ICC EVALUATION SERVICE®

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November 22, 2024

TO: **PARTIES INTERESTED IN FIBER-REINFORCED MAGNESIUM-OXIDE-BASED SHEETS**

SUBJECT: Proposed Revisions to the Acceptance Criteria for Fiber-Reinforced Magnesium-Oxide-Based Sheets AC386-0225-R1-1 (WU/AC)

Hearing Information:
WebEx Event Meeting
Wednesday, February 19, 2025
8:00 am Pacific Standard Time
Click the date above to register

Dear Colleague:

You are invited to comment on proposed revisions to AC386 which will be discussed at the Evaluation Committee hearing noted above.

The proposed revisions are outlined by the proponent in the attached letter dated November 8, 2024, by Eric Polzin, P.E. (NEXGEN Building Products) and Ben Richardson (Huber Engineered Woods).

Should the committee approve the proposed revisions to the criteria, the ICC-ES staff will not recommend a mandatory compliance date. Compliance with the revised criteria will therefore be at the option of existing report holders.

You are invited to submit written comments on this or any other agenda item, or to attend the Evaluation Committee hearing and present your views in person. If you wish to contribute to the discussion, please note the following:

1. Regarding written comments and presentations:

   a. You should submit these via e-mail to es@icc-es.org by the applicable due date.

   b. Comments are to be received by **December 18, 2024**. These written comments will be forwarded to the committee before the meeting, and will also be posted on the ICC-ES web site shortly after the deadline for submission. Written comments that are not submitted by this deadline will not be considered at the meeting.

   c. Rebuttal comments, from the proponent noted in this letter, are to be received by **January 9, 2025**. They will be forwarded to the committee before the meeting, and will also be

posted on the ICC-ES web site shortly after the deadline for submission. Written rebuttal comments that are not submitted by the deadline will not be considered at the meeting.

d. If you want to make a visual presentation at the hearing, it must be received in PowerPoint format. The presentation is to be received by **January 24, 2025.** These will be forwarded to the committee before the meeting, and will also be posted on the ICC-ES web site after the deadline for submission. Presentations that are not submitted by the deadline cannot be presented at the meeting. **Note:** Videos will not be posted on the web site.

   Presentations will be retained with other records of the meeting.

e. ICC-ES will post to the web site, on **February 5, 2025**, memos by the ICC-ES staff, responding to the previously received public comments.

f. If you miss the deadlines for submission of written comments and visual presentations, your verbal comments can be presented at the meeting.

g. Proposed criteria, written public comments, visual presentations, and responses by ICC-ES staff for this agenda item are all available on our website.

2. Regarding verbal comments and presentations:

   Please plan to speak for not more than ten minutes. As noted above, visuals are to be in PowerPoint format.

3. Keep in mind that all materials submitted for committee consideration are part of the public record and will not be treated as confidential. It is the presenter's responsibility to certify to ICC-ES staff that no materials infringe copyright.

4. Please do not communicate with committee members before the meeting about any items on the agenda.

We appreciate your interest in the work of the Evaluation Committee. If you have any questions, please contact me at (800) 423-6587, extension 5699, or Alex Collins, at extension 5684. You may also reach us by e-mail at es@icc-es.org.

Yours very truly,

Will Utsey
Director of Engineering, Evaluation Services

WU/ls

Encl.

cc: Evaluation Committee

Date: 8 November 2024

Re: Proposed revisions to ICC-ES Acceptance Criteria for Fiber-Reinforced Magnesium Oxide-Based Sheets (AC386)

From: Eric Polzin, P.E. (NEXGEN Building Products) and Ben Richardson (Huber Engineered Woods)

Dear Colleagues,

NEXGEN Building Products, LLC. and Huber Engineered Woods, LLC have collaborated to draft proposed language to AC386. The purpose of the revisions is to provide pathways for evaluation of Magnesium Oxide Sheets for the following three items:

1. Establish fastener capacities for use in design of attachment of lightweight cladding directly to MgO sheathing.
2. Establish dowel bearing capacities for use in design of lateral connections utilizing the NDS, or establish allowable lateral design capacities of specific tested assemblies.
3. Establish allowable compressive bearing capacities of the panels for use in design.

As part of our development process, we reached out to other organizations, to ensure that proposed testing and analysis paths are adequate. A short summary of our thoughts with some justifications as to how we arrived at the proposed draft language is included below.

Proposed AC386 Section 3.6: Fastener Withdrawal and Lateral Capacity for Direct Attachment of Cladding [Max. Cladding Weight ≤ 10 psf (48.8 kg/m2); Max. Cladding Thickness 5/8- inch (15.9 mm)] (Optional)

Direct attachment of lightweight cladding to MgO sheathing requires consideration of two primary functions – the ability to resist wind loads (pull-out) and the ability to resist gravity loads (lateral). For purposes of this portion of the proposal, the intent is to limit cladding weight, lateral capacity (20lbf max), cladding thickness (≤5/8”) and require the cladding to be directly attached the sheathing without intermediate materials, such as insulation board, to alleviate concerns regarding possible bending or deflection of the fastener under cantilever-type loading.

The proposed test methodology is to utilize ASTM D1761 for both withdrawal and lateral test configurations. Additionally, it is proposed that the testing be performed in both a “dry” laboratory conditioned state as well as in a wet/re-dry state to ensure adequate performance in the case that the panels get wet during construction (similar to the conditioning requirements for fastener testing under AC367).

For both test configurations, the minimum fastener embedment into the main member is the full thickness of the MgO panel plus ¼". This requirement was pulled from Table R703.3.3 of the IRC (excerpt below) for direct attachment of siding to wood structural panels. *It is noted in this table that the siding weight is limited to 3psf, but this table also allows the placement of up to 2-inch thick foam sheathing between the wood panel and the siding (effectively providing a 2" cantilever arm between the siding and wood panel).*

TABLE R703.3.3
OPTIONAL SIDING ATTACHMENT SCHEDULE FOR FASTENERS WHERE NO STUD PENETRATION NECESSARY

APPLICATION	NUMBER AND TYPE OF FASTENER	SPACING OF FASTENERS[b]
Exterior wall covering (weighing 3 psf or less) attachment to wood structural panel sheathing, either direct or over foam sheathing a maximum of 2 inches thick.[a] Note: Does not apply to vertical siding.	Ring shank roofing nail (0.120″ min. dia.)	12″ o.c.
	Ring shank nail (0.148″ min. dia.)	15″ o.c.
	No. 6 screw (0.138″ min. dia.)	12″ o.c.
	No. 8 screw (0.164″ min. dia.)	16″ o.c.

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.479 kPa.

a. Fastener length shall be sufficient to penetrate the back side of the wood structural panel sheathing by at least $^{1}/_{4}$ inch. The wood structural panel sheathing shall be not less than $^{7}/_{16}$ inch in thickness.

b. Spacing of fasteners is per 12 inches of siding width. For other siding widths, multiply "Spacing of Fasteners" above by a factor of 12/s, where "s" is the siding width in inches. Fastener spacing shall never be greater than the manufacturer's minimum recommendations.

For the lateral testing configuration, it is proposed that testing be conducted in both the machine and cross-machine directions (with the lesser of the two to be used as the reference value). The MgO sheathing will be installed as the main member and that a thin steel member (22-gauge; 0.0299-inch thick) be used as the side member. The use of this specific thin side member was selected based on the minimum thickness of a sheet metal masonry veneer tie specified in Section R703.8.4.1 of the IRC (excerpt below). Additionally, available data included in the American Wood Council's *National Design Specification for Wood Construction* (NDS) indicates that the use of a very thin side member in a lateral test configuration will produce lower allowable load values than if thicker side members are used. Therefore, the use of a thin steel side member for determination of allowable lateral (gravity) loads can be conservatively extended to claddings of greater thickness (see additional discussion and excerpts from the NDS on the following pages.

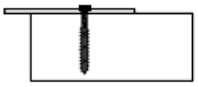
R703.8.4.1 Size and spacing. Veneer ties, if strand wire, shall be not less in thickness than No. 9 U.S. gage [(0.148 inch) (4 mm)] wire and shall have a hook embedded in the mortar joint, or if sheet metal, shall be not less than No. 22 U.S. gage by [(0.0299 inch) (0.76 mm)] $^{7}/_{8}$ inch (22 mm) corrugated. Each tie shall support not more than 2.67 square feet (0.25 m^2) of wall area and shall be spaced not more than 32 inches (813 mm) on center horizontally and 24 inches (635 mm) on center vertically.

The excerpts on the following pages from the NDS are intended to provide evidence in support the use of a thin side member as a conservative method for providing a prescriptive allowable attachment value for greater cladding thicknesses. The tables provide reference lateral capacities for single shear connections with both steel and wood side members. The tables also cover a wide range of wood species with varying specific gravities / dowel bearing strength, which further demonstrates that the relationship is seen across a wide range of substrates.

- Table 12M covers attachment of Grade 33 steel (same as what we proposed in the AC), and you can see that as the side member thickness increases, the reference design value also increases. The #6 screw for each configuration has been highlighted in blue boxes.
- Table 12L covers attachment of various thicknesses of wood side members. The same general relationship is also demonstrated (increased side member thickness = increased capacity) until you reach a point of no added capacity with additional side member thickness. The #14 screw is highlighted for each configuration in blue boxes (the larger diameter fastener demonstrates this trend over a larger range of side member thicknesses when compared to the smaller diameter fasteners).

Table 12M **WOOD SCREWS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2,3]**

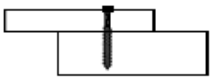
for sawn lumber or SCL with ASTM 653, Grade 33 steel side plate
(tabulated lateral design values are calculated based on an assumed length of wood screw penetration, p, into the main member equal to 10D)



Side Member Thickness t_s	Wood Screw Diameter D	Wood Screw Number	G=0.67 Red Oak	G=0.55 Mixed Maple Southern Pine	G=0.5 Douglas Fir-Larch	G=0.49 Douglas Fir-Larch(N)	G=0.46 Douglas Fir(S) Hem-Fir(N)	G=0.43 Hem-Fir	G=0.42 Spruce-Pine-Fir	G=0.37 Redwood	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods	G=0.35 Northern Species
in.	in.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0.036 (20 gage)	0.138	6	89	76	70	69	66	62	60	54	53	52
	0.151	7	99	84	78	76	72	68	67	60	59	57
	0.164	8	113	97	89	87	83	78	77	69	67	66
0.048 (18 gage)	0.138	6	90	77	71	70	67	63	61	55	54	53
	0.151	7	100	85	79	77	74	69	68	61	60	58
	0.164	8	114	98	90	89	84	79	78	70	69	67
0.060 (16 gage)	0.138	6	92	79	73	72	68	64	63	57	56	54
	0.151	7	101	87	81	79	75	71	70	63	61	60
	0.164	8	116	100	92	90	86	81	79	71	70	68
	0.177	9	136	116	107	105	100	94	93	83	82	79
	0.190	10	146	125	116	114	108	102	100	90	88	86
0.075 (14 gage)	0.138	6	95	82	76	75	71	67	66	59	58	57
	0.151	7	103	90	84	82	78	74	72	65	64	62
	0.164	8	119	103	95	93	89	84	82	74	73	71
	0.177	9	139	119	110	108	103	97	95	86	84	82
	0.190	10	150	128	119	117	111	105	103	92	91	88
	0.216	12	186	159	147	145	138	130	127	114	112	109
	0.242	14	204	175	162	158	151	142	139	125	123	120
0.105 (12 gage)	0.138	6	104	90	84	82	79	74	73	66	65	63
	0.151	7	114	99	92	90	86	81	80	72	71	69
	0.164	8	129	111	103	102	97	92	90	81	80	77
	0.177	9	148	128	119	116	111	105	103	93	91	89
	0.190	10	160	138	128	125	120	113	111	100	98	96
	0.216	12	196	168	156	153	146	138	135	122	120	116
	0.242	14	213	183	170	167	159	150	147	132	130	126
0.120 (11 gage)	0.138	6	110	95	89	87	83	79	77	70	68	67
	0.151	7	120	104	97	95	91	86	84	76	75	73
	0.164	8	135	117	109	107	102	96	94	85	84	82
	0.177	9	154	133	124	121	116	110	107	97	95	93
	0.190	10	166	144	133	131	125	118	116	104	103	100
	0.216	12	202	174	162	159	152	143	140	126	124	121
	0.242	14	219	189	175	172	164	155	152	137	134	131
0.134 (10 gage)	0.138	6	116	100	93	92	88	83	81	73	72	70
	0.151	7	126	110	102	100	96	91	89	80	79	77
	0.164	8	141	122	114	112	107	101	99	89	88	86
	0.177	9	160	139	129	127	121	114	112	101	100	97
	0.190	10	173	149	139	136	130	123	121	109	107	104
	0.216	12	209	180	167	164	157	148	145	131	129	126
	0.242	14	226	195	181	177	169	160	157	141	139	135
0.179 (7 gage)	0.138	6	126	107	99	97	92	86	84	76	74	72
	0.151	7	139	118	109	107	102	95	93	84	82	80
	0.164	8	160	136	126	123	117	110	108	96	95	92
	0.177	9	184	160	148	145	138	129	127	113	111	108
	0.190	10	198	172	159	156	149	140	137	122	120	117
	0.216	12	234	203	189	186	178	168	165	149	146	143
	0.242	14	251	217	202	198	190	179	176	159	156	152
0.239 (3 gage)	0.138	6	126	107	99	97	92	86	84	76	74	72
	0.151	7	139	118	109	107	102	95	93	84	82	80
	0.164	8	160	136	126	123	117	110	108	96	95	92
	0.177	9	188	160	148	145	138	129	127	113	111	108
	0.190	10	204	173	159	156	149	140	137	122	120	117
	0.216	12	256	218	201	197	187	176	172	154	151	147
	0.242	14	283	241	222	217	207	194	190	170	167	162

Table 12L WOOD SCREWS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2,3]

for sawn lumber or SCL with both members of identical specific gravity (tabulated lateral design values are calculated based on an assumed length of wood screw penetration, p, into the main member equal to 10D)



Side Member Thickness	Wood Screw Diameter	Wood Screw Number	G=0.67 Red Oak	G=0.55 Mixed Maple Southern Pine	G=0.5 Douglas Fir-Larch	G=0.49 Douglas Fir-Larch(N)	G=0.46 Douglas Fir(S) Hem-Fir(N)	G=0.43 Hem-Fir	G=0.42 Spruce-Pine-Fir	G=0.37 Redwood	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods	G=0.35 Northern Species
t_s in.	D in.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1/2	0.138	6	88	67	59	57	53	49	47	41	40	38
	0.151	7	96	74	65	63	59	54	52	45	44	42
	0.164	8	107	82	73	71	66	61	59	51	50	48
	0.177	9	121	94	83	81	76	70	68	59	58	56
	0.190	10	130	101	90	87	82	75	73	64	63	60
	0.216	12	156	123	110	107	100	93	91	79	78	75
	0.242	14	168	133	120	117	110	102	99	87	86	83
5/8	0.138	6	94	76	66	64	59	53	52	44	43	41
	0.151	7	104	83	72	70	64	58	56	48	47	45
	0.164	8	120	92	80	77	72	65	63	54	53	51
	0.177	9	136	103	91	88	81	74	72	62	61	58
	0.190	10	146	111	97	94	88	80	78	67	65	63
	0.216	12	173	133	117	114	106	97	95	82	80	77
	0.242	14	184	142	126	123	115	106	103	89	87	84
3/4	0.138	6	94	79	72	71	65	58	57	47	46	44
	0.151	7	104	87	80	77	71	64	62	52	50	48
	0.164	8	120	101	88	85	78	71	69	58	56	54
	0.177	9	142	114	99	96	88	80	78	66	64	61
	0.190	10	153	122	107	103	95	86	83	71	69	66
	0.216	12	192	144	126	122	113	103	100	86	84	80
	0.242	14	203	154	135	131	122	111	108	93	91	87
1	0.138	6	94	79	72	71	67	63	61	55	54	51
	0.151	7	104	87	80	78	74	69	68	60	59	56
	0.164	8	120	101	92	90	85	80	78	67	65	62
	0.177	9	142	118	108	106	100	94	90	75	73	70
	0.190	10	153	128	117	114	108	101	97	81	78	75
	0.216	12	193	161	147	143	131	118	114	96	93	89
	0.242	14	213	178	157	152	139	126	122	102	100	95
1-1/4	0.138	6	94	79	72	71	67	63	61	55	54	52
	0.151	7	104	87	80	78	74	69	68	60	59	57
	0.164	8	120	101	92	90	85	80	78	70	68	66
	0.177	9	142	118	108	106	100	94	92	82	80	78
	0.190	10	153	128	117	114	108	101	99	88	87	84
	0.216	12	193	161	147	144	137	128	125	108	105	100
	0.242	14	213	178	163	159	151	141	138	115	111	106
1-1/2	0.138	6	94	79	72	71	67	63	61	55	54	52
	0.151	7	104	87	80	78	74	69	68	60	59	57
	0.164	8	120	101	92	90	85	80	78	70	68	66
	0.177	9	142	118	108	106	100	94	92	82	80	78
	0.190	10	153	128	117	114	108	101	99	88	87	84
	0.216	12	193	161	147	144	137	128	125	111	109	106
	0.242	14	213	178	163	159	151	141	138	123	120	117
1-3/4	0.138	6	94	79	72	71	67	63	61	55	54	52
	0.151	7	104	87	80	78	74	69	68	60	59	57
	0.164	8	120	101	92	90	85	80	78	70	68	66
	0.177	9	142	118	108	106	100	94	92	82	80	78
	0.190	10	153	128	117	114	108	101	99	88	87	84
	0.216	12	193	161	147	144	137	128	125	111	109	106
	0.242	14	213	178	163	159	151	141	138	123	120	117

Proposed AC 386 Section 3.7: Reference Lateral Design Values (Optional)

Fiber-reinforced magnesium-oxide-based sheets used as floor underlayment or subfloor typically support loads from bearing walls or transfer loads from shear/braced walls through the panel to the supporting structure below. Design professionals are requesting information on allowable bearing stress and dowel bearing strength to ensure these materials are suitable for use in these areas. In addition to providing information for design of shear transfer in flooring applications, the proposed section will also provide a pathway for validation of design methodology for other lateral connections.

Reference lateral design values in wood frame construction are calculated using the Yield Limit Equations presented in Chapter 12 of the American Wood Council's *National Design Specification for Wood Construction* (NDS). To use these equations, the dowel bearing strength of the attached members must be known. Wood structural panels, such as plywood and OSB, are typically used as subfloor and floor underlayment, and their dowel-bearing strengths are published in Table 12.3.3B of the NDS. The NDS identifies ASTM D5764 as the methodology used to derive dowel bearing strength.

ICC-ES Acceptance Criteria for Nails (AC116) addresses connection strength determination in Section 3.3. This AC provides a pathway for confirming that dowel bearing strengths from testing are suitable for use with the yield mode equations from the NDS. First, dowel bearing testing is conducted in accordance with ASTM D5764. The derived dowel bearing strength is then used to calculate the reference lateral design value using the equations in the NDS. Finally, connection testing (in accordance with ASTM D1761) is used as a confirmatory test to check that the calculated reference lateral design value does not exceed 75% of the proportional limit load from the connection test as described in Section 3.3.1.1 of AC116. This is an important check to ensure the tested dowel bearing strength is usable with the yield mode equations.

Alternatively, AC116 as well as the ICC-ES Acceptance Criteria for Dowel-Type Threaded Fasteners (AC233) provide pathways to simply run the connection test and derive the ASD reference lateral design value from connection testing. Although more simplistic, it places some limitations on designers. The appropriate sections from each of those criteria have been referenced in the proposed revisions, as applicable.

Proposed AC386 Section 3.8: Allowable Bearing Stress of MgO Sheet (Optional)

Bearing stress is the compression stress that is applied perpendicular to the surface of the magnesium oxide panel. Information on the allowable bearing stress for wood structural panels is provided by The Engineered Wood Association (APA) in Technical Bulletin TT-001B. This technical bulletin identifies ASTM D143 as the testing protocol. Bearing stress values for wood structural panels were calculated from test loads corresponding to deformations at 0.02-inch and 0.04-inch. To account for variability and uncertainty, the characteristic values are based on the lower 95 percent confidence interval (LCI) and standard adjustment factor of 1.67.

While the intent is to provide analogous data for use in design, the concern with directly adopting the wood structural panel methodology for MgO, is that the specimen may have already yielded at 0.04". Based on preliminary testing, it is note that MgO panels tested in accordance with ASTM D143 exhibit different behavior than wood structural panels tested under the same methodology. Figure 1 below illustrates those differences. At deformations of 0.02-inch and 0.04-inch, MgO panels are approaching or have surpassed the proportional limit load as identified in the load-deformation curve.

Taking into account the differences in material behavior and to add an additional layer of conservatism in comparison to the approach the APA used, the proposal intentionally limits the load to a range in which the deformation would remain in the elastic zone. In summary using the proportional limit is a more conservative approach that will offer lower allowable bearing stress than following the APA approach directly.

In our discussions with industry professionals on this topic, it was determined that the standard factor of 1.67 comes from the factor used when converting from ASD to LRFD (see $F_{c\perp}$ in Table 9.3.1 of the NDS). Essentially, that format conversion factor gives a bump of 1.67 when converting to LRFD. The suggestion to use the adjustment factor is to ensure that the potential conversion to LRFD by increasing the reported ASD value by 1.67 has been appropriately accounted for. Again, this approach limits the design load to the elastic region of the load-deformation curve without over-penalizing the performance relative to the wood methodology.

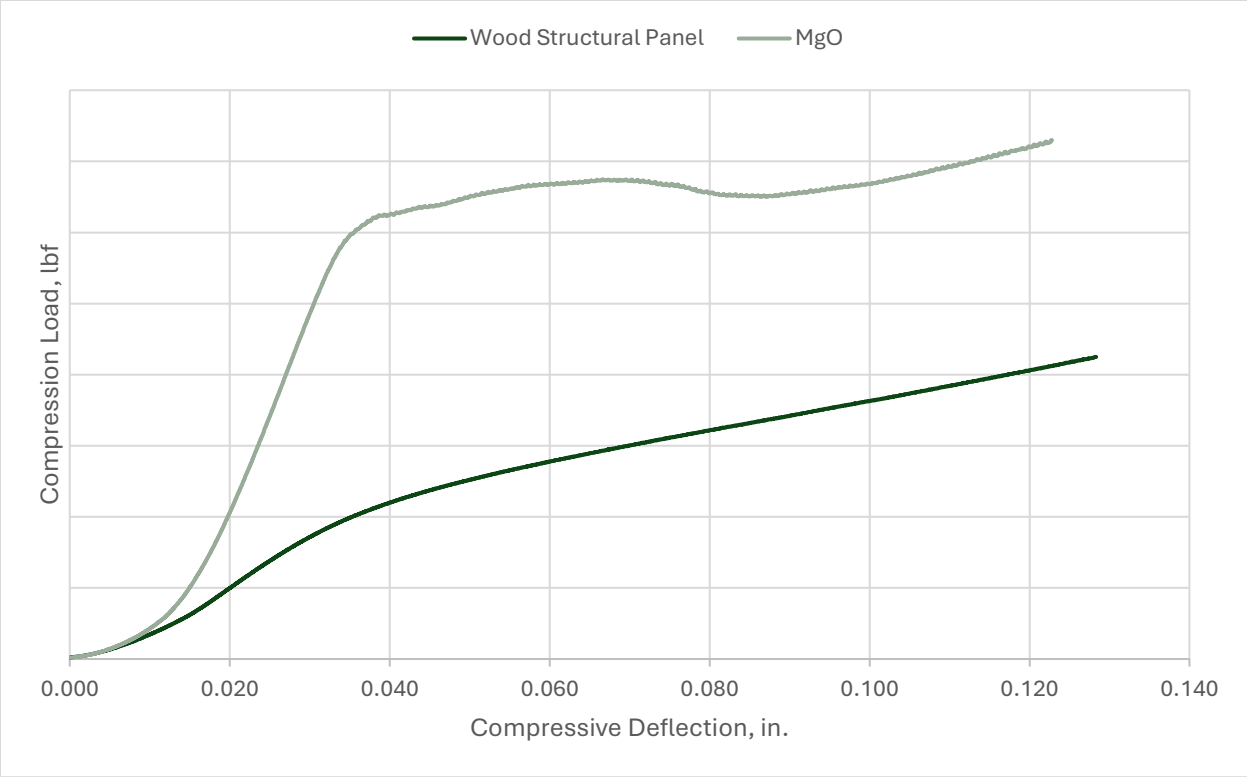


Figure 1 Compression Perp Load-Deflection Curve

Huber Engineered Woods, LLC. and NEXGEN Building Products, LLC. appreciate the opportunity to propose these revisions to AC386.

Sincerely,

Ben Richardson
Technology Manager, EXACOR®
Huber Engineered Woods

Eric J. Polzin, P.E.
Chief Construction Science Officer
NEXGEN Building Products

ICC EVALUATION SERVICE, LLC, RULES OF PROCEDURE FOR THE EVALUATION COMMITTEE

1.0 PURPOSE

The purpose of the Evaluation Committee is to review and approve acceptance criteria on which evaluation reports may be based.

2.0 MEMBERSHIP

2.1 The Evaluation Committee has a membership of not fewer than nine, with one of the members named by the ICC-ES president each year to serve as the chairperson–moderator.

2.2 All members of the committee shall be representatives of a body enforcing regulations related to the built environment.

2.3 Persons are appointed to the committee by the ICC-ES president, from among individuals who have formally applied for membership.

2.4 The ICC-ES Board of Managers, using simple majority vote, shall ratify the nominations of the president.

2.5 Committee membership is for one year, coinciding with the calendar year. Members may be renominated and reappointed.

2.6 In the event that a member is unable to attend a committee meeting or complete a term on the committee, the ICC-ES president may appoint a replacement to fill in at the meeting or for the remainder of the member's term. Any replacement appointed for only one meeting must have prior experience as a member of the Evaluation Committee. Appointments under this section (Section 2.6) are subject to ratification as noted in Section 2.4.

3.0 MEETINGS

3.1 The Evaluation Committee shall schedule meetings that are open to the public in discharging its duties under Section 1.0, subject to Section 3.0.

3.2 All scheduled meetings shall be publicly announced. There shall be three to six meetings per year (as necessary).

3.3 More than half of the Evaluation Committee members, counting the chairperson, shall constitute a quorum. A majority vote of members present is required on any action. To avoid any tie vote, the chairperson may choose to exercise or not exercise, as necessary, their right to vote.

3.4 In the absence of the chairperson–moderator, Evaluation Committee members present shall elect an alternate chairperson from the committee for that meeting. The alternate chairperson shall be counted as a voting committee member for purposes of maintaining a committee quorum and to cast a tie-breaking vote of the committee.

3.5 Minutes shall be kept and shall be the official record of each meeting.

3.6 An electronic record of meetings may be made by ICC-ES if deemed necessary; no other audio, video, electronic recordings of the meetings will be permitted. Visual aids (including, but not limited to, charts, slides, videos, or presentation software) viewed at meetings shall be permitted only if the presenter provides ICC-ES before the presentation with a copy of the visual aid in a medium which can be retained by ICC-ES with its record of the meeting and which can also be provided to interested parties requesting a copy.

3.7 Parties interested in the deliberations of the committee should refrain from communicating, whether in writing or verbally, with committee members regarding agenda items. All written communications and submissions regarding agenda items must be delivered to ICC-ES and shall be considered nonconfidential and available for discussion in open session of an Evaluation Committee meeting. Such materials will be posted on the ICC-ES web site (www.icc-es.org) prior to the meeting. Comments and submissions not meeting the following deadlines will not be considered at the meeting:

- Initial comments on agenda items shall be submitted at least 28 days before the scheduled meeting.
- A rebuttal comment period shall follow, whereby rebuttal comments to the initial comments may be submitted by the proponent at least 21 days before the scheduled meeting.
- Those planning on giving a visual presentation at the meeting must submit their presentation, in PowerPoint format only, at least 10 days before the scheduled meeting.

The committee reserves the right to refuse recognition of communications which do not comply with the provisions of this section.

4.0 CLOSED SESSIONS

Evaluation Committee meetings shall be open except that at the discretion of the chairperson, staff counsel may be necessary. Also, matters related to clients or potential clients covered by confidentiality requirements of ICC-ES Rules of Procedure for Evaluation Reports are discussed only during closed meetings.

5.0 ACCEPTANCE CRITERIA

5.1 Acceptance criteria are established by the committee to provide a basis for issuing ICC-ES evaluation reports on products and systems under codes referenced in Section 2.0 of the Rules of Procedure for Evaluation Reports. They also clarify conditions of acceptance for products and systems specifically regulated by the codes.

Acceptance criteria may involve a product, material, or method of construction. Consideration of any acceptance criteria must be in conjunction with a current and valid application for an ICC-ES evaluation report, an existing ICC-ES evaluation report, or as otherwise determined by the ICC-ES President.

EXCEPTIONS: The following acceptance criteria are controlled by the ICC-ES executive staff and are not subject to committee approval:

- The Acceptance Criteria for Quality Documentation (AC10)
- The Acceptance Criteria for Test Reports (AC85)
- The Acceptance Criteria for Inspections and Inspection Agencies (AC304)

5.2 Procedure:

5.2.1 Proposed acceptance criteria shall be developed by the ICC-ES staff and discussed in open session with the Evaluation Committee during a scheduled meeting, except as permitted in Section 4.0 of these rules.

5.2.2 Proposed acceptance criteria shall be available to interested parties at least 30 days before discussion at the committee meeting.

5.2.3 The committee shall be informed of all pertinent written communications received by ICC-ES.

5.2.4 Attendees at Evaluation Committee meetings shall have the opportunity to speak on acceptance criteria listed on the meeting agenda, to provide information to committee members. In the interest of fairness, each speaker requesting to testify on a proposed acceptance criteria or proposed changes to an existing acceptance criteria will be given the same amount of time, as follows:

a. A 10-minute time limit applies to speakers giving their first testimony on any item, which applies to both verbal testimony and/or visual presentations.

b. A 5-minute time limit applies to speakers returning to the microphone to offer additional testimony and/or to rebut testimony given by others.

c. A 2-minute time limit applies to speakers offering testimony on the staff recommendation to criteria.

Should a company have multiple speakers, the speaker time limits above apply the company, in that multiple speakers from the same company shall share the testimony time, i.e., multiple speakers from the same company shall not each get their own testimony times. Time limits do not include time needed to answer questions from the staff and/or committee members. The chairperson–moderator shall have limited authority to modify time limitations on testimony. The chairperson–moderator shall also have the authority to adjust time limits as necessary in order to get through the hearing agenda.

An automatic timing device shall keep time for testimony and shall provide the time remaining to the speaker testifying. Interruptions during testimony will not be tolerated. It is the responsibility of the chairperson–moderator to maintain decorum and order during all testimony.

5.3 Approval of any action on an acceptance criteria shall be as specified in Section 3.3 of these rules. Possible actions made by the Evaluation Committee include: Approval; Approval with Revisions; Disapproval; or Further Study. The Evaluation Committee must give the reason(s) for any Disapproval or Further Study actions with specific recommendations.

5.4 Actions of the Evaluation Committee may be appealed in accordance with the ICC-ES Rules of Procedure for Appeal of Acceptance Criteria or the ICC-ES Rules of Procedure for Appeals of Evaluation Committee Technical Decisions.

6.0 COMMITTEE BALLOTING FOR ACCEPTANCE CRITERIA

6.1 Acceptance criteria may be revised without a public hearing following a 30-day public comment period and a majority vote for approval by the Evaluation Committee (i.e., alternative criteria development process), when at the discretion of the ICC-ES executive staff, the subject is a revision that requires formal action by the Evaluation Committee.

6.2 Negative votes must be based upon one or more of the following, for the ballots to be considered valid and require resolution:

a. *Lack of clarity*: There is insufficient explanation of the scope of the acceptance criteria or insufficient description of the intended use of the product or system; or the acceptance criteria is so unclear as to be unacceptable. (The areas where greater clarity is required must be specifically identified.)

b. *Insufficiency*: The criteria is insufficient for proper evaluation of the product or system. (The provisions of the criteria that are in question must be specifically identified.)

c. *The subject of the acceptance criteria is not within the scope of the applicable codes*: A report issued by ICC-ES is intended to provide a basis for approval under the codes. If the subject of the acceptance criteria is not regulated by the codes, there is no basis for issuing a report, or a criteria. (Specifics must be provided concerning the inapplicability of the code.)

d. *The subject of the acceptance criteria needs to be discussed in public hearings*. The committee member requests additional input from other committee members, staff or industry.

6.3 An Evaluation Committee member, in voting on an acceptance criteria, may only cast the following ballots:

- Approved
- Approved with Comments
- Negative: Do Not Proceed

7.0 COMMITTEE COMMUNICATION

Direct communication between committee members, and between committee members and an applicant or concerned party, with regard to the processing of a particular acceptance criteria or evaluation report, shall take place only in a public hearing of the Evaluation Committee. Accordingly:

7.1 Committee members receiving an electronic ballot should respond only to the sender (ICC-ES staff). Committee members who wish to discuss a particular

matter with other committee members, before reaching a decision, should ballot accordingly and bring the matter to the attention of ICC-ES staff, so the issue can be placed on the agenda of a future committee meeting.

7.2 Committee members who are contacted by an applicant or concerned party on a particular matter that will be brought to the committee will refrain from private communication and will encourage the applicant or concerned party to forward their concerns through the ICC-ES staff in writing, and/or make their concerns known by addressing the committee at a public hearing, so that their concerns can receive the attention of all committee members.■

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ACCEPTANCE CRITERIA FOR FIBER-REINFORCED MAGNESIUM-OXIDE-BASED SHEETS

AC386

Proposed February 2025

Compliance Date - October 2025

(Editorially Revised October 2024)

Previously approved October 2023, July 2023, February 2023, February 2021, April 2019, October 2007

(Previously editorially revised August 2021, May 2021, February 2016)

PREFACE

Evaluation reports issued by ICC Evaluation Service, LLC (ICC-ES), are based upon performance features of the International family of codes, and may include other codes, as applicable.

For alternative materials, design and methods of construction and equipment, see Section 104.2.3 of the 2024 *International Building Code*® (IBC), Section R104.2.2 of the 2024 *International Residential Code*® (IRC), Section 104.11 of the 2021 IBC and earlier editions, and Section R104.11 of the 2021 IRC and earlier editions.

ICC-ES may consider alternate criteria for report approval, provided the report applicant submits data demonstrating that the alternate criteria are at least equivalent to the criteria set forth in this document, and otherwise demonstrate compliance with the performance features of the codes. ICC-ES retains the right to refuse to issue or renew any evaluation report, if the applicable product, material, or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or if malfunctioning is apt to cause injury or unreasonable damage.

Acceptance criteria are developed for use solely by ICC-ES for purposes of issuing ICC-ES evaluation reports

ACCEPTANCE CRITERIA FOR FIBER-REINFORCED MAGNESIUM-OXIDE-BASED SHEETS (AC386)

1.0 INTRODUCTION

1.1 Purpose: The purpose of this acceptance criteria is to establish requirements for fiber-reinforced magnesium-oxide-based interior substrate sheets to be the subject of an ICC Evaluation Service, LLC (ICC-ES), evaluation report under the 2024 *International Building Code*® (IBC) and the 2024 *International Residential Code*® (IRC). Bases of evaluation are 2024 IBC Section 104.2.3 and 2024 IRC Section R104.2.2. For the applicable sections of earlier editions of the IBC and IRC, see Table 3 of this criteria.

The reason for the development of this criteria is that the code does not provide guidance for evaluating fiber-reinforced magnesium-oxide-based substrate sheets that are used as sheathings in walls, roofs, floors, or as backer boards for adhered veneers.

1.2 Scope: This criteria is applicable to mechanically attached, fiber-reinforced, magnesium-oxide-based substrate sheets complying with the physical property requirements described in Section 3.1 of this criteria. End use application of the substrate sheets is evaluated by testing and conditions of acceptance in accordance with the applicable ICC-ES acceptance criteria outlined in Section 3.2. Evaluation for use in fire-resistance rated construction or use as a noncombustible material is outlined in Sections 3.3 through 3.5 of this criteria. The substrate sheets are suitable for decoration with paint, wallpaper, resilient flooring, ceramic tile, natural stone or dimensional stone veneers on floors and walls in interior dry areas. The substrate sheets are limited to use on interior surfaces as defined in IBC Section 202 and may not be used in wet areas as defined in IBC Section 2509. Under the IRC, the substrate sheets may not be used in showers.

Evaluation is limited to Type V construction unless the substrate sheets comply with Section 3.46 or Section 3.5 of this criteria.

1.3 Codes and Referenced Standards: For the applicable editions of the referenced standards, see Table 2 of this criteria.

1.3.1 2024, 2021, 2018, 2015, 2012, 2009 and 2006 *International Building Code*® (IBC), International Code Council.

1.3.2 2024, 2021, 2018, 2015, 2012, 2009 and 2006 *International Residential Code*® (IRC), International Code Council.

1.3.3 ASTM C473, Test Method for Physical Testing of Gypsum Panel Products, ASTM International.

1.3.4 ASTM C666 Test Method for Resistance of Concrete to Rapid Freezing and Thawing, ASTM International.

1.3.5 ASTM C1185 Test Methods for Sampling and Testing Non-asbestos Fiber-cement Flat Sheet, Roofing and Siding Shingles, and Clapboards, ASTM International.

1.3.6 ASTM C1186 Standard Specification for Flat Fiber-Cement Sheets.

1.3.7 ASTM C1396 Standard Specification for Gypsum Wallboard, ASTM International.

1.3.8 ASTM D143-23 Standard Test Methods for Small Clear Specimens of Timber, ASTM International.

1.3.9 ASTM D1037 Test Methods for Evaluating Properties of Wood-base Fiber and Particle Panel Materials, ASTM International.

1.3.10 ASTM D1761-20 Standard Test Methods for Mechanical Fasteners in Wood and Wood-Based Materials, ASTM International.

1.3.11 ASTM D2394 Methods for Simulated Service Testing of Wood and Wood-base Finish Flooring, ASTM International.

1.3.12 ASTM D2915-17(2022) Standard Practice for Sampling and Data-Analysis for Structural Wood and Wood-Based Products, ASTM International.

1.3.13 ASTM D5764-24 Standard Test Method for Evaluating Dowel-Bearing Strength of Wood and Wood-Based Products, ASTM International.

1.3.14 ASTM E84 Test Methods for Surface Burning Characteristics of Building Materials, ASTM International.

1.3.15 ASTM E119 Test Methods for Fire Tests of Building Construction and Materials, ASTM International.

1.3.16 ASTM E136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C, ASTM International.

1.3.17 ASTM E455 Standard Test Method for Static Load Testing of Framed Floor or Roof Diaphragm Constructions for Buildings, ASTM International.

1.3.18 ANSI A118.1 Standard Specifications for Dry-set Portland Cement Mortar, American National Standards Institute.

1.3.19 ANSI A118.4 Standard Specifications for Latex–Portland Cement Mortar, American National Standards Institute.

1.3.20 ICC-ES Acceptance Criteria for Nails (AC116).

1.3.21 ICC-ES Acceptance Criteria for Dowel-Type Threaded Fasteners Used in Wood (AC233).

1.3.22 ICC-ES Acceptance Criteria for Proprietary Sheathing Attached to Wood Light-Frame Wall Construction Use as Braced Wall Panels under the IRC (AC269.1).

1.3.23 ICC-ES Acceptance Criteria for Structural Cementitious Floor and Roof Sheathing Panels (AC318).

1.3.24 ICC-ES Acceptance Criteria for Horizontal Diaphragms Consisting of Structural Cementitious Sheathing Panels Attached to Cold-Formed Steel Framing (AC319).

1.3.25 ICC-ES Acceptance Criteria for Fiber-reinforced Cement Sheet Structural Floor Sheathing (AC367).

1.3.26 ICC-ES Acceptance Criteria for Reinforced Cementitious Sheets Used as Wall Sheathing and Floor Underlayment (AC376).

1.3.27 ICC-ES Acceptance Criteria for Reinforced Cementitious Interior Substrate Sheets Used in Wet and Dry Areas (AC378).

1.3.28 UL 263, Fire Tests of Building Construction and Materials, UL LLC.

1.3.29 UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, UL LLC.

1.3.30 ISO 21930-2017, Sustainability in Buildings and Civil Engineering Works – Core Rules for Environmental product Declarations of Construction Products and Services, International Organization of Standardization (ISO).

1.4 Definitions:

1.4.1 Fiber-reinforced Magnesium-oxide-based Sheets: Fiber-reinforced magnesium-oxide-based sheets are sheet products consisting of a proprietary composition of magnesium oxychloride cement or magnesium oxysulfate cement that is reinforced by a fibermat or fiber scrim made of organic or inorganic fibers. The sheets may contain proprietary additives and have factory-applied coatings. The sheets are manufactured in various lengths and widths, and in thicknesses from $^1/_4$ to 1 inch (6.3 to 25.4 mm).

1.4.2 Wet Areas: Shower and public toilet areas, as defined in IBC Section 2509.1.

1.4.3 Dry Areas: All areas not included in the definition under Section 1.4.2 of this criteria.

1.4.4 Fastening System: A fastening system is defined as a method to mechanically attach the sheathing or single floor grade sheets to framing.

1.4.5 Span Rating: The recommended maximum center-to-center spacing in inches (mm) of floor or roof framing used to support the sheets for the specified end use under normal use conditions.

1.4.6 Single Floor Grade: Sheets used as a combination subfloor and underlayment installed with edge treatment, blocking or covered with one of the materials described in Footnote c of Table 2304.8(3) of the IBC, or footnote j of IRC Table R503.2.1.1(1), as applicable.

1.4.7 Sheathing Grade: Sheets used as sheathing that require a separate underlayment installed on top of the sheets.

2.0 BASIC INFORMATION

2.1 General: The following information shall be submitted:

2.1.1 Product Description: Complete information concerning material specifications, thickness, size and the manufacturing process.

2.1.2 Installation Instructions: Installation details and limitations, fastening methods, joint treatments, and face treatments.

2.1.3 Packaging and Identification: Product identification shall be in accordance with the product identification provisions of the ICC-ES Rules of Procedure for Evaluation Reports and shall include the evaluation report number.

2.1.4 Field Preparation: A description of the methods of field-cutting, application and finishing.

2.2 Testing Laboratories: Testing laboratories shall comply with Section 2.0 of the ICC-ES Acceptance Criteria for Test Reports (AC85) and Section 4.2 of the ICC-ES Rules of Procedure for Evaluation Reports.

2.3 Test Reports: Test reports shall comply with AC85.

2.4 Product Sampling: Products for testing under this criteria shall be sampled in accordance with Sections 3.1, 3.3 and 3.4 of AC85.

2.5 Qualification Test Plan: A qualification test plan shall be submitted to and approved by ICC-ES staff prior to any testing being conducted.

3.0 TEST AND PERFORMANCE REQUIREMENTS

Reports of tests shall be submitted in accordance with the following requirements, which are also summarized in Table 1:

3.1 Physical Properties: The following physical properties are applicable for all applications of MgO sheets evaluated under this criteria, unless noted otherwise:

3.1.1 Flexural Strength: Testing in accordance with ASTM C1185, with conditions of acceptance of 580 psi (4000 kPa) minimum average flexural strength, both wet and dry.

3.1.2 Freeze/Thaw Cycling: When testing sheathing for non-roof applications in accordance with ASTM C666, Procedure B, the test samples shall show no disintegration following 25 cycles. A minimum of 5 specimens shall be tested.

3.1.3 Dimensions and Tolerances: Testing in accordance with ASTM C1185 with conditions of acceptance as noted in Section 7 of ASTM C1186.

3.1.4 Moisture Movement: When tested in accordance with ASTM C1185, linear variation with change in moisture content shall be stated as the percentage change in length based on a relative humidity change from 30 to 90 percent. Sampling for tests shall be in accordance with Section 4 of ASTM C1185.

3.1.5 Water Absorption: When testing sheathing for non-roof applications in accordance with Section 9 of ASTM C1185, the water absorption shall be reported as the percentage increase in weight of dry specimens following submersion for a period of 48 hours. Sampling for tests shall be in accordance with Section 4 of ASTM C1185.

3.1.6 Compression Indentation: When tested in accordance with ASTM D2394, samples shall show a value greater than 1250 psi (8620 kPa) at less than 0.05 inch (1.3 mm). A minimum of 5 specimens shall be tested.

3.1.7 Nail-head Pull Through: The substrate sheets shall have a minimum thickness of $^1/_4$-inch-thick (6 mm) and shall have a minimum saturated nail-head pull-through resistance of 90 lbf (400 N) when tested in accordance with ASTM D1037 utilizing a roofing nail with a 0.375-inch-diameter (10 mm) head and a shank diameter of 0.121 inch (3 mm). Substrate sheets having thicknesses greater than $^1/_4$ inch (6 mm), shall meet the nail-head pull-through resistance of this criteria [90 lbf (400 N)]. A minimum of 5 specimens shall be tested.

3.1.8 Falling Ball Impact: When tested in accordance with ASTM D1037, samples shall show no damage to top or bottom surfaces at a 12-inch (305 mm) drop. A minimum of 5 specimens shall be tested.

3.1.9 Shear Bond Strength:

3.1.9.1 Dry-set Portland Cement: The substrate sheets shall be tested in accordance with ANSI A 118.1, using test specimens consisting of the substrate sheet adhered to substrate sheet, and shall demonstrate a minimum shear bond strength at seven-day curing of 50 psi (345 kPa). A minimum of 5 specimens shall be tested.

3.1.9.2 Latex-Portland Cement Mortar: The substrate sheets shall be tested in accordance with ANSI A 118.4, using test specimens consisting of the substrate sheet adhered to substrate sheet, and shall demonstrate a minimum shear bond strength at seven-day curing of 50 psi (345 kPa). A minimum of 5 specimens shall be tested.

3.1.10 Humidified Deflection: Testing in accordance with ASTM C473. Conditions of acceptance are as described in Section 5.1.2 of ASTM C1396. For use as ceiling boards, the sheets shall have a maximum humidified deflection of $^{5}/_{16}$ inch (7.9 mm), when used as ceiling finish (textured or painted), or 0.0639 inch (1.62 mm), when used as a base for tile.

3.1.11 Flame-Spread Characteristics: The substrate sheets shall be tested in accordance with ASTM E84 or UL 723 and shall be Class A interior finish materials.

3.1.12 Corrosion Effects: The sheets shall be evaluated for corrosion effects in accordance with Appendix A of this criteria. The appropriate end use exposure test conditions shall be selected with consideration of the end use applications evaluated in accordance with Section 3.2 of this criteria (i.e., if the panels are evaluated for use as roof sheathing in accordance with Section 3.2.2.2, corrosion effects must be evaluated per the requirements of End Use Severity Rating 2 and/or 3 as outlined in Table A2, as applicable).

3.2 End Use Applications: At least one of the following optional end use applications shall be included in the evaluation:

3.2.1 Use as Structural Floor Sheathing Attached to Wood Framing (Optional): For use as structural floor sheathing attached to wood framing, testing and conditions of acceptance shall be in accordance with Sections 3.2 through 3.4 and 3.6 of AC367.

3.2.2 Use as Structural Floor and Roof Sheathing Attached to Cold-formed Steel Framing (Optional):

3.2.2.1 Floor Sheathing: For use as structural floor sheathing, testing and conditions of acceptance in accordance with AC318 Sections A5.2.1 through A5.2.3. Allowable uniform loads shall be determined in accordance with AC318 Sections 3.3.1 for floor sheathing.

3.2.2.2 Roof Sheathing: For use as structural roof sheathing, testing and conditions of acceptance in accordance with AC318 Sections A5.2.1 through A5.2.4, A5.3.2, A5.3.3, A5.4, A5.8, A5.10 and A5.11. Allowable uniform loads shall be determined in accordance with AC318 Sections 3.3.2 for roof sheathing.

3.2.2.3 Diaphragms: When used as structural sheathing in horizontal diaphragms constructed with cold-formed steel framing, testing and analysis shall be in accordance with Sections 3.2, 3.4 and 3.5 of AC319.

When used as structural sheathing in horizontal diaphragms constructed with wood framing, testing shall be in accordance with Section 3.4 of AC319 where the test method is based on ASTM E455; and analysis shall be in accordance with Section 3.5 of AC319 with the exception that the allowable strength shall be determined using a safety factor of 3.

3.2.3 Use as Wall and Ceiling Sheathing or Floor Underlayment (Optional): For use as wall and ceiling sheathing or floor underlayment, testing and conditions of acceptance shall be in accordance with Sections 3.4 and 3.6 through 3.8 of AC376.

3.2.4 Use as a Substrate in Interior Areas (Optional): For use as a substrate in interior areas, testing and conditions of acceptance shall be in accordance with Sections 3.2, 3.3, 3.5 and 3.6 of AC378.

3.2.5 Use as Braced Wall Panels (Optional): If the evaluation includes the uses outlined in Section 3.2.3 or 3.2.4 of this criteria, the sheets may also be evaluated for use as braced wall panels in accordance with AC269.1.

3.3 Fire-resistance-rated Construction (Optional): For use in fire-resistance-rated construction, tests shall be conducted in accordance with ASTM E119 or UL 263.

3.4 Noncombustible Construction (Optional): For use as a noncombustible material in Types I, II, III and IV construction under the IBC, the material must be shown to be noncombustible in accordance with ASTM E136.

3.5 Use as an Alternative to Fire-Retardant Treated Wood Structural Panels In Non-Weather Exposed Areas (Optional): For use as an alternative to fire-retardant treated wood structural panels in non-weather exposed applications, the material shall be tested in accordance with the modified ASTM E84 or UL723 procedure outlined in IBC Section 2303.2 and shall meet the conditions of acceptance outlined in IBC Section 2303.2; the material shall also demonstrate compliance with the associated end use(s) outlined in Section 3.2, as applicable. When evaluated in accordance with this section, the evaluation report shall include the limitation outlined in Section 5.7.

Note: If products are shown to comply with Section 3.4, compliance with this section is not needed.

3.5.1 Exterior wall sheathing in buildings of Type I and II construction as described in IBC Section 603.1, Item 1 Subsection 1.2.

3.5.2 Wall sheathing for exterior walls for Type III construction with a two-hour rating or less (IBC Section 602.3 and Tables 601 and 705.5).

3.6 Fastener Withdrawal and Lateral Capacity for Direct Attachment of Cladding [Max. Cladding Weight ≤ 10 psf (48.8 kg/m^2); maximum thickness $^{5}/_{8}$- inch (15.9 mm)] (Optional): Evaluation for use as wall sheathing in accordance with Section 3.2.3 of this criteria must be conducted prior to utilizing this section. When direct attachment of lightweight cladding without intermediate materials between the cladding and the sheathing (such as continuous exterior insulation) is to be evaluated, withdrawal and lateral capacity testing of fasteners (commodity nails, commodity screws, proprietary nails, or proprietary screws) shall be performed in accordance with Sections 3.6.5, and 3.6.6. Samples, including sample size, fabrication, and conditioning shall be in accordance with Sections 3.6.1 through 3.6.4. The tested reference withdrawal capacity shall be determined in accordance with Section 3.6.7.

3.6.1 Magnesium-Oxide Sheet Requirements: Prior to testing, sheets should be conditioned to equilibrium per ASTM C1185 Section 5.2.3.1.

3.6.2 Sample Size: A minimum number of specimens shall be tested for each exposure condition to achieve a precision of 5 percent at a 75 percent confidence interval (determined in accordance with ASTM D2915, Equation 1), with a minimum sample size of 15 specimens and a maximum sample size of 40 specimens. There is an implied maximum limit on the Coefficient of Variation (COV) of 27 percent. If 40 specimens are tested with a COV above

27 percent, the product has failed the test. Alternatively, a minimum of 10 specimens may be tested, provided a precision of 5 percent at a 95 percent confidence interval is achieved. In this case, there is no limit on the maximum sample size.

3.6.3 Fastener Installation: The use of pilot holes and/or predrilled holes for installation of the fasteners shall be in accordance with the manufacturer's instructions. When splitting is observed during fastener installation or testing, the installation method shall be adjusted as needed to preclude splitting, and installation or testing shall be repeated with no splitting observed. The installation method (use of pilot holes / pre-drilling, if applicable) shall be included in the evaluation report.

For each selected fastener, the fastener must be embedded through the full thickness of the Magnesium Oxide sheet plus $^1/_4$-inch (6.4 mm), at a minimum, unless otherwise noted in the manufacturer's instructions.

3.6.4 Sample Conditioning: For each selected fastener, a full set of testing shall be conducted on specimens in the equilibrium condition and in the wet / re-dry condition. The wet / re-dry condition shall be achieved by continuously wetting one side of the panel (with the fastener installed) for three days followed by drying. The moisture content at the time of testing of the wet/redry condition shall be within +/- 3% of the equilibrium conditioned samples.

3.6.5 Withdrawal Load Testing: Fastener withdrawal strength shall be tested in general accordance with ASTM D1761 and this section.

3.6.6 Lateral Capacity Testing: Lateral resistance test shall be conducted in accordance with ASTM D1761 procedures in both the machine direction and the cross-machine direction of the MgO specimens. The lateral resistance tests shall be conducted utilizing the Magnesium Oxide sheet as the main member, and a 22-gauge steel [minimum thickness 0.0299-inch (0.759 mm)] side member with a minimum tensile yield strength (fy) of 33 ksi (227.5 Mpa). Testing shall be conducted with a 1-inch (25.4 mm) edge distance on both the main member and side member.

Note: The intent of the use of a steel side member is to induce bearing failure in the MgO Sheet. In the event that the steel side member fails prior to bearing failure in the MgO sheet, an alternative side member thickness may be used upon approval from ICC-ES.

3.6.7 Determination of Reference Capacities: Reference withdrawal and lateral capacities shall be determined in accordance with Sections 3.6.7.1 and 3.6.7.2. No adjustment factors for load duration may be applied to the reference withdrawal and lateral capacities. The reference withdrawal and lateral values for each fastener evaluated must be included in the evaluation report.

3.6.7.1 Reference Withdrawal Capacity: The condition (equilibrium or wet / re-dry) that produces the lowest average ultimate withdrawal capacities in accordance with Section 3.6.5 shall be used as the "average maximum test value" purposes of determining the reference withdrawal capacity in accordance with this section. The reference withdrawal capacity shall be determined by dividing the average maximum test value shall by a reference factor of 5.0.

3.6.7.2 Reference Lateral Capacity: The condition (equilibrium or wet / re-dry) and direction (machine direction vs cross-machine direction) that produces the lowest average ultimate lateral capacities in accordance with Section 3.6.6 shall be used as the "average maximum test value" for the purposes of determining the reference lateral capacity in accordance with this section. The reference lateral capacity shall be determined by dividing the average maximum test value shall by a reference factor of 5.0; the maximum allowable reference capacity shall not exceed 20lbf.

3.7 Reference Lateral Design Values (Optional): When recognition is sought for using the yield mode equations in the NDS with magnesium-oxide sheets, dowel bearing strength shall be determined in accordance with Sections 3.7.1 and 3.7.2, and the reference lateral design value shall be calculated in accordance with the NDS. Dowel diameters used for calculation and testing shall be in accordance with Section 12.3.7 of the NDS. The calculated reference lateral design value shall be assessed by confirmatory connection testing and evaluation in accordance with Sections 3.3.1.1 and 4.1 of AC116 for nails and Sections 3.4 and 4.2.4 of AC233 for screws. The dowel bearing strength for each combination of fastener and panel thickness evaluated shall be included in the test report.

Alternatively, the ASD reference lateral value may be derived from connection testing in accordance with Sections 3.7.1 and 3.7.3.

3.7.1 Sample Conditioning: For each selected fastener, a full set of testing shall be conducted on specimens in the equilibrium condition and in the wet / re-dry condition. The wet / re-dry condition shall be achieved by continuously wetting one side of the panel (with the fastener installed) for three days followed by drying. The moisture content at the time of testing of the wet/redry condition shall be within +/- 3% of the equilibrium conditioned samples.

3.7.2 Dowel Bearing Strength: Dowel bearing strength shall be tested in general accordance with ASTM D5764 and this section. Prior to testing, specimens should be conditioned in accordance with Section 3.7.1. A minimum of 15 specimens are required for each fastener diameter to be evaluated in both the machine direction and the cross-machine direction of the specimens. Dowel bearing strength shall be derived from Section 11 of ASTM D5764.

The evaluation report shall include the average dowel bearing strength for each evaluated combination of fastener, panel thickness, orientation and conditioning.

3.7.3 Testing Only: In lieu of dowel bearing testing, testing and analysis for the ASD reference lateral design value shall be in accordance with Sections 3.3.1.3 and 4.1 of AC116 for nails or Sections 3.4.2 and 4.2.4 of AC233 for screws.

3.8 Allowable Bearing Stress of MgO Sheet (Optional): The bearing stress of fiber-reinforced magnesium oxide-based sheets evaluated for use as structural floor sheathing and/or underlayment shall be based on tests conducted in accordance with this section. The allowable bearing stress results shall be reported in the Evaluation Report.

3.8.1 Conditioning Requirements: Prior to testing, sheets should be conditioned to equilibrium per ASTM C1185 Section 5.2.3.1. For each selected fastener, a full set of testing shall be conducted on specimens in the equilibrium condition and in the wet / re-dry condition. The

wet / re-dry condition shall be achieved by continuously wetting one side of the panel (with the fastener installed) for three days followed by drying. The moisture content at the time of testing of the wet/redry condition shall be within +/- 3% of the equilibrium conditioned samples.

3.8.2 Sample Size: A minimum number of specimens shall be tested for each exposure condition to achieve a precision of 5 percent at a 75 percent confidence interval (determined in accordance with ASTM D2915, Equation 1), with a minimum sample size of 15 specimens and a maximum sample size of 40 specimens. There is an implied maximum limit on the Coefficient of Variation (COV) of 27 percent. If 40 specimens are tested with a COV above 27 percent, the product has failed the test. Alternatively, a minimum of 10 specimens may be tested, provided a precision of 5 percent at a 95 percent confidence interval is achieved. In this case, there is no limit on the maximum sample size.

3.8.3 Test Method: Testing shall be conducted in accordance with Section 12 of ASTM D143, modified as follows: the tests shall be made on 2 in. wide by 6 in. long specimens for each thickness of magnesium oxide sheet. The specimens shall be centered in the test fixture and placed such that the load is applied perpendicular to the face of the specimen. The allowable total bearing stress ($F_{c\perp a}$) shall be derived from the average bearing stress measured at the proportional limit divided by a standard adjustment factor of 1.67.

Bearing stress at the yield for each specimen shall be calculated using the following equation:

$$F_{c\perp y}=\frac{P_{pl}}{A}$$

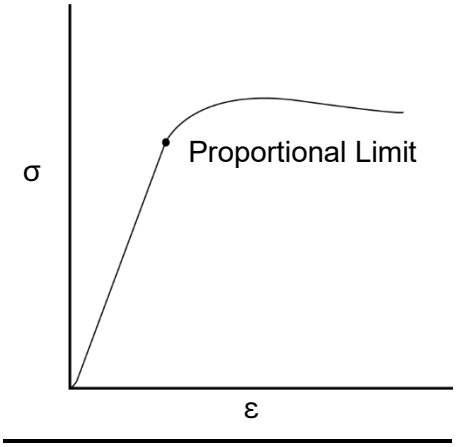
Where:

P_{pl} = load at proportional limit[1] (lbf)

$F_{c\perp y}$ = bearing stress at proportional limit (psi)[1]

A = bearing area under metal loading block (in.^{2})

[1] Proportional Limit is defined as a point on the stress-strain curve where the material transitions from a linear relationship to a non-linear relationship (see figure below).



4.0 QUALITY CONTROL

4.1 The products shall be manufactured under an approved quality control program with inspections by ICC-ES or by a properly accredited inspection agency that has a contractual relationship with ICC-ES.

4.2 Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted.

4.3 A qualifying inspection shall be conducted at each manufacturing facility when required by the ICC-ES Acceptance Criteria for Inspections and Inspection Agencies (AC304).

5.0 EVALUATION REPORT REQUIREMENTS

5.1 The evaluation report shall include a statement that support framing shall be designed for a maximum allowable assembly deflection of L/360 under seismic or wind loads for exterior or interior walls; or live loads for ceilings supported by floor framing; or live, seismic, or wind loads for ceilings supported by roof framing.

5.2 When used as a structural floor sheathing attached to wood framing, the evaluation report shall include information required in Section 6.0 of AC367.

5.3 When used as a structural floor or roof sheathing attached to cold-formed steel framing, the evaluation report shall include information required in Section 5.0 of AC318.

5.4 When used as a structural sheathing in horizontal diaphragms constructed with cold-formed steel framing, the evaluation report shall include information required in Section 4.0 of AC319.

5.5 When used as roof sheathing, an approved roof covering in accordance with the IBC or IRC, as applicable, is required.

5.6 When used as a substrate in interior dry areas, the evaluation report shall include information required in Section 6.0 of AC378.

5.7 If compliance with Section 3.5 is shown, the evaluation report shall include a statement similar to the following: MgO sheets may be used in non-weather exposed locations where fire-retardant treated wood structural panels are allowed in the applicable codes for the same end uses noted in the evaluation report.

5.8 The evaluation report shall include a condition of use that the substrate sheets are limited to use on interior surfaces as defined in IBC Section 202.

5.9 The evaluation report shall include a list of the metals and associated end uses evaluated for corrosion effects in accordance with Appendix A of this criteria. If the evaluation does not include wet areas, the evaluation report shall include a condition of use that the MgO sheets must not be used in wet areas as defined in IBC Section 2509; under the IRC, the substrate sheets must not be used in showers.

5.10 If compliance with Section 3.6 is shown, the evaluation report shall include the following statements:

5.10.1 Direct attachment of cladding to the Magnesium Oxide sheet is limited to claddings with a maximum weight 10 psf (48.8 kg/m^2) and maximum thickness of $^5/_8$-inch (15.9 mm).

5.10.2 The cladding must be attached directly to the sheathing; other than thin membranes, such as water-resistive barriers, no intermediate materials between the cladding and sheathing such as continuous insulation are permitted.

5.10.3 No adjustment factors for load duration may be applied to the reference withdrawal and lateral values.

5.10.4 Utilization of the allowable fastener withdrawal and lateral capacities for design of cladding attachment, including consideration of resistance to wind and gravity loads, must be performed by a registered design professional, and is outside of the scope of this report.

5.11 If compliance with Section 3.8 is shown, the evaluation report shall include the following statement: the allowable bearing stress of the underlying construction must not be exceeded.

6.0 ENVIRONMENTAL PRODUCT DECLARATION (Optional)

Environmental impacts shall be assessed via an Environmental Product Declaration (EPD) based on a Life Cycle Assessment (LCA). The LCA and EPD shall be conducted in accordance with ISO 21930 and the appropriate Product Category Rule(s) for the product type.■

TABLE 1—TESTING FOR PHYSICAL PROPERTIES AND END USES

PHYSICAL PROPERTY REQUIREMENTS FOR ANY USE (AC386 Section 3.1)[1,2]		**SUMMARY OF TESTING FOR EACH END USE (Minimum of One End Use Must be Selected)**					
		Structural Floor Sheathing – Attached to Wood Framing (AC386 Section 3.2.1)	**Structural Floor Sheathing – Attached to Cold-formed Steel Framing (AC386 Sections 3.2.2.1 and 3.2.2.3)**	**Structural Roof Sheathing - Attached to Cold-formed Steel Framing (AC386 Sections 3.2.2.2 and 3.2.2.3)**		**Use as Wall and Ceiling Sheathing or Floor Underlayment (AC 386 Section 3.2.3)**	**Use as a Substrate in Interior Areas (AC386 Section 3.2.4)**
AC386 Section 3.1.1 – Flexural Strength	AC386 Section 3.1.7 – Nail-Head Pull Through	AC367 Section 3.2 – Concentrated Static and Impact Load Tests	AC318 Section A5.2.1 – Concentrated Loads	AC318 Section A5.2.1 – Concentrated Loads	AC318 Section A5.4 – Panel Freeze/Thaw Resistance	AC376 Section 3.4 – Types I-IV Construction (Optional)	AC378 Section 3.2 – Resistance to Transverse Loads
AC386 Section 3.1.2 – Freeze-Thaw Cycling	AC386 Section 3.1.8 – Falling Ball Impact	AC367 Section 3.3 – Transverse Uniform Load Tests	AC318 Section A5.2.2 - Uniform Loads	AC318 Section A5.2.2 - Uniform Loads	AC318 Section A5.8 – Long Term Durability (Warm Water)	AC376 Section 3.6 – Racking Shear Resistance per AC269.2 (Optional)	AC378 Section 3.3 – Racking Shear Resistance per AC269.2 (Optional)
AC386 Section 3.1.3 – Dimensions and Tolerances	AC386 Section 3.1.9 – Shear Bond Strength	AC367 Section 3.4 – Fastener Holding	AC318 Section A5.2.3 – Fastener Holding	AC318 Section A5.2.3 – Fastener Holding	AC318 Section A5.10 – Density	AC376 Section 3.7 – Exterior Wall Sheathing Resistance to Transverse Loads	AC378 Section 3.6 – Ceiling Applications (Optional)
AC386 Section 3.1.4 – Moisture Movement	AC386 Section 3.1.10 - Humidified Deflection	AC367 Section 3.6 – Diaphragm (Optional)	AC318 Section 3.3.1 – Allowable Uniform Load for Floor Sheathing	AC318 Section A5.2.4 – Flexural Strength	AC318 Section A5.11 – Heat/Rain – Roof Sheathing	AC376 Section 3.8 – Ceiling Applications (Optional)	
AC386 Section 3.1.5 – Water Absorption	AC386 Section 3.1.11 – Flame Spread Characteristics	AC 386 Section 3.7 – Reference Lateral Design Values (Optional)	AC319 3.2, 3.4, and 3.5 Diaphragms (Optional)	AC318 Section A5.3.2 – Thickness Swell	AC318 Section 3.3.2 – Allowable Uniform Load for Roof Sheathing	AC386 Section 3.2.5 – Use as Braced Wall Panel per AC269.1 (Optional)	
AC386 Section 3.1.6 – Compression Indentation	AC386 Section 3.1.12 – Corrosion Effects	AC 386 Section 3.8 – Allowable Bearing Stress (Optional)	AC 386 Section 3.7 – Reference Lateral Design Values (Optional)	AC318 Section A5.3.3 – Water Absorption	AC319 3.2, 3.4, and 3.5 Diaphragms (optional)	AC386 Section 3.6 – Fastener Capacities for Direct Attachment of Lightweight Cladding (Optional)	
			AC 386 Section 3.8 – Allowable Bearing Stress (Optional)			AC 386 Section 3.7 – Reference Lateral Design Values (Optional)	
						AC 386 Section 3.8 – Allowable Bearing Stress (Optional)	

[1] Freeze-thaw cycling in accordance with Section 3.1.2 of AC386 is not required for sheets evaluated for use as roof sheathing. Panel Freeze-Thaw Resistance testing for sheets evaluated for use as roof sheathing shall be in accordance with Section A5.4 of AC318.

[2] Water absorption testing in accordance with Section 3.1.5 of AC386 is not required for sheets evaluated for use as roof sheathing. Water absorption testing for sheets evaluated for use as roof sheathing shall be in accordance with Section A5.3.3 of AC318.

TABLE 2 – REFERENCED STANDARDS

STANDARD	DATE OF STANDARD						
	2024 IBC, IRC	2021 IBC, IRC	2018 IBC, IRC	2015 IBC, IRC	2012 IBC, IRC	2009 IBC, IRC	2006 IBC, IRC
ASTM C473	19	17	15	12	07	06a	03
ASTM C666[1]	97						
ASTM C1185[1]	08(2012)					08	03
ASTM C1186	08(2016)		08(2012)		08	07	02
ASTM C1396	17		14a	13	06a		02
ASTM D143[1]	23						
ASTM D1037[1]	06a						99
ASTM D1761[1]	20						
ASTM D2915[1]	17(2022)						
ASTM D2394[1]	99						83
ASTM D5764	24						
ASTM E119	20	18b	16	12a	08a	07	00
ASTM E136	22	19	16	12	00	04	99
ASTM E84	21a	18b	16	13a	09	07	04
ASTM E455	19						
ANSI A118.1	19	18	16	99			
ANSI A118.4	19	18	16	99			
UL 263	11[2]	11[3]	11[4]	11	03[5]	03	--
UL 723	18		08[6]	08[7]	08	--	--

[1]Not referenced in the IBC or IRC
[2]UL 263-2011 with Revisions through August 2021
[3]UL 263-2011 with Revisions through March 2018
[4]UL 263-2011 with Revisions through June 2015
[5]UL 263-2003 with Revisions through October 2007
[6]UL 723-2008 with Revisions through August 2013
[7]UL 723-2008 with Revisions through September 2010

TABLE 3 – REFERENCED SECTIONS OF THE IBC and IRC

2024 IBC	2021 IBC	2018 IBC	2015 IBC	2012 IBC	2009 IBC	2006 IBC
104.2.3	104.11					
Section 202			Section 2502			
Table 601						
Table 705.5		Table 602				
Section 602.3						
Section 2509						
Section 2509.1						
Section 2302						
Footnote c of Table 2304.8(3)			Footnote d of Table 2304.8(3)	Footnote d of Table 2304.7(3)		
2024 IRC	**2021 IRC**	**2018 IRC**	**2015 IRC**	**2012 IRC**	**2009 IRC**	**2006 IRC**
R104.2.2	R104.11					
Footnote j of IRC Table R503.2.1.1(1)						

APPENDIX A – EVALUATION OF CORROSION EFFECTS OF MAGNESIUM-OXIDE-BASED SHEETS

A1.0 INTRODUCTION

A1.1 Purpose: The purpose of this appendix is to provide requirements for evaluating the corrosion effects of magnesium-oxide based sheets (MgO sheets) in contact with common construction metals.

This appendix is needed since the code does not provide applicable test methods and performance requirements for determining corrosion effects of proprietary MgO sheets.

A1.2 Scope: This appendix is used to evaluate corrosion effects of MgO sheets via comparison to the corrosion effects of preservative treated plywood. The criteria is intended to address MgO sheet compatibility with common construction metals, including fasteners used for attachment of the MgO sheets and metals in contact with the surfaces of the MgO sheets. Test results have comparative value and are not correlated to exposure time in a natural environment.

A2.0 REFERENCED STANDARDS SPECIFICALLY APPLICABLE TO THIS APPENDIX: For the applicable editions of the referenced standards, see Table A3 of this criteria.

A2.1 ASTM A123, Standard Specification for Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products, ASTM International.

A2.2 ASTM A653, Specification for Steel Sheet, Zinc-coated Galvanized or Zinc-iron Alloy-coated Galvannealed by the Hot-Dip Process, ASTM International.

A2.3 ASTM A792, Specification for Steel Sheet, 55% Aluminum-zinc Alloy-coated by the Hot-dip Process, ASTM International.

A2.4 ASTM A875, Standard Specification for Steel Sheet, Zinc-5%, Aluminum Alloy-coated by the Hot-dip Process, ASTM International

A2.5 ASTM B117, Standard Practice for Operating Salt Spray (Fog) Apparatus, ASTM International.

A2.6 ASTM B370, Standard Specification for Copper Sheet and Strip for Building Construction, ASTM International.

A2.7 ASTM C1185, Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards.

A2.8 ASTM D4442, Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials, ASTM International.

A2.9 ASTM D4444, Standard Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters, ASTM International.

A2.10 ASTM D610, Standard Test method for Evaluating Degree of Rusting on painted Steel Surfaces, ASTM International.

A2.11 AWPA E12©, Standard Method of Determining Corrosion of Metals in contact with Treated Wood, American Wood Protection Association.

A2.12 AWPA P23©, Standard for Chromated Copper Arsenate Type C (CCA-C), American Wood Protection Association.

A2.13 AWPA U1©, Use Category System: User Specification for Treated Wood, American Wood Protection Association.

A2.14 DOC PS1, Structural Plywood, U.S. Department of Commerce

A2.15 ICC-ES Acceptance Criteria for Fiber-Reinforced Magnesium-Oxide-Based Sheets with a Factory-Bonded Water-Resistive Overlay Membrane (AC530).

A3.0 DEFINITIONS SPECIFICALLY APPLICABLE TO THIS APPENDIX:

A3.1 Coastal Region: Areas within 3,000 feet (915 m) of the shoreline of a body of saltwater.

A3.2 Test Assemblies:

A3.2.1 Benchmark Test Assembly: The combination of plywood treated with the benchmark chemical specified in Section A5.0 and hot-dip galvanized steel coupons (ASTM A123, average 1 oz/ft^2 per side).

A3.2.2 Alternative Test Assembly: The combination of MgO sheets and metal coupons of the type being evaluated.

A3.2.2.1 Uncoated MgO Sheets: For MgO sheets that do not have a coating or surface treatment on either side, one set of samples for each combination of exposure condition described in Section A6.5, MgO sheet, and coupon shall be tested.

A3.2.2.2 Coated MgO Sheets: For the purposes of this section, coated MgO sheets are those which have a coating or surface treatment, other than those intended for weather resistance as addressed in AC530.

A3.2.2.2.1 Sheets Coated on One Side: For sheets that are coated on one side, two sets of samples for each combination of exposure condition described in Section A6.5, MgO sheet, and coupon shall be tested. Both the coated and uncoated side shall be tested in contact with the metal coupons unless it can be established that one side (coated or uncoated) is a worst case scenario. If it can be established that one side is a worst case scenario, then this side can be used for validation of both sides.

A3.2.2.2.2 Sheets Coated on Both Sides: For sheets that are coated on both sides, one set of samples for each combination of exposure condition described in Section A6.5, MgO sheet, and coupon shall be tested.

A4.0 BASIC INFORMATION

A4.1 See Section 2.0, as applicable.

A4.2 Product Sampling: MgO sheets shall be sampled in accordance with Section 3.1 of AC85. Wood test members and metal coupons shall be sampled in accordance with Section 3.2 of AC85 and Section A5.0.

A5.0 TEST MATERIAL REQUIREMENTS

1. A minimum of five plywood sheets treated with the benchmark treatment chemical, shall be sampled and prepared following AWPA E12. The sheets shall be sized to accommodate coupons to be tested. The thickness of the treated plywood shall be less than or equal to the MgO sheets being evaluated. The plywood sheets shall comply with DOC PS1 and shall be identified in accordance with IBC Sections 2303.1.5 and 2303.1.9.1.
2. A minimum of five proprietary MgO based sheets sampled in accordance with Section A4.2 shall be prepared following AWPA E12 for each type of coupon to be evaluated. The sheets shall be sized to accommodate coupons to be tested. The MgO sheets used in testing shall be the maximum thickness to be included in the evaluation report for each formulation and end use as applicable.
3. The benchmark treatment chemical shall be chromated copper arsenate (CCA), Type C, oxide formulation complying with AWPA P23. The minimum retention rate shall be 0.4 pcf (6.4 kg/m^3). NOTE: Plywood treated with preservatives known to have lesser corrosion effects may be used in lieu of CCA because the comparison would be more conservative.
4. Treatment chemical retention and penetration shall be verified by using AWPA test methods and representative specimens of treated wood cut from the wood test members.
5. Any type of metal may be evaluated if a standard coupon can be obtained which is representative of the metal composition and surface treatment, as applicable. Suggested metals to be tested are galvanized steel, stainless steel, aluminum (2024-T3 or 5154-0 alloys), copper (ASTM B370) and any other metals that are representative of fasteners, coatings and metals to be specified by the report applicant. For evaluation of corrosion effects on galvanized cold-formed steel, guidance is given in the table A1. Actual coating weights of materials tested shall be verified to be within %10 of the minimum coating weight specified in the applicable standard. Testing with the minimum coating weight designated in Table A1 will also qualify use of heavier coating weights. Coupons shall be 1 inch by 2 inches (25.4 mm x 50.8 mm) in accordance with AWPA E12 and shall have a minimum thickness of 16 gauge [54 mils, 0.0538 inch (1.37 mm)] and a maximum thickness of 14 gauge [75 mils, 0.0747 inch (1.90 mm)].

TABLE A1—MINIMUM COATING WEIGHTS FOR COMMON GALVANIZED STEEL MATERIALS

Coating Type:	Applicable Standard	Minimum Coating Weight Designation for Testing, Imperial (SI)	Coating Weight Designations Qualified by Extension, Imperial (SI)
Zinc	ASTM A653	G40 (Z120)	G60 (Z180), G90 (Z275)
Zinc Iron	ASTM A653	A60 (ZF180)	
55% Al-Zinc	ASTM A792	AZ50 (AZM150)	
Zinc-5%	ASTM A875	GF30 (ZGF90)	GF45 (ZGF135)

6. Exposure tests shall include both benchmark and alternative assemblies.

A6.0 TEST METHODS AND REQUIREMENTS

A6.1 Testing Scope: Testing shall be performed for the most severe application for which evaluation is being sought. Tests for a defined application are applicable to the same metal / MgO Sheet combination at lower application levels. Table A1 shall be used to establish the exposure test requirements for each application level.

A6.2 Test Method: Testing shall include exposure of metal coupons to treated wood in accordance with the general size and assembly methods of AWPA E12. The initial moisture condition of the material shall be in accordance with the following:

A6.2.1 Benchmark Plywood: The moisture content of the test members shall be recorded when the test assemblies are placed in the chamber and when they are removed from the chamber. The beginning and final moisture contents of the test members shall be determined by using calibrated moisture meters in accordance with ASTM D4444 or by oven-drying methods in accordance with ASTM D4442. For chemical treatments carried in water, the initial moisture content of the test member shall not be less than 15 percent (oven-dry basis); and for treatments applied dry, the test member shall be conditioned to equilibrium moisture content at not less than 90ºF (32ºC) and 90 percent relative humidity.

A6.2.2 Proprietary MgO Sheets: Prior to testing, sheets should be conditioned to equilibrium per ASTM C1185 5.2.3.1. For Exposure Condition 1 only (Section A6.5.1) the test member shall be initially conditioned to equilibrium moisture content at not less than 90ºF (32ºC) and 90 percent relative humidity. Equilibrium moisture content should be verified by recording less than 0.2% wt. change in a 24-hour period. No sweating or leaching should be observed during this equilibration.

A6.3 Number of Coupons: A minimum of ten (10) coupons per metal type given in Section A5.0 shall be exposed to the proprietary MgO sheet with an equal number of hot-dip galvanized coupons exposed to the benchmark wood treatment.

A6.4 Coupon Measurements: Each coupon shall be weighed to a precision of 0.5 percent, and the thickness measured at a precision of 1 percent.

A6.5 Exposure Testing Conditions:

A6.5.1 Exposure Condition 1—: The test specimens shall be exposed to a steady state environment of not less than 90°F (32°C) and 90-percent relative humidity. The test duration shall be a minimum of 720 hours.

A6.5.2 Exposure Condition 2—: Water-spray testing shall be performed in accordance with ASTM B117 for a period of 720 hours, except distilled water (Type IV) shall be used in place of salt water.

A6.5.3~~2~~ Exposure Condition 3—: Water-spray testing shall be performed in accordance with ASTM B117 for a period of 720 hours, with salt water.

A6.6 Coupon Removal and Cleaning: When the tests are terminated, the metal coupons shall be removed by opening the plywood or MgO sheet test specimen, followed by careful separation of the metal coupon from the wood or MgO sheet test member. If coating is lost by adhesion to the test members, the loss shall be noted in the report.

Coupons shall be cleaned in accordance with AWPA E12 Section 8.

A7.0 ASSESSMENT OF RESULTS

A7.1 Assessment of Coupons: Both contact surfaces of the metal coupons shall be evaluated according to AWPA E12-20, section 9.0. Hot-dip galvanized coupons from the benchmark assemblies shall serve as a test control and shall be evaluated in the same manner.

A7.2 Comparisons to Benchmarks:

1. Corrosion ratings for all coupons shall be summarized by treatment using summary statistics, mean, standard deviation, and coefficient of variation.
2. Corrosion ratings of the benchmark materials and the alternative materials shall be compared using a one-tail t-test to assess equality of corrosion performance. The significance level shall be 0.05 for comparisons and inferences.
3. For statistical tests where equality is rejected: If the mean corrosion rating of the alternative is better than that of the benchmark, the inference is that the corrosion resistance exceeds that of the benchmark; if the mean corrosion rating of the alternative is not as good as that of the benchmark, the inference is that the corrosion resistance is less than that of the benchmark.
4. The statistical results shall be combined with assessment of functional differences, that is, severe but not statistically equivalent corrosion conditions may be not functionally different and shall be subject to interpretation.
5. A corrosion rating relative to the benchmark assembly shall be calculated and reported for each alternative assembly and shall be a ratio of the mean corrosion rating of the alternative assembly to the benchmark assembly.
6. Data and information from other documented assessment methods may be considered as supplemental documentation for comparison to visual assessment. Examples of other assessment methods are weight loss of samples, x-ray analysis, tension test results, etc.

A8.0 EVALUATION REPORT REQUIREMENTS

The evaluation report shall include a description of the intended end uses in accordance with Table A2. The evaluation report shall also include the corrosion rating for each alternative assembly as determined in accordance with Section A7.2, Item 5.

TABLE A2—EXPOSURE TEST CONDITIONS BASED ON END USE

END USE SEVERITY RATING	END USE	DESCRIPTION	APPLICABLE EXPOSURE TESTING REQUIREMENTS
1	Interior Walls	Walls that do not fall under the definition of "Exterior Walls" that are fully contained within the conditioned interior space, outside of wet areas.	A6.5.1
	Interior Floors	Floors fully contained within the conditioned interior space, outside of wet areas.	
2	Exterior Walls in Non-Coastal Regions	Walls, meeting the definition in Section 202 of the IBC, including fire-resistance rated walls located more than 3,000 feet from the shoreline of a body of saltwater. The MgO sheets shall be covered by the weather-resistive envelope.	A6.5.2*
	Roof Sheathing in Non-Coastal Regions	Roof sheathing in structures located more than 3,000 feet from the shoreline of a body of saltwater. The MgO sheets shall be covered by an approved roof covering.	
	Interior Wet Areas	Areas defined in IBC Section 2509	
3	Exterior Walls in Coastal Regions	Walls meeting the definition in Section 202 of the IBC, including fire-resistance rated walls, in structures located less than 3,000 feet from the shoreline of a body of saltwater. The MgO sheets shall be protected by the weather-resistive envelope	A6.5.3**
	Roof Sheathing in Coastal Regions	Roof sheathing in structures located less than 3,000 feet from the shoreline of a body of saltwater. The MgO sheets shall be covered by an approved roof covering.	

* Successful passing of A6.5.2 also qualifies for A6.5.1 for the same metal / MgO Sheet combination
** Successful passing of A6.5.3 also qualified for A6.5.1 and A6.5.2 for the same metal / MgO Sheet combination

TABLE A3 – REFERENCED STANDARDS in Appendix A

STANDARD	DATE OF STANDARD						
	2024 IBC, IRC	2021 IBC, IRC	2018 IBC, IRC	2015 IBC, IRC	2012 IBC, IRC	2009 IBC, IRC	2006 IBC, IRC
ASTM A123[1]	17						
ASTM A653	20	17	15	11	08	07	04a
ASTM A792	21a	10(2015)		10	08	06a	03
ASTM A875	21	13			06		02a
ASTM B117[1]	19						
ASTM B370	12(2019)	12			09	03	
ASTM C1185[1]	08(2016)						
ASTM D4442[1]	20						
ASTM D4444[1]	13(2018)						
ASTM D610[1]	08(2019)						
AWPA E12[1]	20						
AWPA P23[1]	14(R2020)						
AWPA U1	23	20	16	14	11	07	04

[1]Not referenced in the IBC

TABLE A4 – REFERENCED SECTIONS OF THE IBC in Appendix A

2024 IBC	2021 IBC	2018 IBC	2015 IBC	2012 IBC	2009 IBC	2006 IBC
Section 2303.1.5				Section 2303.1.4		
Section 2303.1.9.1				Section 2303.1.8.1		