appendix B - Limitations
3. Appendix C - Ministry of Municipal Affairs & Housing - Memorandum - Re: Dampproofing of flat insulating concrete forms, dated November 19, 2010

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LIST OF DOCUMENTS REVIEWED

1. 2006 Ontario Building Code – Part 9 and the Objective & Functional Statements.
2. Nudura ICF as an Air Barrier System – report by CTL Group, dated July 28, 2005.
3. Ministry of Municipal Affairs & Housing – Memorandum – Re: Dampproofing of flat insulating concrete forms, dated November 19, 2010.
4. NUDURA Waterproof Membrane – technical data sheet – *reviewed as it relates to the product being installed as dampproofing.*
5. NUDURA Waterproof Membrane – technical bulletin for installation – *reviewed as it relates to the product being installed as dampproofing.*
6. NUDURA® Corporation 5 Years Material Warranty.
7. Canadian General Standards Board (CGSB) 37-GP-56M – Standard for Membrane, Modified, Bituminous, Prefabricated and Reinforced for Roofing, dated July 1980.
8. Adhesion Performance of COLPHENE ICF Membrane - ICF application, dated November 6, 2009 – *product is comparable to Nudura Brand Damproofing.*
9. Water Vapour Transmission for ICF Membrane, dated March 14th, 2009 – *product is comparable to Nudura Brand Damproofing.*
10. Letter from supplier of Nudura ICF Dampproofing membrane supplier, Soprema, dated November 25, 2010 – confirms compatibility of SBS modified bitumen and expanded polystyrene (EPS) used for Nudura's ICF.
11. Nudura Dampproofing Equivalency Submission Options 1, 2 and 3 – At and Below Grade, Details DPES01/03/05 dated November 2010 and DPES02/04/06 dated April 2011.



LIMITATIONS

- ▶ Any third party user of this report specifically denies any right to any claims, whether in contract, tort and/or any other cause of action in law, against the Consultant (including their officers, agents and employees).
- ▶ The work reflects the Consultant's best judgement in light of the information reviewed by them at the time of preparation. Unless otherwise agreed in writing by Halsall, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. This is not a certification of compliance with past or present regulations. No portion of this report may be used as a separate entity; it is written to be read in its entirety.
- ▶ Only the specific information identified has been reviewed. The Consultant is not obligated to identify mistakes or insufficiencies in the information obtained from the various sources or to verify the accuracy of the information.
- ▶ Halsall is not investigating or providing advice about pollutants, contaminants or hazardous materials.
- ▶ The Client and other users of this report expressly deny any right to any claim, including personal injury claims, which may arise out of pollutants, contaminants or hazardous materials, including but not limited to mould, mildew or other fungus.
- ▶ Installers of the Nudura ICF and Damproofing products are responsible for complying with manufacturer's specifications and installation details, as well as applying reasonable judgement and follow industry practice.
- ▶ The detailing of ICF wall systems remain the responsibility of the designer.



**Ministry of
Municipal Affairs
and Housing**

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**Ministère des
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www.ontario.ca/buildingcode



November 19, 2010

Re: Dampproofing of flat insulating concrete forms.

There has been much debate as to how the Ontario Building Code deals with "peel and stick" membranes when they are used as dampproofing of flat insulating concrete forms and which have no Canadian Construction Material Centre approval.

Peel and stick membranes are included in CGSB-37-GP-56M which appears in Table 5.10.1.1. of Part 5 (Environmental Separation) and Article 9.26.2.1. of Part 9 (small buildings).

This same standard was found in the 1997 OBC in Article 9.13.2.1. which contained a list of acceptable exterior dampproofing materials. This standard was removed from this list in the 2006 OBC following the lead of the mNBC.

Peel and stick membranes that comply to CGSB-37-GP-56M have the capacity to perform as a dampproofing membrane provided they are chemically compatible with the material over which they are being placed.

It would be appropriate therefore, for the proponent of any dampproofing material to demonstrate that the system is appropriate for its intended use. It would be reasonable to accept a report from a professional engineer or architect or competent evaluation agency.

Division A, Section 2.1. "Alternative Solutions" of the Building Code provides for achieving compliance via an "alternative solution" using "objectives" and "functional statements". The alternative solution must demonstrate to the municipality, through documentation that establishes on the basis of past performance, testing, or other evaluation, that the design(s) will achieve the level of performance required by the Code.

Under the Building Code Act 1992, the local principal authority has jurisdiction for enforcing the Act and the Building Code. Proponents should consult with the local principal authority before taking any action.

Viviana Zothner-Cotic, M.Arch., OAA
Manager Technical Training, Registration and Code Advisory Unit
Building and Development Branch
Ministry of Municipal Affairs and Housing

NUDURA FORM UNIT

1 mm (40 mil) NUDURA BRAND DAMPPROOFING MEMBRANE INSTALLED AS PER NUDURA INSTALLATION MANUAL INSTRUCTIONS (SUBJECT TO MODIFICATION NOTE BELOW) INTENDED TO MEET SECTION 9.13.2.2/2006 OBC SUBMITTED FOR EQUIVALENCY COMPLIANCE UNDER DIVISION A SECTION 1.2.1.1(b)/2006 OBC

CCMC/BMEC/BCC APPROVED HIGH DENSITY POLYETHYLENE DIMPLED MEMBRANE DRAINAGE/PROTECTION LAYER AS PROVIDED FOR UNDER SECTION 9.14.2.1(2)(b)/2006 OBC

NATIVE SOIL BACKFILL

CONTINUOUS CONCRETE FOOTING ON UNDISTURBED SOIL AS PER SECTION 9.15.3.4 & 9.15.3.5

*NOTE: 1 mm (40 mil) NUDURA BRAND DAMPPROOFING MEMBRANE TO LAP FOOTING

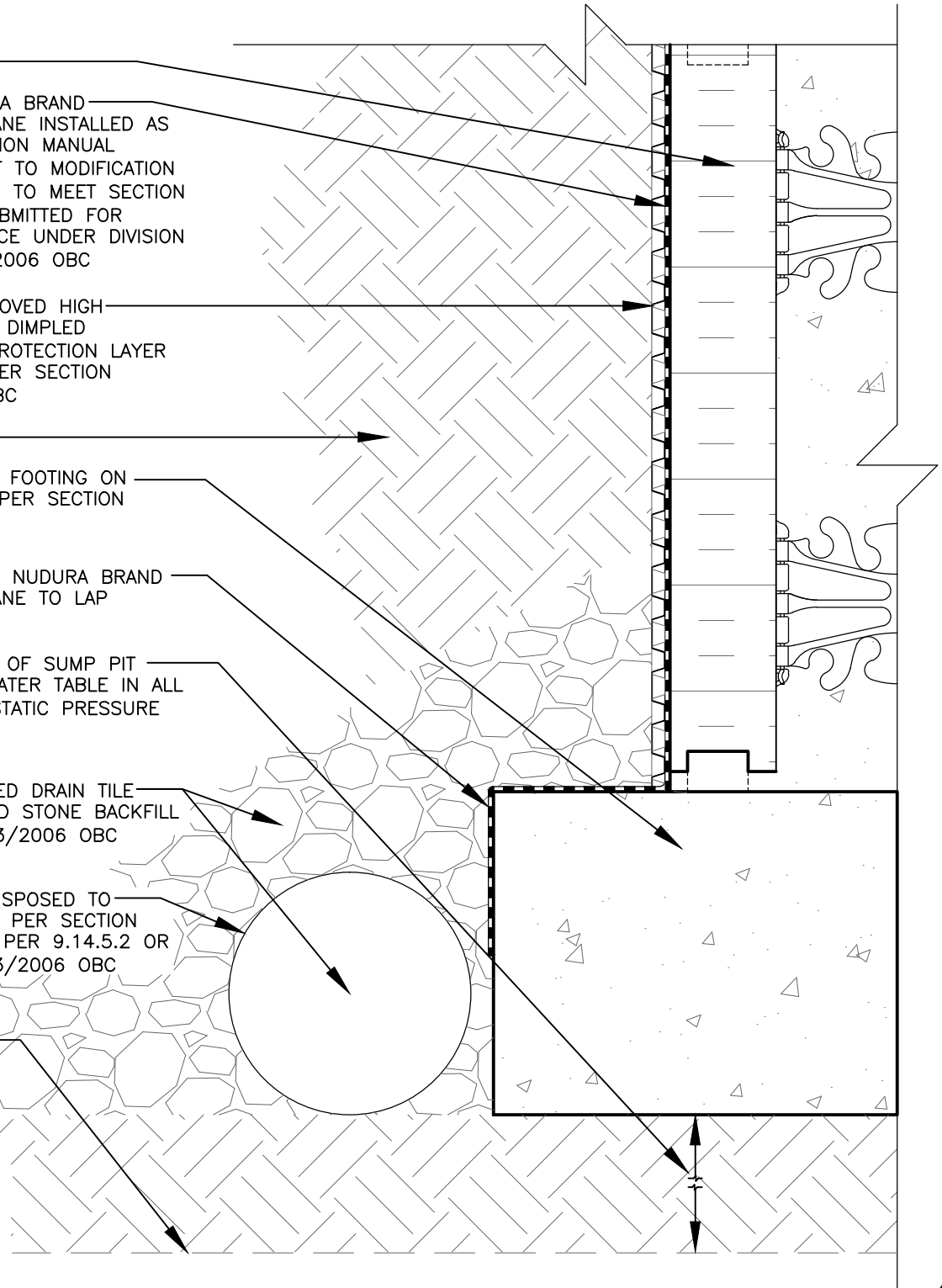
FOOTING AND/OR BASE OF SUMP PIT SHALL BE CLEAR OF WATER TABLE IN ALL SEASONS (NO HYDRO STATIC PRESSURE ON WALL)

CONTINUOUS PERFORATED DRAIN TILE COVERED WITH CRUSHED STONE BACKFILL AS PER SECTION 9.14.3/2006 OBC

PERIMETER DRAINAGE DISPOSED TO SEWER DRAINAGE DITCH PER SECTION 9.14.5.1 OR SUMP PIT PER 9.14.5.2 OR DRY WELL PER 9.14.5.3/2006 OBC

WATER TABLE BELOW FOOTING

DISCLAIMER NOTICE:
SPECIFIC INFORMATION
REQUIRED FOR COMPLIANCE
WITH LOCAL CODES IS THE
RESPONSIBILITY OF THE
DESIGNER



NUDURA

INTEGRATED BUILDING TECHNOLOGY

Building Value.

NUDURA DAMPPROOFING
EQUIVALENCY SUBMISSION
OPTION 3
BELOW GRADE

REV. NO.
001 KS

DATE:
APRIL 2011

DRAWN BY:
K. STILL

DWG NO.

DPES06

SCALE:
1 : 4

NUDURA FORM UNIT

EXTERIOR FINISH

TOP OF NUDURA FOUNDATION WALL TO TERMINATE OR (WHEN NUDURA WALL USED ABOVE GRADE), FIRST STOREY FINISH TO COMMENCE MINIMUM 150mm (5 7/8") ABOVE GRADE (AS SHOWN) PER SECTION 9.15.4.6(1)/2006 OBC

EXPOSED ABOVE GRADE PORTION OF FOUNDATION WALL TO BE FINISHED WITH PREP COAT B2000 PARGE COAT AS PER SECTION 8.0 OF 2010 NUDURA INSTALLATION MANUAL PER INTENT OF SECTION 9.15.6.2 OF THE 2006 OBC

FINISH MAINTAINED MINIMUM 152mm (6") ABOVE FINISHED GRADE LEVEL PER 9.15.4.6(1)/2006 OBC

SLOPE GRADE AT MINIMUM 2% AWAY FROM BUILDING FOR ENTIRE APRON OF BUILDING

TOPSOIL

DIMPLED PROTECTION BOARD TO BE ANCHORED AT TOP OF INSTALLATION ONLY. SCREWS TO BE INSTALLED ABOVE TOP LIMIT OF NUDURA MEMBRANE

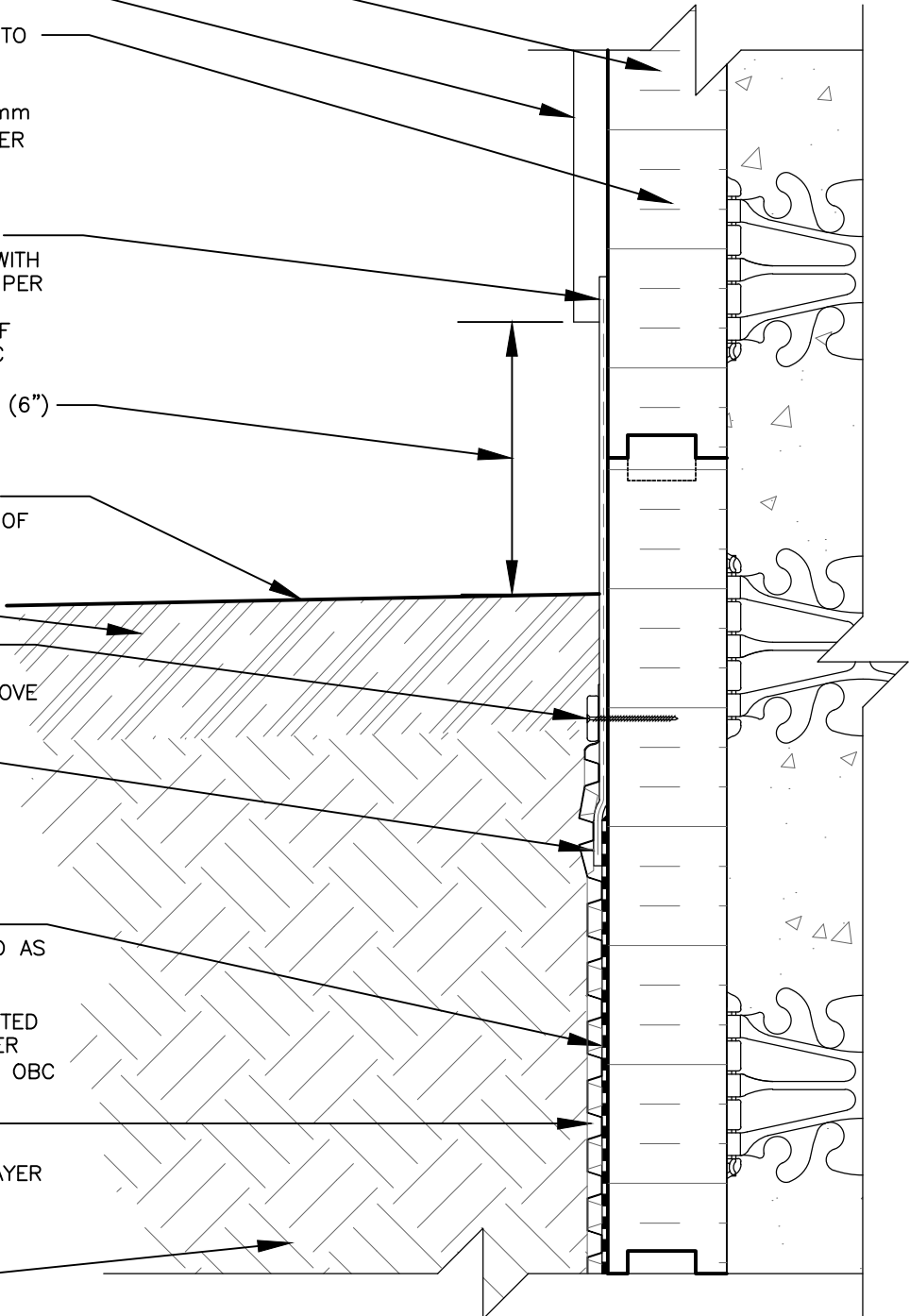
TOP OF MEMBRANE TO BE PROTECTED CONTINUOUS WITH MINIMUM 25mm (1") LAP OF ACRYLIC PARGE COATING INSTALLED AS PER SECTION 8.0 OF 2010 NUDURA INSTALLATION MANUAL

1 mm (40 mil) NUDURA BRAND DAMPPROOFING MEMBRANE INSTALLED AS PER NUDURA INSTALLATION MANUAL INSTRUCTIONS INTENDED TO MEET SECTION 9.13.2.2/2006 OBC SUBMITTED FOR EQUIVALENCY COMPLIANCE UNDER DIVISION A SECTION 1.2.1.1(b)/2006 OBC

CCMC/BMEC/BCC APPROVED HIGH DENSITY POLYETHYLENE DIMPLED MEMBRANE DRAINAGE/PROTECTION LAYER AS PROVIDED FOR UNDER SECTION 9.14.2.1(2)(b)/2006 OBC

NATIVE SOIL BACKFILL

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NUDURA DAMPPROOFING
EQUIVALENCY SUBMISSION
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K. STILL

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DPES05

SCALE:
1 : 4

NUDURA FORM UNIT

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MINIMUM 19mm (3/4") MINERAL FIBER INSULATION BOARD TO PROVIDED PROTECTION FOR MEMBRANE AS APPROVED FOR IN SECTION 9.14.2.1(2)(a)(i)/2006 OBC

NATIVE SOIL BACKFILL

CONTINUOUS CONCRETE FOOTING ON UNDISTURBED SOIL AS PER SECTION 9.15.3.4 & 9.15.3.5

*NOTE: 1 mm (40 mil) NUDURA BRAND DAMPPROOFING MEMBRANE TO LAP FOOTING

FOOTING AND/OR BASE OF SUMP PIT SHALL BE CLEAR OF WATER TABLE IN ALL SEASONS (NO HYDRO STATIC PRESSURE ON WALL)

CONTINUOUS PERFORATED DRAIN TILE COVERED WITH CRUSHED STONE BACKFILL AS PER SECTION 9.14.3/2006 OBC

PERIMETER DRAINAGE DISPOSED TO SEWER DRAINAGE DITCH PER SECTION 9.14.5.1 OR SUMP PIT PER 9.14.5.2 OR DRY WELL PER 9.14.5.3/2006 OBC

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NUDURA DAMPPROOFING
EQUIVALENCY SUBMISSION
OPTION 2
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DPES04

SCALE:
1 : 4

NUDURA FORM UNIT

EXTERIOR FINISH

TOP OF NUDURA FOUNDATION WALL TO TERMINATE OR (WHEN NUDURA WALL USED ABOVE GRADE), FIRST STOREY FINISH TO COMMENCE MINIMUM 150mm (5 7/8") ABOVE GRADE (AS SHOWN) PER SECTION 9.15.4.6(1)/2006 OBC

EXPOSED ABOVE GRADE PORTION OF FOUNDATION WALL TO BE FINISHED WITH PREP COAT B2000 PARGE COAT AS PER SECTION 8.0 OF 2010 NUDURA INSTALLATION MANUAL PER INTENT OF SECTION 9.15.6.2 OF THE 2006 OBC

FINISH MAINTAINED MINIMUM 152mm (6") ABOVE FINISHED GRADE LEVEL PER 9.15.4.6(1)/2006 OBC

SLOPE GRADE AT MINIMUM 2% AWAY FROM BUILDING FOR ENTIRE APRON OF BUILDING

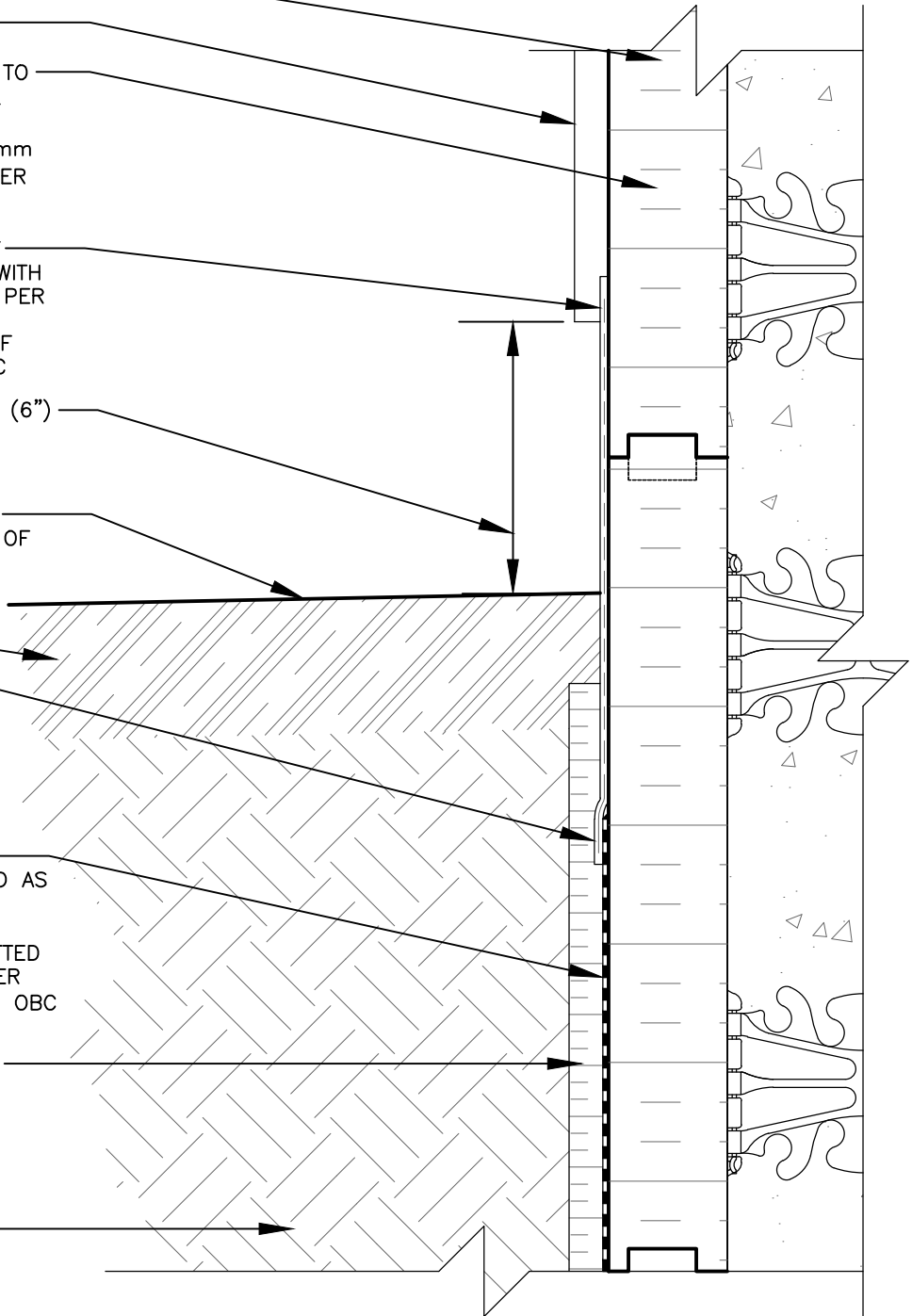
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NATIVE SOIL BACKFILL



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OPTION 2
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DPES03

SCALE:
1 : 4

NUDURA FORM UNIT

1 mm (40 mil) NUDURA BRAND DAMPPROOFING MEMBRANE INSTALLED AS PER NUDURA INSTALLATION MANUAL INSTRUCTIONS (SUBJECT TO MODIFICATION NOTE BELOW) INTENDED TO MEET SECTION 9.13.2.2/2006 OBC SUBMITTED FOR EQUIVALENCY COMPLIANCE UNDER DIVISION A SECTION 1.2.1.1(b)/2006 OBC

MINIMUM 100mm (4") SAND DRAINGAGE/PROTECTION LAYER FOR NUDURA MEMBRANE AS PER SECTION 9.14.2.1(2)(a)(ii)/2006 OBC

NATIVE SOIL BACKFILL

CONTINUOUS CONCRETE FOOTING ON UNDISTURBED SOIL AS PER SECTION 9.15.3.4 & 9.15.3.5

*NOTE: 1 mm (40 mil) NUDURA BRAND DAMPPROOFING MEMBRANE TO LAP FOOTING

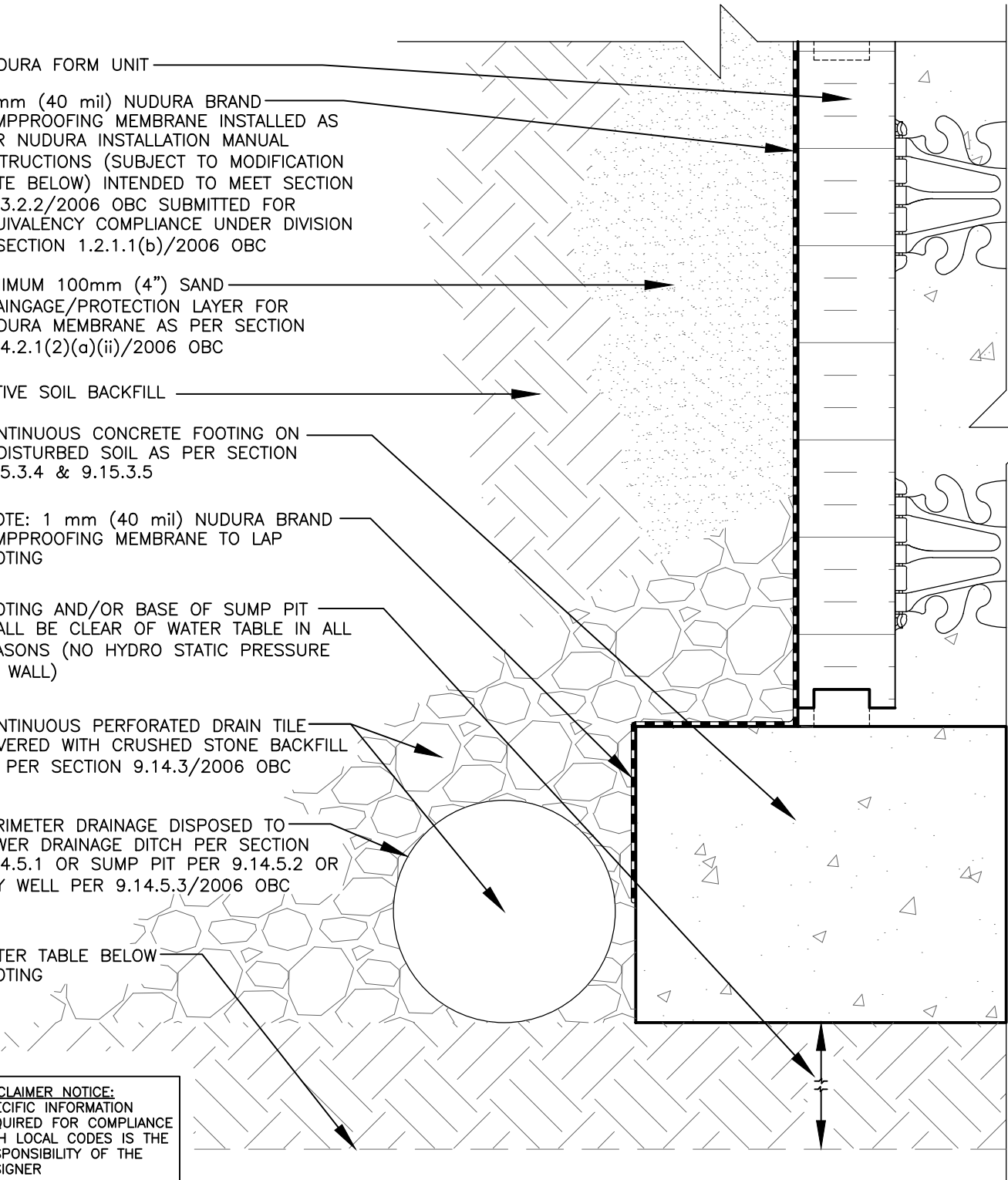
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WATER TABLE BELOW FOOTING

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NUDURA DAMPPROOFING
EQUIVALENCY SUBMISSION
OPTION 1
BELOW GRADE

REV. NO.
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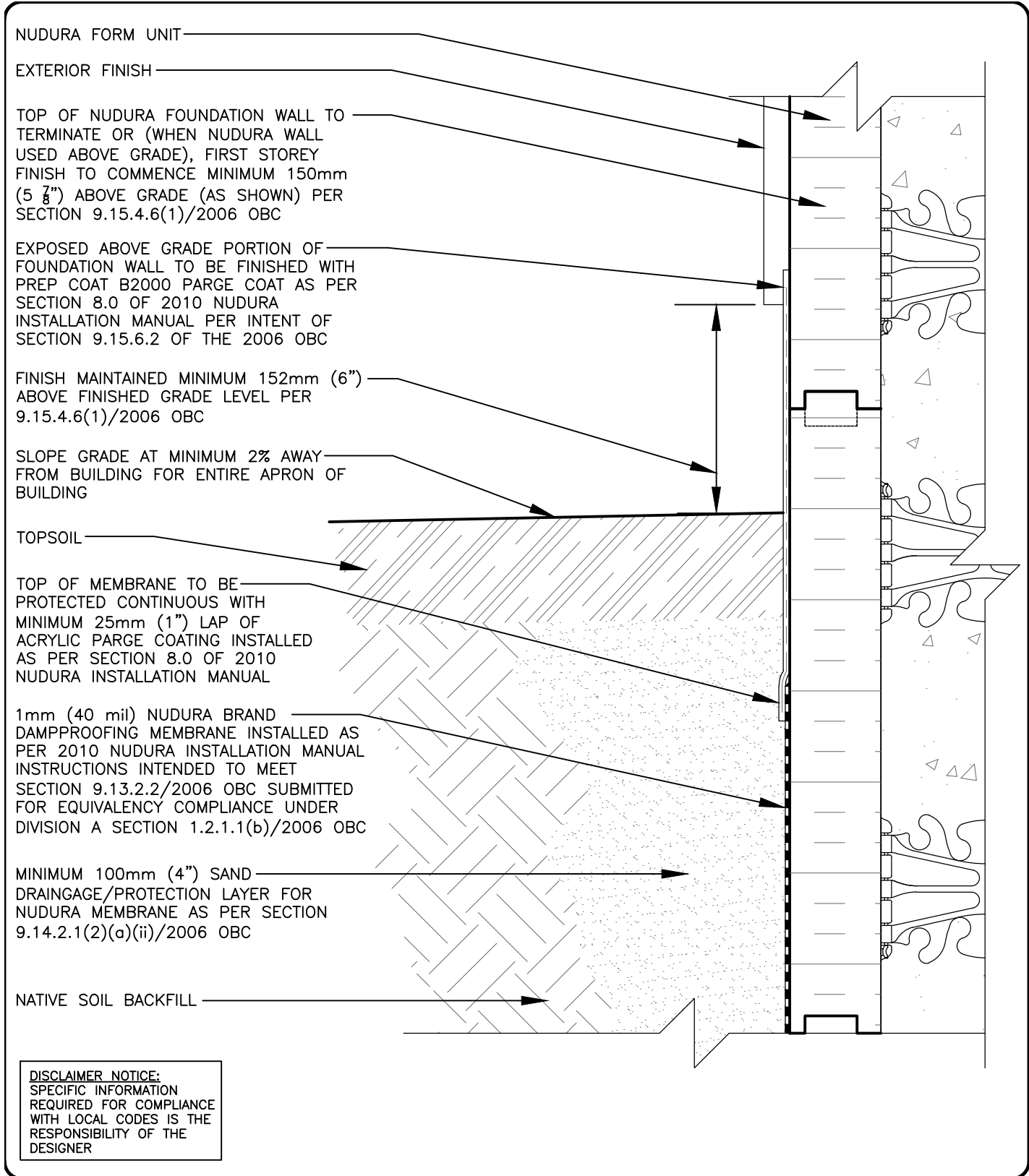
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APRIL 2011

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DPES02

SCALE:
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NUDURA DAMPPROOFING
 EQUIVALENCY SUBMISSION
 OPTION 1
 AT GRADE

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REV. DATE:
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DPES01

SCALE:
1 : 4

WATERPROOFING MEMBRANE - Technical Bulletin



SUPERIOR PERFORMANCE

- NUDURA® brand Waterproofing Membrane is a peel and stick membrane that adheres to NUDURA® expanded polystyrene (EPS) foam.
- The membrane satisfies damp proofing and water proofing requirements for all building codes in North America.
- A 3" (76mm) wide hand roller is available and recommended to ensure that the adhesive side of the membrane is fully and properly affixed to the foam. NUDURA® makes available both summer and winter grade membrane as seasonal temperatures dictate. Be sure you qualify with your distributor which grade you require at time of ordering.

DELIVERY AND SITE CONSIDERATIONS

- Care should be taken to protect the material on site from moisture, dust and general wear and tear. Store rolls in a cool, dry location, not in direct ground contact and protect with a tarp to prevent exposure until ready to use.
- Working temperature range should ideally be between 35°F and 100°F (2°C and 38° C) Note: if below this range or other special conditions such as air borne dust exist on site, consider using an adhesion primer **available from your NUDURA® distributor**. To maximize primerless adhesion on colder days, store the material in a heated location on site until needed. (A heat gun can also be used to assist in application).
- NUDURA® Waterproofing Membrane should not be exposed to sunlight for extended periods of time. Backfilling should take place within 1 week of installing the membrane. If daytime temperature exceeds 80°F (27°C) after installation, NUDURA® recommends shading the applied membrane temporarily until backfilling is completed.

SITE PREPERATION

1. Ensure that the wall surface is smooth, dry, free from dust, dirt and any other impurities that could be on the wall.
2. If the EPS foam surface has been exposed to sunlight for extended periods of time, the resulting yellow dust coating must be fully removed in order for the membrane to adhere properly.

NOTE:

Installation works most efficiently with a 2 person work crew - one handling the material from each side. The most efficient method of installation (as described in this bulletin) is vertical application of the sheets with 2" (51mm) overlaps at the sides of the material. If horizontal application of the material is preferred or required in some locations, be sure to work from the bottom of the wall to the top and lap material a minimum of 6" (152mm) in shingle fashion so that water is shed downward and OVER the layer below.

WATERPROOFING MEMBRANE - Technical Bulletin

INSTALLATION INSTRUCTIONS

1. Establish the finished grade around the entire perimeter of the building using a chalk line and/or marker.
2. Begin material installation by first cutting strips of membrane 16" (406mm) to 24" (610mm) wide. These will be used to pre-seal all inside and outside corner conditions. Fold strips in half vertically.
3. At each inside corner, starting at the footing level, peel release paper away and apply the strips in a shingle like fashion from the base to the top of the corner, installing the strips vertically so that an equal amount of material is applied to either side of the corner. Take care to press the fold tightly into the corner so that no air pockets are trapped behind - then press or roll the membrane flat to the wall surfaces on either side using a plastic roller as necessary. Each strip of material should lap the strip below it by 6" (152mm) Continue application and lapping of the strips to the grade line and trim the membrane above it.
4. Select an outside corner for the start of full membrane installation and measure the distance from the chalked grade line to the top of the footing. For sloping grade lines, measure to longest side of the membrane.
5. Roll out the membrane on a flat surface, then mark and cut it to the required length.
6. Peel back the silicone release paper a distance of about 1' (305mm) from the top edge of the cut edge of the membrane.
7. Align the top edge of the membrane with the chalk line so that one side of the membrane extends past the corner by approx. 4" to 5" (102mm -127mm). (For sloping grade lines, lightly tack the portion of membrane above the chalk line and trim back to chalk line after rest of membrane is secured in place). Use the score lines in the form face as guides to keep the membrane vertical while installing.
8. While keeping the extended side of the membrane in plane with the starting wall, firmly press it into place onto the face of the EPS foam. Use the plastic roller to roll the membrane from the center out to the edges to prevent any air bubbles from getting trapped.
9. Continue down the surface of the wall by further peeling back the release paper and pressing and/or rolling the membrane into position as outlined in step 8. Repeat process down the length of the wall to the footing.
10. Now press the free 4" to 5" (102mm-127mm) side of the material into place down the opposing wall from the corner condition following procedure outlined in step 8.
11. For service or utility penetrations that project outward through the wall: (a) Cut a 12" x 12" (305mm x 305mm) piece of membrane-then use the pipe as a template to cut 2 cross cut slits at the center of the piece just short of the full pipe diameter. (b) Peel the backing paper away and slide the piece into place over the projecting pipe penetrating it through the center of the slits. (c) Press the membrane piece firmly into place, sealing the flaps against the pipe. (d) Apply the standard sheet membrane (cut to required length), following the same procedures as outlined in step 8, except at the pipe location - peel back the paper clear of the pipe, lower membrane to pipe and cut a cross slit right over pipe and seal around, then continue the installation procedure
12. Should the service penetration be flush with the wall, mark this opening to allow the following sub trade the opportunity to use it.
13. For sites with coarse backfill or risk of sharp edged aggregates, NUDURA® recommends that a backfill protection layer be installed over the waterproofing membrane consisting of board, heavy plastic sheet materials, fan-fold ribbed plastic board etc.



NUDURA Waterproof Membrane

Description:

NUDURA Waterproof Membrane is a self adhesive waterproofing membrane designed for below grade damp proofing and waterproofing applications. It is composed of SBS modified bitumen and a polyethylene woven complex. This surface provides 100 % protection from UV radiation. A silicone release paper protects the adhesive side.

NUDURA Waterproof Membrane can be applied directly the EPS (expanded polystyrene) and the NUDURA ICF forms. Clean, dry and even surfaces generally do not require priming. If specific conditions call for the use of primer, such as dusty work sites, NUDURA recommends using a **polymer emulsion**-based primer called ELASTOCOL STICK H₂O. Solvent-based primers may damage polystyrene and therefore must not be used. The ELASTOCOL STICK H₂O is only available through special order.

Application temperatures: Winter Grade: -10°C to 40°C (14°F to 104°F)
 Summer Grade: 10°C to 50°C (50°F to 122°F)

Service temperatures: Winter and Summer: -45°C to 70°C (-49°F to 158 °F)

Installation:

NUDURA's Membrane needs to be installed vertically onto the wall surface. The surface should be cleaned of all excess foreign debris before applying the membrane. When apply the membrane vertically the overlap needs to be 50mm (2") as per the markings on the edges of the membrane. Should the membrane need to be installed horizontally then the overlap will need to be 150mm (6"). For complete installation instructions please refer to technical bulletins section at NUDURA's web site www.nudura.com.

If needed, apply ELASTOCOL **STICK H₂O** primer at the rate of 0.15 to 0.25 L/m². Allow drying completely before application of the membrane. Membrane must be applied the same day as the application of primer.

To ensure a perfect seal, a trowelled bead of polystyrene foam compatible mastic/adhesive should be installed along the top edge of the membrane and at the termination and/or angle change where the ICF meets the concrete footing. For rocky soil, a protection board (e.g. SOPRABOARD, etc...) must be installed prior to backfilling.

Additional information is available from your local NUDURA distributor.

Properties:

Properties	Standards	NUDURA Waterproof Membrane	
		METRIC	IMPERIAL
Thickness	-	1.0 mm	40 mil
Dimension	-	22.9 x 0.91 m	75 ft x 36 in
Gross / Net coverage per roll	-	20.8 / 19.1 m ²	225 / 206 ft ²
Roll weight	-	20 kg	44 lb
Top face	-	Polyethylene woven complex	
Under face	-	Silicone release paper	
Tensile strength, MD/XD	ASTM D5147	11.3 / 15.4 kN/m	64 / 88 lbs/in
Ultimate elongation, MD/XD	ASTM D5147	52 / 24 %	
Flexibility at cold temperature	ASTM D5147	-30 °C	-22 °F
Static puncture	ASTM D5602	400 N	90 lbs
Tear resistance, MD/XD	ASTM D1876	375 / 400 N	85 / 90 lbs
Lap adhesion	ASTM D1876	2000 N/m	11.4 lbs/in
Peel resistance	ASTM D903	3050 N/m	17.5 lbs/in
Water absorption	ASTM D5147	< 0.1 %	
Water vapour permeance	ASTM E96 (Procedure B)	< 0.90 ng/Pa.s.m ²	< 0.016 perm

(All values are nominal)