

13 Physical Properties Tests Clearly Separate DECRA from the Competition

Stone-coated steel roofing systems are largely known for their strong performance in passing national building code compliance tests involving primarily wind and fire to satisfy U.S. International Residential Code (IRC) and International Building Code (IBC) requirements. DECRA goes one step further – undertaking extensive DECRA roof panel physical properties testing – going well beyond core U.S. national building code minimum required test standards.

DECRA prescribes to the following physical properties test methodology, conducted at independent laboratories, for its stone coated steel roof panels:

Roof Panels Using Aluminum-Zinc Alloy Coated Steel Base Material

Test Procedure	Testing Method	DECRA Panel Test Result
Material Thickness	Micrometer or Vernier Caliper	Pass
Aluminum-Zinc Alloy Thickness	ASTM A653	Pass
Coating Quality	CAN/CGSB-93.3 Section 6.2	Pass
Coating Thickness	AN/CGSB-93.3 Section 6.2 Thickness measured per ASTM D1005	Pass
Film Adhesion	CAN/CGSB-93.3 Section 6.5.1	Pass
Hardness	CAN/CGSB-93.3 Section 6.7.1 Test per ASTM D3363	Pass
Flexibility	CAN/CGSB-93.3 Section 6.8	Pass
Humidity Resistance	ASTM D2247	Pass
Salt Spray Resistance	ASTM B117	Pass
Durability	CAN/CGSB-93.3 Test per ASTM G155	Pass
Granular Mineral Surfacing – Loss of Adhesion	ASTM D4977	Pass
Traffic Load	ASTM E661	Pass
Uniform Load	APA Test S-2 in APA PRP-108	Pass

Test Standards

APA PRP-108: American Plywood Association – Engineered Wood Systems (APA-EWS)

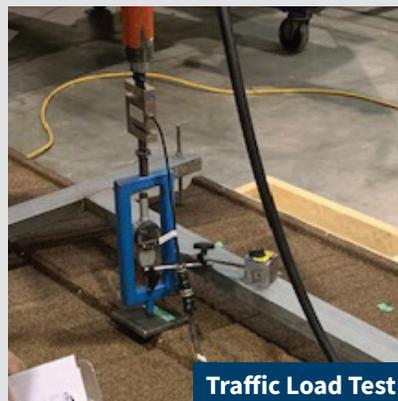
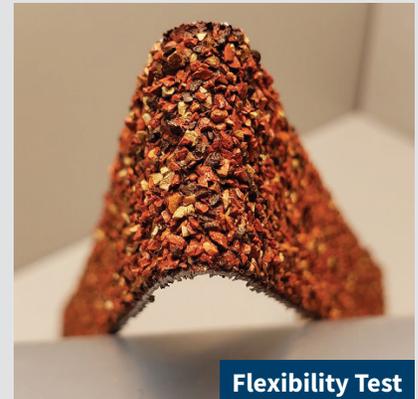
ASTM: American Society for Testing and Materials International

CAN/CGSB: Canadian General Standards Board (Version 93.3: Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet)

Physical Properties Test Summary

DECRA Roofing Systems manufactures top-quality stone coated steel roofing, backed by independent laboratory tests that verify performance standards to withstand long term weather exposure, even in the harshest climates. DECRA stands well ahead of the competition when committing to extensive physical properties testing. The decision to purchase a stone coated steel roof is an important investment – protecting both life and property. Trust DECRA to a higher standard of performance – guaranteed.

Test Lab Photos





Technical Guide for Decra® Tile, Shake, and Shingle Plus

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Prepared by the Canadian Construction Materials Centre for
Decra® Roofing Systems Inc.

This Technical Guide was prepared under contract by CCMC for the evaluation of Decra® Tile, Shake, and Shingle Plus. The technical requirements and performance criteria it contains are not valid for the evaluation of other products unless verified by CCMC under separate contract.

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1.0 Purpose

The proponent sought the CCMC opinion to determine if Decra® Tile, Shake, and Shingle Plus will achieve at least the minimum level of performance required by Division B of the National Building Code (NBC) of Canada 2015 in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions for a sheet metal roofing system.

A successful evaluation conforming to this Technical Guide will result in a published CCMC Evaluation Report for the evaluated product. The evaluation will only be applicable to products bearing the proper identification of CCMC's evaluation number (see Appendix C2).

2.0 Scope

2.1 Scope of Evaluation

This Technical Guide describes the technical requirements and performance criteria for the assessment of Decra® Tile, Shake, and Shingle Plus panels for use as roofing. These products cannot be assessed solely on the basis of any existing Canadian standard.

Decra® Tile, Shake, and Shingle Plus roofing systems are comprised of stamped steel panels that are installed on sloped roofs with a minimum slope of 1 in 4, over battens and that require a roofing underlay. Both roofing systems are designed for minimal access for maintenance purposes. Decra® Tile and Decra® Shake panels emulate the look of Mediterranean tile and wood shakes respectively. Each of the roofing systems feature a hidden fastening clip system.

2.2 Product Description

The products consist of modular metal roofing panels that are intended for use in residential and light commercial buildings falling under the scope of Part 9 of Division B of the NBC 2015.

The products are sheet-metal roofing systems consisting of a basic panel that is pressure-formed from a 0.39-mm B.M.T. (base metal thickness) sheet steel coated with 150 g/m² of aluminum/zinc alloy on each side. The underside is further protected by a rust-resistant acrylic seal coat. The upper surface is covered with an acrylic base coat onto which mineral aggregates are spread and then finished with a spray-on acrylic resin overglaze.

The “DECRA® Tile” panel has a nominal measurement of 1320 mm x 400 mm. The longitudinal panel cross-section consists of seven modules, each of which is 178 mm wide with a curved profile and raised flutes along the sides. There is an additional raised flute section along the side edge of each panel to enable interlocking with the adjacent panel. The butt edge of the panel is bent down 25 mm and follows the pan contour of the panel below it, thus providing an overlap for weathertightness and fastening. The top edge of each panel is bent up 25 mm and folded back horizontally by 25 mm so the back of the panel rests on the batten below.

The “DECRA® Shake” panel has a nominal measurement of 1365 mm x 385 mm. The longitudinal panel cross-section consists of seven detailed “shake” impressions of varying widths. The butt edge of the panel is bent down by 25 mm while the top edge is bent up 25 mm, and then folded back 65 mm so that the back of the panel rests on the batten below.

The Decra® Shingle Plus panel has a nominal measurement of 419 mm x 1321 mm. The panel profile consists of raised and lowered sections that form a series of rectangular shingle shapes. The butt edge is bent down 25.4 mm to provide an overlap. The top edge is formed to rest on the batten, and receive the fasteners and the lower edge of the panel above. The side edges allow for an overlap with adjacent panels. Panels are to be installed working right to left.

All systems include accessory strips for hip and ridge cap, and associated flashings.

3.0 Code Compliance

3.1 Compliance with the NBC 2015

The requirements and criteria referenced herein were developed to evaluate the performance of Decra® Tile, Shake, and Shingle Plus with respect to its compliance with the NBC 2015:

- Clause 1.2.1.1.(1)(a), Division A, as an acceptable solution from Division B:
 - Sentence 9.26.13.1., Thickness (Sheet Metal Roofing)
- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
 - Article 9.26.2., Material Standards (Roofing Materials)

3.2 Compliance with Other Codes

At this time, CCMC has not been requested to evaluate Decra® Tile, Shake, and Shingle Plus against Codes other than the NBC.

4.0 Referenced Documents

American Architectural Manufacturers Association (AAMA)

AAMA 621-02	Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates
AAMA 501.1	Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure

American Plywood Association – Engineered Wood Systems (APA-EWS)

APA PRP-108	Performance Standards and Qualification Policy for Structural-Use Panels
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American Society for Testing and Materials International (ASTM)

ASTM A653/A653M-15e1	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A792/A792M-10(2015)	Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM B117-09	Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM B248-07	Standard Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar
ASTM B370-11	Standard Specification for Copper Sheet and Strip for Building Construction
ASTM D522-93a (2008)	Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
ASTM D714 – 02(2009)	Standard Test Method for Evaluating Degree of Blistering of Paints
ASTM D968-05 (2010)	Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1005-95(2013)	Standard Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers
ASTM D1400-00	Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base (withdrawn 2006)
ASTM D2240-15	Standard Test Method for Rubber Property–Durometer Hardness
ASTM D2247-15	Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D3260-01 (2011)	Standard Test Method for Acid and Mortar Resistance of Factory-Applied Clear Coatings on Extruded Aluminum Products
ASTM D3359-09e2	Standard Test Methods for Measuring Adhesion by Tape Test
ASTM D3363-05 (2011)e1	Standard Test Method for Film Hardness by Pencil Test
ASTM D4977-03(2009)	Standard Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion
ASTM D7091-05	Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals
ASTM E661-03(2009)	Standard Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads
ASTM G155-05a	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

Canadian General Standards Board (CGSB)

CAN/CGSB-93.1	Sheet, Aluminum Alloy, Prefinished, Residential
CAN/CGSB-93.3	Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet For Residential Use

Underwriters' Laboratories of Canada (ULC)

CAN/ULC-S101	Standard Methods of Fire Endurance Tests of Building Construction and Materials
CAN/ULC-S107	Standard Methods of Fire Tests of Roof Coverings

For a list of where to purchase these documents, see Appendix A.

5.0 Definitions and Terminology

<i>Installation manual</i>	- a document governing all aspects of storage, transportation, handling, installation, inspection and repair.
<i>Licensed installer</i>	- an installer who has undergone such training as to be formally licensed by the proponent.
<i>Performance requirement</i>	- actual requirement that a product must meet that closely simulates the pattern of behavior in its intended use.

- Prescriptive requirement* - requirement of physical properties characterizing specific elements, components or individual materials.
- Proponent* - the manufacturer or sub-manufacturer of a product or its sole Canadian distributor.
- Recognized laboratory* - a laboratory complying with the CCMC Laboratory Recognition Guideline.

6.0 Sampling, Testing and Reporting

6.1 Sampling Procedure

The proponent must arrange for an independent third-party organization acceptable to CCMC to obtain a random selection of samples from the production line or main storage facility as indicated in the covering letter.

The organization performing the product sampling must clearly identify the samples and produce a report providing detailed information on the material sampling (sampling date, method of sampling, sites where sampling was performed and sample reference number/identification). The identified samples must be forwarded directly to the testing laboratory by the proponent or the sampling organization.

If sampling is to be performed at more than one storage facility, additional material will need to be sampled for fingerprint testing to confirm that it is the same product that has been sampled at the different storage facilities. The proponent must obtain information from CCMC on the required fingerprint testing that needs to be carried out by the testing laboratory.

If several plants manufacture this product, samples from each facility are required.

The proponent must cover the costs of the material sampling and authorize the sampling organization to forward the original sampling report directly to CCMC. The submitted report is retained by CCMC.

The proponent must also authorize the sampling organization to forward a copy of the sampling report directly to the testing laboratory so that the identification of the samples it received can be verified and reported in the test report.

6.2 Testing

Testing must be performed at a recognized laboratory as indicated in the covering letter. When CCMC protects a technical guide for a proponent, the proponent is also advised to control the Guide's dissemination. The proponent must provide copies of the complete Technical Guide, including appendices, to each testing laboratory to obtain information regarding fees and the number of samples required for testing in accordance with the Guide.

The proponent must cover the costs of testing and authorize the testing organization to forward the original test report for each sample directly to CCMC. The submitted test reports are retained by CCMC.

Information on CCMC's policy on Laboratory Recognition is available at <https://nrc.canada.ca/en/certifications-evaluations-standards/calibration-laboratory-assessment-service/directory-accredited-calibration-laboratories>.

6.3 Reporting

6.3.1 Test Report(s)

The following information shall be provided by testing laboratories in report(s) intended for CCMC evaluation purposes:

- detailed information on material sampling identification, including the date the samples were received;
- the start and end date(s) of test(s);
- detailed specimen preparation methods (if other than specified in the test method, standard or Technical Guide);
- test procedure identification, including:
 - any deviations from the referenced test procedure,
 - reasons for the deviations,
 - additional instrumentation requirements, and
 - photos;
- all information mentioned in the reporting section of the referenced standards or standard test methods;
- test results (table format, if appropriate), including:
 - explanations to account for any discrepancies;
- a concluding statement on the product's performance with respect to the testing performed and the results obtained.
- detailed observations, including photographs if applicable, describing the performance of the product and any comments the testing laboratory deems necessary to include. In the case of a revised test report, the document should contain a clear description of why the report was revised and what the revisions entailed; and
- the following statement: "Tested for CCMC Evaluation Purposes."

6.3.2 Engineering Report, Analysis, etc.

At this time, CCMC has not identified any additional engineering, analysis or other technical reporting requirements.

7.0 Required Documentation

7.1 General

The following documentation shall be submitted to CCMC:

- a certificate stating that the manufacturing facility is under the control of a registered quality assurance agency or a copy of the QCM prepared as outlined in Appendix C;
- a copy of the installation manual provided to installers, as outlined in Section 7.2;
- detailed descriptions of the product;
- the original test reports; and

- information demonstrating how reference will be made to CCMC's evaluation number on the product (see Appendix C2).

Note that lack of information will delay the evaluation and may result in an unsuccessful evaluation.

All information to be submitted shall be shipped prepaid, including clearance through Canada Customs, if applicable, to:

Canadian Construction Materials Centre	Telephone:	(613) 993-6189
NRC Construction	Facsimile:	(613) 952-0268
National Research Council Canada		
1200 Montreal Road, Building M-23a		
Ottawa, Ontario		
Canada		K1A 0R6

7.2 Installation Manual

7.2.1 Purpose

The proponent shall provide a well-defined and detailed installation manual that does not contravene the NBC 2015 and that can be used as educational material for installers and users of the product. The manual must be identified with a reference number or an issue date.

7.2.2 Content

The installation manual shall include the following information:

- detailed instructions on all the steps involved in the installation of the system;
- a description of the tools and equipment required to install the system;
- detailed drawings of the system and all the accessories;
- a description of connectors and fasteners used;
- storage and handling procedures, including all precautions involved;
- on-site quality control;
- safety for workers; and
- other information the proponent deems pertinent to the installation.

8.0 Technical Requirements

This section sets out the technical evidence required by CCMC to enable it to evaluate a product and/or system as an acceptable or alternative solution in compliance with the NBC 2015.

8.1 NBC 2015 Compliance Requirements

8.1.1 Performance Requirements and Properties

8.1.1.1 Performance Properties

Table 8.1.1.1

Property	Unit	Test Method	Requirement
Traffic load	N	ASTM E661 and Section 8.1.1.2 of this Guide	≥ 900
Uniform load	–	APA PRP-108 (Test Method S-2) and Section 8.1.1.3 of this Guide	No large deformations or permanent openings at the lap
Wind uplift	–	Section 8.1.1.4 of this Guide	No evidence of deformation or permanent damage
Dynamic pressure water infiltration	–	AAMA 501.1 and Section 8.1.1.5 of this Guide	No leakage or damage

8.1.1.2 Traffic Load

Metal roofing systems applied over solid sheathing, furring or spaced sheathing must be designed to support a traffic load equivalent to 900 N concentrated on an area of 125 mm × 125 mm when tested according to ASTM E661. Testing must occur where the support spacing is the maximum specified by the manufacturer, and the worst loading conditions determined by the laboratory. The occurrence of any plastic deformation or permanent openings at the lap that will adversely affect the function of the product will result in the system being deemed a failure.

Should a roofing system fail this criterion by the occurrence of only a plastic deformation at mid-span between the battens, then the test must be redone directly over the battens. If the roofing system passes this second type of loading, then the system can be accepted with a limitation on its usage that restricts walking on the panels to the area above the battens. Consequently, the manufacturer will be required to indicate such restrictions in its installation literature.

8.1.1.3 Uniform Load

Metal roofing systems applied over a batten system must be designed to support the maximum uniform live load that may be expected to act on the roof based on the snow and wind load requirements of Part 4 of Division B of the NBC 2015.

The uniform load test must be conducted in accordance with APA Test Method S-2 in APA PRP-108. The test specimen must be installed according to the manufacturer's instructions. The test must be conducted at a uniform loading rate of 0.479 kPa/min until the maximum load has been achieved. The maximum load is considered to be the load beyond which a deformation occurs that can adversely affect the performance of the roofing system. The occurrence of large

deformations or permanent openings at the lap that will adversely affect the function of the roofing system will result in the system being deemed a failure.

8.1.1.4 Wind Uplift

The metal roofing system must be installed as recommended by the manufacturer. The test specimen must consist of a roof section that is a minimum of 4 or 5 courses high and 2 to 4 panels wide, mounted on a wood-frame shed sheathed with 13-mm-thick plywood, with rafters at 600 mm on center (o.c.). The test specimen is sealed to the deck at the perimeter and a polyethylene film air bag, installed between the panels and the plywood deck, must be pressurized at a controlled rate to produce a uniform negative static pressure on the panels. The test specimen must be subjected to incrementally increasing negative pressures of -0.5 kPa, -1.0 kPa, -1.4 kPa, -1.9 kPa, -2.9 kPa, -3.8 kPa, -4.3 kPa, -4.8 kPa and up to failure, or to the test pressure specified for the system for 10 s, with the pressure reduced to zero between loadings. The panels, sheets or tiles must be inspected for any deformation or damage resulting from the pressure between each loading.

8.1.1.5 Dynamic Pressure Water Infiltration

The dynamic pressure water infiltration resistance test must be conducted using a modification of the test method in AAMA 501.1. This modified test method consists of mounting a test specimen of sufficient size so that the performance of all typical parts of the roofing system can be determined. The test specimen must be mounted according to the manufacturer's instructions, with the minimum slope at which the system is intended to be used. The panels, sheets or tiles are then sealed to the flashing with a silicone sealant. An aircraft engine wind generator is then placed normally and nominally 30 m downwind from the eave of the test specimen. Water spray is then added to the air stream upwind of the deck at a rate equal to approximately 3.4 L/ m²•min for each square meter of roof area. The test specimen must be subjected to incrementally increasing wind speeds from 80 km/h to 170 km/h for 5 minute time periods. If water leakage or damage to the roofing system is observed, the roofing system must be deemed a failure.

8.1.1.6 Aluminum Base Roofing

Products of this category must meet the requirements stated in Table 8.1.1.6.

Table 8.1.1.6

Property	Unit	Test Method	Requirement
Thickness	mm	See Note 1 of this Section	0.48
Coating quality	–	CAN/CGSB-93.1 Section 6.1 ²	Smooth and uniform, free from cracks, pinholes, blisters and flaking
Coating thickness	µm	CAN/CGSB-93.1 Section 6.4 ³	20
Impact resistance	–	CAN/CGSB-93.1 Section 6.5 ⁴	No visible cracking
Film adhesion	–	CAN/CGSB-93.1 Section 6.6 ⁵	No removal of finish coat
Hardness	–	ASTM D3363 ⁶	No rupture
Flexibility	–	CAN/CGSB-93.1 Section 6.8 ⁷	No cracking or flaking
Humidity resistance	–	ASTM D2247 ⁸	No formation of blisters
Salt spray resistance	–	ASTM B117 ²	≥ 7 rating
Durability	–	ASTM G155 ¹⁰	Slight colour change; not greater than No. 8 degree of chalking; no flaking or cracking

Notes to Table 8.1.1.6:

- Thickness** – Measure and record the thickness of the material in several locations to the nearest 0.01 mm using a micrometer or vernier caliper. Record the average of the readings and confirm the calibration of the instrument used.
- Coating quality** – Examine for defects on the coated surface, without magnification in diffused daylight (such as obtained in a Macbeth daylight booth) at several viewing angles not less than 45° to the surface, with the eyes of the observer 600 mm from the surface under examination.
- Coating thickness** – The minimum film thickness of a one-coat finish coating, unless otherwise specified (Par. 8.1), must be not less than 20 µm at any measured point when determined by one of the methods described in ASTM D1400.
- Impact resistance** – Test the specimen at room temperature using a Gardner variable impact tester or equivalent, with a 16-mm mandrel, under a reverse impact energy of 2.25 J. Examine the impact area for cracks at a viewing distance of 400 mm.
- Film adhesion** – On each of the three specimens and with a sharp instrument, scribe through the coating making 11 lines at 2.5-mm intervals. Then at right angles scribe 11 more lines across the first set and at the same spacing to form 100 square islands of coating 645 mm². Assess adhesion by carrying out the tape test described in 1-GB-71, Method 137.1 across the scored area. Each full square of coating removed constitutes 1% loss of adhesion. Do not count part squares removed.
- Hardness** – The finish coating must not rupture when tested in accordance with ASTM D3363.
- Flexibility** – With the test specimen at room temperature bend it through 135° at a uniform rate to complete the bend in 1 s, with the test coating on the outside of the bend over a mandrel of the following radius according to sheet thickness. For a base sheet thickness (t) ≤ 0.80 mm, use a mandrel radius of 2t; for a base sheet thickness (t) ≥ 0.80 mm, use a mandrel radius of 3t. View the specimen at a distance of 400 mm, without magnification, for cracks after bending with no evidence of cracking or flaking.

8. **Humidity resistance** – The coated sheet must withstand exposure for 1 000 h (ASTM D2247) with no formation of blisters on the finish coating to an extent greater than illustrated in Figure 4 of ASTM D714. Specimens must be examined within 30 minutes after completion of the test.
9. **Salt spray resistance** – The test specimen must provide at least 1 m² of coated surface. Score the coating diagonally and sufficiently deep to expose the specimen, supported or suspended at 15° from the vertical for 1 000 h in a salt spray chamber in accordance with ASTM B117 using a 5% sodium chloride solution. Examine the specimen for undercutting of the film from the scored lines.
10. **Durability** – The uniform finish coated sheet must withstand exposure to an accelerated weathering test in accordance with ASTM G155.

8.1.1.7 Galvanized and Aluminum-Zinc Alloy Coated Steel Base Material Requirements

Products of this category must meet the requirements stated in Table 8.1.1.7.

Table 8.1.1.7

Property	Unit	Test Method	Requirement
Thickness	mm	See Note 1 below	0.33
Thickness of zinc coating	–	ASTM A653	Conforms to Z275 designation of ASTM A653
Thickness of aluminum-zinc coating	–	CAN/CGSB-93.3 Section 6.1	Conforms to Z150 designation of ASTM A792/A792M
Coating quality	–	CAN/CGSB-93.3 Section 6.2 ²	Smooth and uniform, free of pinholes, cracks, blisters and flaking
Coating thickness - IEC finish - EC finish	µm	CAN/CGSB-93.3 Section 6.5.1 (IEC) and Section 6.5.2 (EC) ³	> 20 > 180
Film adhesion - IEC finish - EC finish	–	CAN/CGSB-93.3 Section 6.6.1 (IEC) and Section 6.6.2 (EC) ⁴	No removal of finish coat No removal of finish coat
Hardness - IEC finish - EC finish	–	CAN/CGSB-93.3 Section 6.7.1 (IEC) and Section 6.7.2 (EC) ⁵	No rupture 75-80 units
Flexibility	–	CAN/CGSB-93.3 Section 6.8 ⁶	No flaking or micro-cracking
Humidity resistance	–	ASTM D2247 ⁷	No formation of blisters
Salt spray resistance	–	ASTM B117 ⁸	≥ 7 rating
Durability	–	CAN/CGSB-93.3 Section 6.10 ²	Slight colour change; not greater than No. 8 degree of chalking; no flaking or cracking

Notes to Table 8.1.1.7:

1. **Thickness** – Measure and record the thickness of the material in several locations to the nearest 0.01 mm using a micrometer or vernier caliper. Record the average of the readings and confirm the calibration of the instrument used.
2. **Coating quality** – Examine for defects on the coated surface, without magnification, in diffused daylight (such as obtained in a Macbeth daylight booth) at several viewing angles not less than 45° to the surface, with the eyes of the observer 600 mm from the surface under examination.
3. **Coating thickness:**
Form IEC (inelastic coating) – The finish coating must be applied as at least a two-coat system and the total dry film thickness must not be less than 20 µm at any measured point when determined in accordance with ASTM D1005.
Form EC (elastic coating) – The finish coating must be applied as at least a two-coat system and the total dry film thickness must not be less than 180 µm at any measured point when determined in accordance with ASTM D1005.
4. **Film adhesion:**
Form IEC (inelastic coating) – Scribe through the coating with a sharp instrument making 11 lines at 2.5-mm intervals. At right angles, scribe 11 more lines across the first set and at the same spacing to form 100 square islands of coating 645 mm². Apply across the scribed area a strip of fresh 25-mm-wide pressure sensitive tape that conforms to the requirements of CGSB 43-GP-3M Type II, Grade A or B. Press the tape down by two passes of a rubber-covered roller 90 mm in diameter and 45-mm-wide with a mass of 2 kg, the rubber having a Durometer hardness of 70 to 80. Remove the tape immediately after application by pulling it back upon itself 180° with one rapid motion. Examine the scribed area for removal of the coating.
Form EC (elastic coating) – Scribe through the coating with a sharp instrument making 11 lines at 2.5-mm intervals. At right angles scribe 11 more lines across the first set and at the same spacing to form 100 square islands of coating 645 mm². Raise an Olson button 6 mm in height as measured from the surface of the test specimen to the top of the button. Boil the sample for 30 minutes in boiling water. Allow to cool. The vinyl film should remain firmly bonded to the substrate and resist peeling from light mechanical working with a fingernail.
5. **Hardness:**
Form IEC (inelastic coating) – The finish coating must not rupture when tested in accordance with ASTM D3363.
Form EC (elastic coating) – Cast a test film of the finish coating. Layer the test films to derive a thickness of 6 mm. Determine the hardness of the coating in accordance with ASTM D2240.
6. **Flexibility** – With the test specimen at room temperature (20°C to 27°C), bend it through 135° at a uniform rate to complete the bend in 1 s, with the test coating on the outside of the bend, over a mandrel of the following radius according to sheet thickness. For a base sheet thickness (t) ≤ 0.80 mm, use a mandrel radius of 2t; for a base sheet thickness (t) ≥ 0.80 mm and ≤ 1.6 mm, use a mandrel radius of 3t. View the specimen at a distance of 400 mm, without magnification, for cracks after bending with no evidence of cracking or flaking.
7. **Humidity resistance** – The coated sheet must withstand exposure for 1 000 h (ASTM D2247) with no formation of blisters on the finish coating to an extent greater than illustrated in Figure 4 of ASTM D714. Specimens must be examined within 30 minutes after completion of the test.
8. **Salt spray resistance** – The test specimen must provide at least 1 m² of coated surface. Score the coating diagonally and sufficiently deep to expose the specimen, supported or suspended at 15° from the vertical for 1 000 h in a salt spray chamber in accordance with ASTM B117 using a 5% sodium chloride solution. Examine the specimen for undercutting of the film from the scored lines.
9. **Durability** – The uniform finish coated sheet must withstand exposure to an accelerated weathering test in accordance with ASTM G155.

8.1.1.8 Copper Base Material Requirements

Products of this category must meet the requirements stated in Table 8.1.1.8.

Table 8.1.1.8

Property	Unit	Test Method	Requirement
Thickness	mm	See Note 1 below	0.46
Material and manufacture	–	ASTM B370 Section 6	Conforms to ASTM B248
Chemical composition (minimum copper content, including silver)	%	ASTM B370 Section 7	Conforms to ASTM B248 (99.9%)
Tensile strength	–	ASTM B370 Section 10.1	Conforms to ASTM B370 Table 2
Rockwell hardness	–	ASTM B370 Section 10.2	Conforms to ASTM B370 Table 2

Note to Table 8.1.1.8:

1. Measure and record the thickness of the material in several locations to the nearest 0.01 mm using a micrometer or vernier caliper. Record the average of the readings and confirm the calibration of the instrument used.

8.1.2 Additional Performance Data

Data in this section will not form part of the CCMC opinion.

8.1.2.1 PVDF Coating (as required)

The product must meet the requirements stated in Table 8.1.2.1.

Table 8.1.2.1

Property	Unit	Test Method	Requirement
Total dry film thickness	µm	ASTM D7091 ¹	25
Dry film hardness	–	ASTM D3363 ²	No rupture
Adhesion - dry - wet	–	ASTM D3359 ³	No removal of film
			No removal of film
Impact resistance	–	See Note 4 of this Table.	No removal of film
Salt spray resistance	–	ASTM B117 ⁵	≥ 7 rating
Weathering (accelerated)	–	ASTM G155 ⁶	No change
Abrasion resistance	–	ASTM D968 ⁷	Coefficient value ≥ 40
Acid resistance	–	See Note 8 of this Table.	No loss of integrity or appreciable change
Flexibility	–	ASTM D522, Test Method B5 ⁹	No flaking or cracking

Notes to Table 8.1.2.1:

- Total dry thickness** – The total dry thickness must be measured on five (5) single-point measurements as per ASTM D7091-13. Reported value must be the mean of the five measurements.
- Dry film hardness** – Test must be performed on five (5) samples each measuring 127 mm × 127 mm based on the procedure defined in ASTM D3363. If rupture to the film is observed, the coating must be deemed a failure.
- Film adhesion:**
Dry adhesion – Samples must be conditioned for a minimum of 48 h at 23 ± 2°C and relative humidity (RH) of 50 ± 5%. Film adhesion must be performed as per ASTM D3359-09e2 Test Method B, on five (5) samples each measuring 127 mm × 127 mm. Any sign of removal of the film must be deemed a failure.
Wet adhesion – Samples must be immersed in distilled water for 24 h at 38 ± 2°C. Remove samples and wipe dry. Wait 5 minutes before testing them under standard laboratory conditions (23 ± 2°C and RH of 50 ± 5%). Film adhesion must be performed as per ASTM D3359-09e2 Test Method B, on five (5) samples each measuring 127 mm × 127 mm. Any sign of removal of the film must be deemed a failure.
- Impact resistance** – Testing must be performed on five (5) samples conditioned for 24 h at 23 ± 2°C and RH of 50 ± 5%. Using a 16-mm diameter round nose impact tester, apply a load of sufficient force to deform the test sample a minimum of 3 mm ± 0.3 mm. Apply 20-mm-wide tape over the area of deformation by firmly pressing down against the coating to eliminate voids and air pockets. Sharply pull the tape off at a right angle to the plane of the surface being tested. If the removal of film is observed, the coating must be deemed a failure.
- Salt spray resistance** – Score the film of the sample sufficiently deep to expose the base metal using a sharp knife or blade instrument. Expose the sample according to ASTM B117 using a salt solution for 1 000 h. Remove and wipe the sample dry. Immediately apply 20-mm-wide tape (Permacel 99 or equivalent) over the scored area by firmly pressing down against the coating to eliminate voids and air pockets. Sharply pull the tape off at a right angle to the plane of the surface being tested. A minimum rating of seven on scribe and cutting edges must be reached. Rate in accordance with AAMA 621, Section 7.9.2.2.

6. **Weathering (accelerated)** – Conduct the 2 000 h Xenon arc exposure test on a minimum of 10 samples, in accordance with ASTM G155 with the exposure conditions of Cycle 2 of Table X3. Samples must not show any change of colour, chalking or cracking.
7. **Abrasion resistance** – The abrasion coefficient is calculated according to the following formula:
Abrasion coefficient – L per mil = V/T
where
V = Volume of sand used in L,
T = thickness of coating in mils.
8. **Acid resistance** – Expose the metal test samples (two samples per test, minimum size 75 mm × 75 mm) with a factory-applied coating to the following acids in accordance with the procedure in Par. 7.4 of ASTM D3260:
- 10% by volume sulphuric acid;
 - 10% by volume hydrochloric acid; and
 - 10% by volume nitric acid.
- Examine the metal test samples for any loss of integrity or appreciable change. Slight change in colour is acceptable.
9. **Flexibility** – Test must be performed on five (5) samples conditioned for 24 h at a temperature of $23 \pm 2^\circ\text{C}$ and a RH of $50 \pm 5\%$.

8.1.2.2 Granular Mineral Surfacing (as required)

The product must meet the requirements stated in Table 8.1.2.2.

Table 8.1.2.2

Property	Unit	Test Method	Requirement
Loss of adhesion	g	ASTM D4977	≤ 2.0

Surface protection on the exposed face of the panels, consisting of mineral granulates, must be continuous, adherent to the panel, and must not reveal the substrate in a way that might affect the uniform appearance of the panels. When tested according to ASTM D4977, the loss of adhesion of the mineral granulates must not exceed 2.0 g.

8.1.2.3 Fire Protection (as required)

The product must meet the requirements stated in Table 8.1.2.3.

Table 8.1.2.3

Property	Unit	Test Method	Requirement
Fire test of roof covering	–	CAN/ULC-S107	As reported
Fire resistance rating	–	CAN/ULC-S101	As reported

8.2 Provincial, Territorial and other Code Compliance Requirements

At this time, the provinces and territories and other stakeholders have not requested that CCMC verify compliance with the requirements of any other Codes.

Note: These mandatory requirements refer to provincial, territorial and/or other Code requirements not covered in the NBC 2015.

8.3 Additional Health and Safety Requirements

At this time, there has not been any additional health and safety data identified by third parties.

Note: These additional health and safety requirements refer to issues that are not covered by the NBC 2015 or its objectives and functional statements and that are of immediate serious concern.

8.4 Additional Data

At this time, the proponent has not requested that CCMC verify any additional data.

Appendix A – Where to Purchase the Codes and Standards Referenced Herein

A1 Code(s)

NBC Client Services, Construction Research Centre
National Research Council Canada
1200 Montreal Road, Building M-20
Ottawa, Ontario K1A 0R6
Tel.: 613-993-2463
Fax: 613-952-7673
Web site: <https://shop-magasin.nrc-cnrc.gc.ca>

A2 Standard(s)

AAMA American Architectural Manufacturers Association
1827 Walden Office Square, Suite 550
Schaumburg, IL 60173-4268
USA
Tel.: 847-303-5664
Fax: 847-303-5774
Web site: www.aamanet.org

APA-EWS American Plywood Association – Engineered Wood Systems
The Engineered Wood Association
P.O. Box 11700
7011 South 19th St.
Tacoma, WA 98411-0700
USA
Tel.: 253-565-6600
Fax: 253-565-7265
Web site: www.apawood.org

ASTM ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
USA
Tel.: 610-832-9585
Fax: 610-832-9555
Web site: www.astm.org

CGSB Canadian General Standards Board, Sales Unit
Place du Portage, Phase III, 6B1
11 Laurier Street
Gatineau, QC K1A 1G6
Tel.: 1-800-665-2472
819-956-0425
Fax: 819-956-5740
Web site: www.tpsgc-pwgsc.gc.ca/cgsb/

ULC Underwriters' Laboratories of Canada
7 Underwriters Road
Toronto, ON M1R 3B4
Tel.: 1-866-937-3852
416-757-3611
Fax: 416-757-8727
Web site: www.ul.com/canada

Appendix B – Testing Agencies

B.1 General

Testing must be performed at a recognized laboratory as indicated in the covering letter. When CCMC protects a Technical Guide for a proponent, the proponent is also advised to control the Guide's dissemination. The proponent must provide copies of the complete Technical Guide, including appendices, to each testing laboratory to obtain information regarding fees and the number of samples required for testing in accordance with the Guide.

The proponent must cover the costs of testing and authorize the testing organization to forward the original test report for each sample directly to CCMC. The submitted test reports are retained by CCMC.

B.2 Sampling

The proponent must arrange for an independent third-party organization acceptable to CCMC to obtain a random selection of samples from the production line or main storage facility as indicated in the covering letter.

The organization performing the product sampling must clearly identify the samples and produce a report providing detailed information on the material sampling (sampling date, method of sampling, sites where sampling was performed and sample reference number/identification). The identified samples must be forwarded directly to the testing laboratory by the proponent or the sampling organization.

If sampling is to be performed at more than one storage facility, additional material will need to be sampled for fingerprint testing to confirm that it is the same product that has been sampled at the different storage facilities. The proponent must obtain information from CCMC on the required fingerprint testing that needs to be carried out by the testing laboratory.

If several plants manufacture this product, samples from each facility are required.

The proponent must cover the costs of the material sampling and authorize the sampling organization to forward the original sampling report directly to CCMC. The submitted report is retained by CCMC.

The proponent must also authorize the sampling organization to forward a copy of the sampling report directly to the testing laboratory so that the identification of the samples it received can be verified and reported in the test report.

B.3 Reports from Testing Laboratories

The following information must be provided by testing laboratories in reports intended for CCMC evaluation purposes:

- a sample report that includes detailed information on material sampling identification, including the date the samples were received;
- the start and end date(s) of test(s);

- detailed specimen preparation methods (if other than specified in the test method, standard or Technical Guide);
- test procedure identification, including:
 - any deviations from the referenced test procedure,
 - reasons for the deviations,
 - additional instrumentation requirements, and
 - photos;

- all information mentioned in the reporting section of the referenced standards or standard test methods;
- test results (table format, if appropriate), including:
 - written explanations to account for any discrepancies; and

- a concluding statement on the product's performance with respect to the testing performed and the results obtained. *(The test report should contain detailed observations, including photographs if applicable, describing the performance of the product and any comments the testing laboratory wishes to include. In the case of a revised test report, the document should contain a clear description of why the report was revised and what the revisions entailed.)*

The report should include the statement: “Tested for CCMC Evaluation Purposes.”

Additional information on the CCMC policy on Laboratory Recognition is available at <https://nrc.canada.ca/en/certifications-evaluations-standards/calibration-laboratory-assessment-service/directory-accredited-calibration-laboratories>.

Appendix C – Quality Assurance Program

The proponent must demonstrate that the production process is governed by a quality assurance program, which ensures consistent quality at least to the level represented by the sample being tested and evaluated. CCMC requests that quality control procedures be applied to incoming materials, processes, and finished products.

C1 Requirements

Quality assurance shall be demonstrated using the ISO 9001 standard or a quality control manual.

C1.1 ISO 9001:2008, "Quality management systems - Requirements"

The production process shall conform to ISO 9001:2008, "Quality management systems - Requirements" through registration by an accredited quality assurance agency. The proponent can demonstrate quality assurance by submitting documentation attesting that the production process has been registered as conforming to ISO 9001:2008 by an accredited quality assurance agency. The proponent may contact the Standards Council of Canada at (613) 238-3222 to inquire about accredited agencies.

C1.2 Quality control manual

The Quality Control Manual (QCM) submitted to CCMC shall contain the following information:

- the company's quality control policies;
- provisions for keeping the manual current, e.g., updates and revisions;
- a production flow chart indicating points of quality control, with an explanation of the control at each point, the frequency of controls, and a summary of the production methods;
- production specifications and process tolerances;
- a clear delineation of what constitutes major and minor defects;
- corrective measures for major and minor defects;
- a list of main production equipment;
- a list of manufacturer's specifications and quality control arrangements for raw materials and equipment;
- measuring equipment: type, model, range, accuracy, frequency of calibration, and calibration agency; and,
- a statement by the proponent that CCMC will be notified, in writing, when major deviations have been discovered.

C2 Identification

Quality control procedures for finished products must include details on how the product will be identified with the CCMC evaluation number, in the form of "CCMC XXXXX-R," which shall be both visible and legible. Where permanently identifying a product is not possible, other forms and methods of identification may be allowed pending review and approval by a CCMC evaluation officer.



Technical Guide for Decra® Shake XD, Shingle XD, Villa Tile, and Shingle Plus

MasterFormat: 07 41 13

Prepared by the Canadian Construction Materials Centre for
Decra® Roofing Systems Inc.

This Technical Guide was prepared under contract by CCMC for the evaluation of Decra® Shake XD, Shingle XD, Villa Tile, and Shingle Plus. The technical requirements and performance criteria it contains are not valid for the evaluation of other products unless verified by CCMC under separate contract.

Original Author: Helene Roche, 2012
Current Author: Mihailo Mihailovic, 2019

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1.0 Purpose

The proponent sought the CCMC opinion to determine if Decra® Shake XD, Shingle XD, Villa Tile, and Shingle Plus will achieve at least the minimum level of performance required by Division B of the National Building Code (NBC) of Canada 2015 in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions for a sheet metal roofing system.

A successful evaluation conforming to this Technical Guide will result in a published CCMC Evaluation Report for the evaluated product. The evaluation will only be applicable to products bearing the proper identification of CCMC's evaluation number (see Appendix C2).

2.0 Scope

2.1 Scope of Evaluation

This Technical Guide describes the technical requirements and performance criteria for the assessment of Decra® Shake XD, Shingle XD, Villa Tile, and Shingle Plus panels for use as roofing. This type of product cannot be assessed solely on the basis of any existing Canadian standard.

Decra® Shake XD, Shingle XD, Villa Tile, and Shingle Plus roofing systems are comprised of stamped steel panels that are installed on sloped roofs with a minimum slope of 1 in 4 and that require a roofing underlay. The roofing is designed for minimal access for maintenance purposes. Decra® Shake XD, Shingle XD, Villa Tile, Shingle Plus panels emulate the look of wood shakes, asphalt shingles and old world Italian tile. Each of the roofing systems feature a hidden fastening clip system.

2.2 Product Description

The products are sheet-metal roofing systems consisting of a basic panel that is pressure-formed from 0.39 mm thick aluminum/zinc alloy coated steel. The sheet steel is coated to 150 g/m² on each side. The underside is further protected by a rust resistant acrylic seal coat. The outer surface is covered with an acrylic base coat onto which mineral aggregate are spread. The surface is finished with a spray-on acrylic resin overgraze.

Decra® Villa Tile: The product panel has a nominal measurement of 1124 mm x 431.8 mm. The panels consist of five peaked and four pan area of consistent dimension giving a curved tile appearance. The butt edge is curved in on itself to form a lower locking mechanism. The top edge is formed to make a clip to receive the lower edge of the panel above. The top edge also has a lip that has four tabs to receive the fasteners. The side edges have an overlap to allow for fitting between adjacent panels.

Decra® Shake XD and Shingle XD: The product panels have a nominal measurement of 1124 mm x 358.8 mm. The panels are stamped along their length to emulate a shakes or shingles, of varying widths. The butt edge is folded on itself to form a lower locking mechanism. The top edge is formed to make a clip to receive the lower edge of the panel above. The top edge also has a lip that is flat to the deck to receive the fasteners. The side edges have a factory edge with an overlap area to allow for fitting with adjacent panels. Panels are to be installed working left to right.

Decra® Shingle Plus: The product panel has a nominal measurement of 419 mm x 1321 mm. The panel profile consists of raised and lowered sections that form a series of rectangular shingle shapes. The butt edge is bent down 25.4 mm to provide an overlap. The top edge is formed to receive the fasteners and the lower edge of the panel above. The side edges allow for an overlap with adjacent panels. Panels are to be installed working right to left.

All systems include accessory strips for hip and ridge cap, and associated flashings.

3.0 Code Compliance

3.1 Compliance with the NBC 2015

The requirements and criteria referenced herein were developed to evaluate the performance of Decra® Shake XD, Shingle XD, Villa Tile, and Shingle Plus with respect to its compliance with the NBC 2015:

- Clause 1.2.1.1.(1)(a), Division A, as an acceptable solution from Division B:
 - Sentence 9.26.13.1., Thickness (Sheet Metal Roofing)
- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
 - Article 9.26.2., Material Standards (Roofing Materials)

3.2 Compliance with Other Codes

At this time, CCMC has not been requested to evaluate Decra® Shake XD, Shingle XD, Villa Tile, and Shingle Plus against Codes other than the NBC.

4.0 Referenced Documents

American Architectural Manufacturers Association (AAMA)

AAMA 621-02	Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates
AAMA 501.1	Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure

American Plywood Association – Engineered Wood Systems (APA-EWS)

APA PRP-108	Performance Standards and Qualification Policy for Structural-Use Panels
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American Society for Testing and Materials International (ASTM)

ASTM A653/A653M-15e1	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A792/A792M-10(2015)	Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM B117-09	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B248-07	Standard Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar
ASTM B370-11	Standard Specification for Copper Sheet and Strip for Building Construction
ASTM D522-93a (2008)	Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
ASTM D714 – 02(2009)	Standard Test Method for Evaluating Degree of Blistering of Paints

ASTM D968-05 (2010)	Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1005-95(2013)	Standard Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers
ASTM D1400-00	Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base (withdrawn 2006)
ASTM D2240-15	Standard Test Method for Rubber Property–Durometer Hardness
ASTM D2247-15	Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D3260-01 (2011)	Standard Test Method for Acid and Mortar Resistance of Factory-Applied Clear Coatings on Extruded Aluminum Products
ASTM D3359-09e2	Standard Test Methods for Measuring Adhesion by Tape Test
ASTM D3363-05 (2011)e1	Standard Test Method for Film Hardness by Pencil Test
ASTM D4977-03(2009)	Standard Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion
ASTM D7091-05	Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals
ASTM E661-03(2009)	Standard Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads
ASTM G155-05a	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

Canadian General Standards Board (CGSB)

CAN/CGSB-93.1	Sheet, Aluminum Alloy, Prefinished, Residential
CAN/CGSB-93.3	Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet For Residential Use

Underwriters' Laboratories of Canada (ULC)

CAN/ULC-S101	Standard Methods of Fire Endurance Tests of Building Construction and Materials
CAN/ULC-S107	Standard Methods of Fire Tests of Roof Coverings

For a list of where to purchase these documents, see Appendix A.

5.0 Definitions and Terminology

<i>Installation manual</i>	- a document governing all aspects of storage, transportation, handling, installation, inspection and repair.
<i>Licensed installer</i>	- an installer who has undergone such training as to be formally licensed by the proponent.
<i>Performance requirement</i>	- actual requirement that a product must meet that closely simulates the pattern of behavior in its intended use.
<i>Prescriptive requirement</i>	- requirement of physical properties characterizing specific elements, components or individual materials.
<i>Proponent</i>	- the manufacturer or sub-manufacturer of a product or its sole Canadian distributor.

Recognized laboratory - a laboratory complying with the CCMC Laboratory Recognition Guideline.

6.0 Sampling, Testing and Reporting

6.1 Sampling Procedure

The proponent must arrange for an independent third-party organization acceptable to CCMC to obtain a random selection of samples from the production line or main storage facility as indicated in the covering letter.

The organization performing the product sampling must clearly identify the samples and produce a report providing detailed information on the material sampling (sampling date, method of sampling, sites where sampling was performed and sample reference number/identification). The identified samples must be forwarded directly to the testing laboratory by the proponent or the sampling organization.

If sampling is to be performed at more than one storage facility, additional material will need to be sampled for fingerprint testing to confirm that it is the same product that has been sampled at the different storage facilities. The proponent must obtain information from CCMC on the required fingerprint testing that needs to be carried out by the testing laboratory.

If several plants manufacture this product, samples from each facility are required.

The proponent must cover the costs of the material sampling and authorize the sampling organization to forward the original sampling report directly to CCMC. The submitted report is retained by CCMC.

The proponent must also authorize the sampling organization to forward a copy of the sampling report directly to the testing laboratory so that the identification of the samples it received can be verified and reported in the test report.

6.2 Testing

Testing must be performed at a recognized laboratory as indicated in the covering letter. When CCMC protects a technical guide for a proponent, the proponent is also advised to control the Guide's dissemination. The proponent must provide copies of the complete Technical Guide, including appendices, to each testing laboratory to obtain information regarding fees and the number of samples required for testing in accordance with the Guide.

The proponent must cover the costs of testing and authorize the testing organization to forward the original test report for each sample directly to CCMC. The submitted test reports are retained by CCMC.

Information on CCMC's policy on Laboratory Recognition is available at <https://nrc.canada.ca/en/certifications-evaluations-standards/calibration-laboratory-assessment-service/directory-accredited-calibration-laboratories>.

6.3 Reporting

6.3.1 Test Report(s)

The following information shall be provided by testing laboratories in report(s) intended for CCMC evaluation purposes:

- detailed information on material sampling identification, including the date the samples were received;
- the start and end date(s) of test(s);
- detailed specimen preparation methods (if other than specified in the test method, standard or Technical Guide);
- test procedure identification, including:
 - any deviations from the referenced test procedure,
 - reasons for the deviations,
 - additional instrumentation requirements, and
 - photos;
- all information mentioned in the reporting section of the referenced standards or standard test methods;
- test results (table format, if appropriate), including:
 - explanations to account for any discrepancies;
- a concluding statement on the product's performance with respect to the testing performed and the results obtained.
- detailed observations, including photographs if applicable, describing the performance of the product and any comments the testing laboratory deems necessary to include. In the case of a revised test report, the document should contain a clear description of why the report was revised and what the revisions entailed; and
- the following statement: "Tested for CCMC Evaluation Purposes."

6.3.2 Engineering Report, Analysis, etc.

At this time, CCMC has not identified any additional engineering, analysis or other technical reporting requirements.

7.0 Required Documentation

7.1 General

The following documentation shall be submitted to CCMC:

- a certificate stating that the manufacturing facility is under the control of a registered quality assurance agency or a copy of the QCM prepared as outlined in Appendix C;
- a copy of the installation manual provided to installers, as outlined in Section 7.2;
- detailed descriptions of the product;
- the original test reports; and

- information demonstrating how reference will be made to CCMC's evaluation number on the product (see Appendix C2).

Note that lack of information will delay the evaluation and may result in an unsuccessful evaluation.

All information to be submitted shall be shipped prepaid, including clearance through Canada Customs, if applicable, to:

Canadian Construction Materials Centre	Telephone:	(613) 993-6189
NRC Construction	Facsimile:	(613) 952-0268
National Research Council Canada		
1200 Montreal Road, Building M-23a		
Ottawa, Ontario		
Canada		K1A 0R6

7.2 Installation Manual

7.2.1 Purpose

The proponent shall provide a well-defined and detailed installation manual that does not contravene the NBC 2015 and that can be used as educational material for installers and users of the product. The manual must be identified with a reference number or an issue date.

7.2.2 Content

The installation manual shall include the following information:

- detailed instructions on all the steps involved in the installation of the system;
- a description of the tools and equipment required to install the system;
- detailed drawings of the system and all the accessories;
- a description of connectors and fasteners used;
- storage and handling procedures, including all precautions involved;
- on-site quality control;
- safety for workers; and
- other information the proponent deems pertinent to the installation.

8.0 Technical Requirements

This section sets out the technical evidence required by CCMC to enable it to evaluate a product and/or system as an acceptable or alternative solution in compliance with the NBC 2015.

8.1 NBC 2015 Compliance Requirements

8.1.1 Performance Requirements and Properties

8.1.1.1 Performance Properties

Table 8.1.1.1

Property	Unit	Test Method	Requirement
Traffic load	N	ASTM E661 and Section 8.1.1.2 of this Guide	≥ 900
Uniform load	–	APA PRP-108 and (Test Method S-2) Section 8.1.1.3 of this Guide	No large deformations or permanent openings at the lap
Wind uplift	–	Section 8.1.1.4 of this Guide	No evidence of deformation or permanent damage
Dynamic pressure water infiltration	–	AAMA 501.1 Section 8.1.1.5 of this Guide	No leakage or damage

8.1.1.2 Traffic Load

Metal roofing systems applied over solid sheathing, furring or spaced sheathing must be designed to support a traffic load equivalent to 900 N concentrated on an area of 125 mm × 125 mm when tested according to ASTM E661. Testing must occur where the support spacing is the maximum specified by the manufacturer, and the worst loading conditions determined by the laboratory. The occurrence of any plastic deformation or permanent openings at the lap that will adversely affect the function of the product will result in the system being deemed a failure.

Should a roofing system fail this criterion by the occurrence of only a plastic deformation at mid-span between the battens, then the test must be redone directly over the battens. If the roofing system passes this second type of loading, then the system can be accepted with a limitation on its usage that restricts walking on the panels to the area above the battens. Consequently, the manufacturer will be required to indicate such restrictions in its installation literature.

8.1.1.3 Uniform Load

Metal roofing systems applied over a batten system must be designed to support the maximum uniform live load that may be expected to act on the roof based on the snow and wind load requirements of Part 4 of Division B of the NBC 2015.

The uniform load test must be conducted in accordance with APA Test Method S-2 in APA PRP-108. The test specimen must be installed according to the manufacturer's instructions. The test must be conducted at a uniform loading rate of 0.479 kPa/min until the maximum load has been achieved. The maximum load is considered to be the load beyond which a deformation occurs

that can adversely affect the performance of the roofing system. The occurrence of large deformations or permanent openings at the lap that will adversely affect the function of the roofing system will result in the system being deemed a failure.

8.1.1.4 Wind Uplift

The metal roofing system must be installed as recommended by the manufacturer. The test specimen must consist of a roof section that is a minimum of 4 or 5 courses high and 2 to 4 panels wide, mounted on a wood-frame shed sheathed with 13-mm-thick plywood, with rafters at 600 mm on center (o.c.). The test specimen is sealed to the deck at the perimeter and a polyethylene film air bag, installed between the panels and the plywood deck, must be pressurized at a controlled rate to produce a uniform negative static pressure on the panels. The test specimen must be subjected to incrementally increasing negative pressures of -0.5 kPa, -1.0 kPa, -1.4 kPa, -1.9 kPa, -2.9 kPa, -3.8 kPa, -4.3 kPa, -4.8 kPa and up to failure, or to the test pressure specified for the system for 10 s, with the pressure reduced to zero between loadings. The panels, sheets or tiles must be inspected for any deformation or damage resulting from the pressure between each loading.

8.1.1.5 Dynamic Pressure Water Infiltration

The dynamic pressure water infiltration resistance test must be conducted using a modification of the test method in AAMA 501.1. This modified test method consists of mounting a test specimen of sufficient size so that the performance of all typical parts of the roofing system can be determined. The test specimen must be mounted according to the manufacturer's instructions, with the minimum slope at which the system is intended to be used. The panels, sheets or tiles are then sealed to the flashing with a silicone sealant. An aircraft engine wind generator is then placed normally and nominally 30 m downwind from the eave of the test specimen. Water spray is then added to the air stream upwind of the deck at a rate equal to approximately 3.4 L/ m²•min for each square meter of roof area. The test specimen must be subjected to incrementally increasing wind speeds from 80 km/h to 170 km/h for 5 minute time periods. If water leakage or damage to the roofing system is observed, the roofing system must be deemed a failure.

8.1.1.6 Aluminum Base Roofing

Products of this category must meet the requirements stated in Table 8.1.1.6.

Table 8.1.1.6

Property	Unit	Test Method	Requirement
Thickness	mm	See Note 1 of this Section	0.48
Coating quality	–	CAN/CGSB-93.1 Section 6.1 ²	Smooth and uniform, free from cracks, pinholes, blisters and flaking
Coating thickness	µm	CAN/CGSB-93.1 Section 6.4 ³	20
Impact resistance	–	CAN/CGSB-93.1 Section 6.5 ⁴	No visible cracking
Film adhesion	–	CAN/CGSB-93.1 Section 6.6 ⁵	No removal of finish coat
Hardness	–	ASTM D3363 ⁶	No rupture
Flexibility	–	CAN/CGSB-93.1 Section 6.8 ⁷	No cracking or flaking
Humidity resistance	–	ASTM D2247 ⁸	No formation of blisters
Salt spray resistance	–	ASTM B117 ²	≥ 7 rating
Durability	–	ASTM G155 ¹⁰	Slight colour change; not greater than No. 8 degree of chalking; no flaking or cracking

Notes to Table 8.1.1.6:

- Thickness** – Measure and record the thickness of the material in several locations to the nearest 0.01 mm using a micrometer or vernier caliper. Record the average of the readings and confirm the calibration of the instrument used.
- Coating quality** – Examine for defects on the coated surface, without magnification in diffused daylight (such as obtained in a Macbeth daylight booth) at several viewing angles not less than 45° to the surface, with the eyes of the observer 600 mm from the surface under examination.
- Coating thickness** – The minimum film thickness of a one-coat finish coating, unless otherwise specified (Par. 8.1), must be not less than 20 µm at any measured point when determined by one of the methods described in ASTM D1400.
- Impact resistance** – Test the specimen at room temperature using a Gardner variable impact tester or equivalent, with a 16-mm mandrel, under a reverse impact energy of 2.25 J. Examine the impact area for cracks at a viewing distance of 400 mm.
- Film adhesion** – On each of the three specimens and with a sharp instrument, scribe through the coating making 11 lines at 2.5-mm intervals. Then at right angles scribe 11 more lines across the first set and at the same spacing to form 100 square islands of coating 645 mm². Assess adhesion by carrying out the tape test described in 1-GB-71, Method 137.1 across the scored area. Each full square of coating removed constitutes 1% loss of adhesion. Do not count part squares removed.
- Hardness** – The finish coating must not rupture when tested in accordance with ASTM D3363.
- Flexibility** – With the test specimen at room temperature bend it through 135° at a uniform rate to complete the bend in 1 s, with the test coating on the outside of the bend over a mandrel of the following radius according to sheet thickness. For a base sheet thickness (t) ≤ 0.80 mm, use a mandrel radius of 2t; for a base sheet thickness (t) ≥ 0.80 mm, use a mandrel radius of 3t. View the specimen at a distance of 400 mm, without magnification, for cracks after bending with no evidence of cracking or flaking.

8. **Humidity resistance** – The coated sheet must withstand exposure for 1 000 h (ASTM D2247) with no formation of blisters on the finish coating to an extent greater than illustrated in Figure 4 of ASTM D714. Specimens must be examined within 30 minutes after completion of the test.
9. **Salt spray resistance** – The test specimen must provide at least 1 m² of coated surface. Score the coating diagonally and sufficiently deep to expose the specimen, supported or suspended at 15° from the vertical for 1 000 h in a salt spray chamber in accordance with ASTM B117 using a 5% sodium chloride solution. Examine the specimen for undercutting of the film from the scored lines.
10. **Durability** – The uniform finish coated sheet must withstand exposure to an accelerated weathering test in accordance with ASTM G155.

8.1.1.7 Galvanized and Aluminum-Zinc Alloy Coated Steel Base Material Requirements

Products of this category must meet the requirements stated in Table 8.1.1.7.

Table 8.1.1.7

Property	Unit	Test Method	Requirement
Thickness	mm	See Note 1 below	0.33
Thickness of zinc coating	–	ASTM A653	Conforms to Z275 designation of ASTM A653
Thickness of aluminum-zinc coating	–	CAN/CGSB-93.3 Section 6.1	Conforms to Z150 designation of ASTM A792/A792M
Coating quality	–	CAN/CGSB-93.3 Section 6.2 ²	Smooth and uniform, free of pinholes, cracks, blisters and flaking
Coating thickness - IEC finish - EC finish	µm	CAN/CGSB-93.3 Section 6.5.1 (IEC) and Section 6.5.2 (EC) ³	> 20 > 180
Film adhesion - IEC finish - EC finish	–	CAN/CGSB-93.3 Section 6.6.1 (IEC) and Section 6.6.2 (EC) ⁴	No removal of finish coat No removal of finish coat
Hardness - IEC finish - EC finish	–	CAN/CGSB-93.3 Section 6.7.1 (IEC) and Section 6.7.2 (EC) ⁵	No rupture 75-80 units
Flexibility	–	CAN/CGSB-93.3 Section 6.8 ⁶	No flaking or micro-cracking
Humidity resistance	–	ASTM D2247 ⁷	No formation of blisters
Salt spray resistance	–	ASTM B117 ⁸	≥ 7 rating
Durability	–	CAN/CGSB-93.3 Section 6.10 ²	Slight colour change; not greater than No. 8 degree of chalking; no flaking or cracking

Notes to Table 8.1.1.7:

1. **Thickness** – Measure and record the thickness of the material in several locations to the nearest 0.01 mm using a micrometer or vernier caliper. Record the average of the readings and confirm the calibration of the instrument used.
2. **Coating quality** – Examine for defects on the coated surface, without magnification, in diffused daylight (such as obtained in a Macbeth daylight booth) at several viewing angles not less than 45° to the surface, with the eyes of the observer 600 mm from the surface under examination.
3. **Coating thickness:**
 - Form IEC (inelastic coating)* – The finish coating must be applied as at least a two-coat system and the total dry film thickness must not be less than 20 µm at any measured point when determined in accordance with ASTM D1005.
 - Form EC (elastic coating)* – The finish coating must be applied as at least a two-coat system and the total dry film thickness must not be less than 180 µm at any measured point when determined in accordance with ASTM D1005.
4. **Film adhesion:**
 - Form IEC (inelastic coating)* – Scribe through the coating with a sharp instrument making 11 lines at 2.5-mm intervals. At right angles, scribe 11 more lines across the first set and at the same spacing to form 100 square islands of coating 645 mm². Apply across the scribed area a strip of fresh 25-mm-wide pressure sensitive tape that conforms to the requirements of CGSB 43-GP-3M Type II, Grade A or B. Press the tape down by two passes of a rubber-covered roller 90 mm in diameter and 45-mm-wide with a mass of 2 kg, the rubber having a Durometer hardness of 70 to 80. Remove the tape immediately after application by pulling it back upon itself 180° with one rapid motion. Examine the scribed area for removal of the coating.
 - Form EC (elastic coating)* – Scribe through the coating with a sharp instrument making 11 lines at 2.5-mm intervals. At right angles scribe 11 more lines across the first set and at the same spacing to form 100 square islands of coating 645 mm². Raise an Olson button 6 mm in height as measured from the surface of the test specimen to the top of the button. Boil the sample for 30 minutes in boiling water. Allow to cool. The vinyl film should remain firmly bonded to the substrate and resist peeling from light mechanical working with a fingernail.
5. **Hardness:**
 - Form IEC (inelastic coating)* – The finish coating must not rupture when tested in accordance with ASTM D3363.
 - Form EC (elastic coating)* – Cast a test film of the finish coating. Layer the test films to derive a thickness of 6 mm. Determine the hardness of the coating in accordance with ASTM D2240.
6. **Flexibility** – With the test specimen at room temperature (20°C to 27°C), bend it through 135° at a uniform rate to complete the bend in 1 s, with the test coating on the outside of the bend, over a mandrel of the following radius according to sheet thickness. For a base sheet thickness (t) ≤ 0.80 mm, use a mandrel radius of 2t; for a base sheet thickness (t) ≥ 0.80 mm and ≤ 1.6 mm, use a mandrel radius of 3t. View the specimen at a distance of 400 mm, without magnification, for cracks after bending with no evidence of cracking or flaking.
7. **Humidity resistance** – The coated sheet must withstand exposure for 1 000 h (ASTM D2247) with no formation of blisters on the finish coating to an extent greater than illustrated in Figure 4 of ASTM D714. Specimens must be examined within 30 minutes after completion of the test.
8. **Salt spray resistance** – The test specimen must provide at least 1 m² of coated surface. Score the coating diagonally and sufficiently deep to expose the specimen, supported or suspended at 15° from the vertical for 1 000 h in a salt spray chamber in accordance with ASTM B117 using a 5% sodium chloride solution. Examine the specimen for undercutting of the film from the scored lines.
9. **Durability** – The uniform finish coated sheet must withstand exposure to an accelerated weathering test in accordance with ASTM G155.

8.1.1.8 Copper Base Material Requirements

Products of this category must meet the requirements stated in Table 8.1.1.8.

Table 8.1.1.8

Property	Unit	Test Method	Requirement
Thickness	mm	See Note 1 below	0.46
Material and manufacture	–	ASTM B370 Section 6	Conforms to ASTM B248
Chemical composition (minimum copper content, including silver)	%	ASTM B370 Section 7	Conforms to ASTM B248 (99.9%)
Tensile strength	–	ASTM B370 Section 10.1	Conforms to ASTM B370 Table 2
Rockwell hardness	–	ASTM B370 Section 10.2	Conforms to ASTM B370 Table 2

Note to Table 8.1.1.8:

1. Measure and record the thickness of the material in several locations to the nearest 0.01 mm using a micrometer or vernier caliper. Record the average of the readings and confirm the calibration of the instrument used.

8.1.2 Additional Performance Data

Data in this section will not form part of the CCMC opinion.

8.1.2.1 PVDF Coating (as required)

The product must meet the requirements stated in Table 8.1.2.1.

Table 8.1.2.1

Property	Unit	Test Method	Requirement
Total dry film thickness	µm	ASTM D7091 ¹	25
Dry film hardness	–	ASTM D3363 ²	No rupture
Adhesion - dry - wet	–	ASTM D3359 ³	No removal of film
			No removal of film
Impact resistance	–	See Note 4 of this Table.	No removal of film
Salt spray resistance	–	ASTM B117 ⁵	≥ 7 rating
Weathering (accelerated)	–	ASTM G155 ⁶	No change
Abrasion resistance	–	ASTM D968 ⁷	Coefficient value ≥ 40
Acid resistance	–	See Note 8 of this Table.	No loss of integrity or appreciable change
Flexibility	–	ASTM D522, Test Method B5 ⁹	No flaking or cracking

Notes to Table 8.1.2.1:

- Total dry thickness** – The total dry thickness must be measured on five (5) single-point measurements as per ASTM D7091-13. Reported value must be the mean of the five measurements.
- Dry film hardness** – Test must be performed on five (5) samples each measuring 127 mm × 127 mm based on the procedure defined in ASTM D3363. If rupture to the film is observed, the coating must be deemed a failure.
- Film adhesion:**
Dry adhesion – Samples must be conditioned for a minimum of 48 h at 23 ± 2°C and relative humidity (RH) of 50 ± 5%. Film adhesion must be performed as per ASTM D3359-09e2 Test Method B, on five (5) samples each measuring 127 mm × 127 mm. Any sign of removal of the film must be deemed a failure.
Wet adhesion – Samples must be immersed in distilled water for 24 h at 38 ± 2°C. Remove samples and wipe dry. Wait 5 minutes before testing them under standard laboratory conditions (23 ± 2°C and RH of 50 ± 5%). Film adhesion must be performed as per ASTM D3359-09e2 Test Method B, on five (5) samples each measuring 127 mm × 127 mm. Any sign of removal of the film must be deemed a failure.
- Impact resistance** – Testing must be performed on five (5) samples conditioned for 24 h at 23 ± 2°C and RH of 50 ± 5%. Using a 16-mm diameter round nose impact tester, apply a load of sufficient force to deform the test sample a minimum of 3 mm ± 0.3 mm. Apply 20-mm-wide tape over the area of deformation by firmly pressing down against the coating to eliminate voids and air pockets. Sharply pull the tape off at a right angle to the plane of the surface being tested. If the removal of film is observed, the coating must be deemed a failure.
- Salt spray resistance** – Score the film of the sample sufficiently deep to expose the base metal using a sharp knife or blade instrument. Expose the sample according to ASTM B117 using a salt solution for 1 000 h. Remove and wipe the sample dry. Immediately apply 20-mm-wide tape (Permacel 99 or equivalent) over the scored area by firmly pressing down against the coating to eliminate voids and air pockets. Sharply pull the tape off at a right angle to the plane of the surface being tested. A minimum rating of seven on scribe and cutting edges must be reached. Rate in accordance with AAMA 621, Section 7.9.2.2.

6. **Weathering (accelerated)** – Conduct the 2 000 h Xenon arc exposure test on a minimum of 10 samples, in accordance with ASTM G155 with the exposure conditions of Cycle 2 of Table X3. Samples must not show any change of colour, chalking or cracking.
7. **Abrasion resistance** – The abrasion coefficient is calculated according to the following formula:
Abrasion coefficient – L per mil = V/T
where
V = Volume of sand used in L,
T = thickness of coating in mils.
8. **Acid resistance** – Expose the metal test samples (two samples per test, minimum size 75 mm × 75 mm) with a factory-applied coating to the following acids in accordance with the procedure in Par. 7.4 of ASTM D3260:
 - 10% by volume sulphuric acid;
 - 10% by volume hydrochloric acid; and
 - 10% by volume nitric acid.
 Examine the metal test samples for any loss of integrity or appreciable change. Slight change in colour is acceptable.
9. **Flexibility** – Test must be performed on five (5) samples conditioned for 24 h at a temperature of $23 \pm 2^\circ\text{C}$ and a RH of $50 \pm 5\%$.

8.1.2.2 Granular Mineral Surfacing (as required)

The product must meet the requirements stated in Table 8.1.2.2.

Table 8.1.2.2

Property	Unit	Test Method	Requirement
Loss of adhesion	g	ASTM D4977	≤ 2.0

Surface protection on the exposed face of the panels, consisting of mineral granulates, must be continuous, adherent to the panel, and must not reveal the substrate in a way that might affect the uniform appearance of the panels. When tested according to ASTM D4977, the loss of adhesion of the mineral granulates must not exceed 2.0 g.

8.1.2.3 Fire Protection (as required)

The product must meet the requirements stated in Table 8.1.2.3.

Table 8.1.2.3

Property	Unit	Test Method	Requirement
Fire test of roof covering	–	CAN/ULC-S107	As reported
Fire resistance rating	–	CAN/ULC-S101	As reported

8.2 Provincial, Territorial and other Code Compliance Requirements

At this time, the provinces and territories and other stakeholders have not requested that CCMC verify compliance with the requirements of any other Codes.

Note: These mandatory requirements refer to provincial, territorial and/or other Code requirements not covered in the NBC 2015.

8.3 Additional Health and Safety Requirements

At this time, there has not been any additional health and safety data identified by third parties.

Note: These additional health and safety requirements refer to issues that are not covered by the NBC 2015 or its objectives and functional statements and that are of immediate serious concern.

8.4 Additional Data

At this time, the proponent has not requested that CCMC verify any additional data.

Appendix A – Where to Purchase the Codes and Standards Referenced Herein

A1 Code(s)

NBC Client Services, Construction Research Centre
National Research Council Canada
1200 Montreal Road, Building M-20
Ottawa, Ontario K1A 0R6
Tel.: 613-993-2463
Fax: 613-952-7673
Web site: <https://shop-magasin.nrc-cnrc.gc.ca>

A2 Standard(s)

AAMA American Architectural Manufacturers Association
1827 Walden Office Square, Suite 550
Schaumburg, IL 60173-4268
USA
Tel.: 847-303-5664
Fax: 847-303-5774
Web site: www.aamanet.org

APA-EWS American Plywood Association – Engineered Wood Systems
The Engineered Wood Association
P.O. Box 11700
7011 South 19th St.
Tacoma, WA 98411-0700
USA
Tel.: 253-565-6600
Fax: 253-565-7265
Web site: www.apawood.org

ASTM ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
USA
Tel.: 610-832-9585
Fax: 610-832-9555
Web site: www.astm.org

CGSB Canadian General Standards Board, Sales Unit
Place du Portage, Phase III, 6B1
11 Laurier Street
Gatineau, QC K1A 1G6
Tel.: 1-800-665-2472
819-956-0425
Fax: 819-956-5740
Web site: www.tpsgc-pwgsc.gc.ca/cgsb/

ULC Underwriters' Laboratories of Canada
7 Underwriters Road
Toronto, ON M1R 3B4
Tel.: 1-866-937-3852
416-757-3611
Fax: 416-757-8727
Web site: www.ul.com/canada

Appendix B – Testing Agencies

B.1 General

Testing must be performed at a recognized laboratory as indicated in the covering letter. When CCMC protects a Technical Guide for a proponent, the proponent is also advised to control the Guide's dissemination. The proponent must provide copies of the complete Technical Guide, including appendices, to each testing laboratory to obtain information regarding fees and the number of samples required for testing in accordance with the Guide.

The proponent must cover the costs of testing and authorize the testing organization to forward the original test report for each sample directly to CCMC. The submitted test reports are retained by CCMC.

B.2 Sampling

The proponent must arrange for an independent third-party organization acceptable to CCMC to obtain a random selection of samples from the production line or main storage facility as indicated in the covering letter.

The organization performing the product sampling must clearly identify the samples and produce a report providing detailed information on the material sampling (sampling date, method of sampling, sites where sampling was performed and sample reference number/identification). The identified samples must be forwarded directly to the testing laboratory by the proponent or the sampling organization.

If sampling is to be performed at more than one storage facility, additional material will need to be sampled for fingerprint testing to confirm that it is the same product that has been sampled at the different storage facilities. The proponent must obtain information from CCMC on the required fingerprint testing that needs to be carried out by the testing laboratory.

If several plants manufacture this product, samples from each facility are required.

The proponent must cover the costs of the material sampling and authorize the sampling organization to forward the original sampling report directly to CCMC. The submitted report is retained by CCMC.

The proponent must also authorize the sampling organization to forward a copy of the sampling report directly to the testing laboratory so that the identification of the samples it received can be verified and reported in the test report.

B.3 Reports from Testing Laboratories

The following information must be provided by testing laboratories in reports intended for CCMC evaluation purposes:

- a sample report that includes detailed information on material sampling identification, including the date the samples were received;
- the start and end date(s) of test(s);

- detailed specimen preparation methods (if other than specified in the test method, standard or Technical Guide);
- test procedure identification, including:
 - any deviations from the referenced test procedure,
 - reasons for the deviations,
 - additional instrumentation requirements, and
 - photos;

- all information mentioned in the reporting section of the referenced standards or standard test methods;
- test results (table format, if appropriate), including:
 - written explanations to account for any discrepancies; and

- a concluding statement on the product's performance with respect to the testing performed and the results obtained. *(The test report should contain detailed observations, including photographs if applicable, describing the performance of the product and any comments the testing laboratory wishes to include. In the case of a revised test report, the document should contain a clear description of why the report was revised and what the revisions entailed.)*

The report should include the statement: "Tested for CCMC Evaluation Purposes."

Additional information on the CCMC policy on Laboratory Recognition is available at <https://nrc.canada.ca/en/certifications-evaluations-standards/calibration-laboratory-assessment-service/directory-accredited-calibration-laboratories>.

Appendix C – Quality Assurance Program

The proponent must demonstrate that the production process is governed by a quality assurance program, which ensures consistent quality at least to the level represented by the sample being tested and evaluated. CCMC requests that quality control procedures be applied to incoming materials, processes, and finished products.

C1 Requirements

Quality assurance shall be demonstrated using the ISO 9001 standard or a quality control manual.

C1.1 ISO 9001:2008, "Quality management systems - Requirements"

The production process shall conform to ISO 9001:2008, "Quality management systems - Requirements" through registration by an accredited quality assurance agency. The proponent can demonstrate quality assurance by submitting documentation attesting that the production process has been registered as conforming to ISO 9001:2008 by an accredited quality assurance agency. The proponent may contact the Standards Council of Canada at (613) 238-3222 to inquire about accredited agencies.

C1.2 Quality control manual

The Quality Control Manual (QCM) submitted to CCMC shall contain the following information:

- the company's quality control policies;
- provisions for keeping the manual current, e.g., updates and revisions;
- a production flow chart indicating points of quality control, with an explanation of the control at each point, the frequency of controls, and a summary of the production methods;
- production specifications and process tolerances;
- a clear delineation of what constitutes major and minor defects;
- corrective measures for major and minor defects;
- a list of main production equipment;
- a list of manufacturer's specifications and quality control arrangements for raw materials and equipment;
- measuring equipment: type, model, range, accuracy, frequency of calibration, and calibration agency; and,
- a statement by the proponent that CCMC will be notified, in writing, when major deviations have been discovered.

C2 Identification

Quality control procedures for finished products must include details on how the product will be identified with the CCMC evaluation number, in the form of "CCMC XXXXX-R," which shall be both visible and legible. Where permanently identifying a product is not possible, other forms and methods of identification may be allowed pending review and approval by a CCMC evaluation officer.