Project Number: U2716.0327.221

January 19, 2022

SunModo
Attn: Peter Abou Chacra
14800 NE 65th Street
Vancouver, WA 98682

REFERENCE: TopTile Deck Mount Assembly Evaluation

Dear Mr. Abou Chacra:

Per your request, Vector Structural Engineering, LLC has reviewed test reports for the 5" and 7" TopTile Deck Mount assemblies. The SunModo part numbers for these assemblies are K10461-105 and K10461-107 respectively. Testing was performed by Applied Materials & Engineering, Inc and is detailed in test reports dated August 19, 2021 (attached). Based on our review of the test data provided, it is our opinion that the TopTile Deck Mount assemblies can safely support the following design loads under the following conditions.

- Allowable loads are determined by applying a factor of safety of 2 to the average ultimate test loads.
- 5" TopTile Deck Mount Kit (K10461-105)
  - Maximum uplift force shall not exceed 623 lbs.
  - Maximum shear force shall not exceed 113 lbs.
- 7" TopTile Deck Mount Kit (K10461-107)
  - Maximum uplift force shall not exceed 422 lbs.
  - Maximum shear force shall not exceed 92 lbs.
- It should be noted that no compressive (downforce) testing was done at the time of our analysis.
- All connections and assemblies shall be installed in accordance with manufacturer's specifications and any applicable load tables. Vector Structural Engineering assumes no responsibility for improper installation of components.
- In situations where design reactions are in excess of the maximum allowable reactions listed above, consult SunModo for project specific design solutions. Vector Structural Engineering assumes no responsibility for site-specific installs that we have not reviewed.
- Adequacy of any existing structure to support the design loads listed above is beyond the scope of this report.

We hope this meets your needs. If you have any questions or require additional information, please contact us at your convenience.

Sincerely,
VECTOR STRUCTURAL ENGINEERING, LLC

01/20/2022

Jacob S Proctor, P.E.
CA License #: 70567, Expires 06/30/2023
Project Engineer

JSP/mih

Attachment A:
5" Hex TopTile Deck Mount Kit Test Report

651 W. Galena Park Blvd, Ste 101 / Draper, UT 84020 / T (801) 990-1775 / F (801) 990-1776 / www.vectorse.com

APPLIED MATERIALS & ENGINEERING, INC.
980 41st Street
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e-mail: info@appmateng.com

August 19, 2021 Project No.: 1210552C

Mr. Peter Abou Chacra
SUNMODO
14800 NE 65th St
Vancouver, WA 98682 Email: PeterA@sunmodo.com

Subject: 5" Hex TopTile™ Deck Mount Kit
Universal Standard 5"Base Hook mounting systems

Dear Mr. Abou Chacra:

As requested, Applied Materials & Engineering, Inc. (AME) has completed load-testing the 5" Hex TopTile™ Deck Mount Kit (Part #K10461-105) with SunModo's fine-threaded screws; see Appendix A, Figure A1. The purpose of our testing was to evaluate the tension (uplift) and shear load capacity of the 5" Hex TopTile™ Deck Mount Kit attached to 1/2" Structural I plywood.

SAMPLE DESCRIPTION

Mockup samples were prepared in our laboratory on August 18, 2021. Mockup configuration consisted of a 1/2" Structural I plywood test sample reinforced with a 2"x4" wood frame to minimize the flexing of the plywood. The 5" Hex TopTile™ Deck Mount Kit is attached to the plywood using provided product hardware.

TEST PROCEDURES & RESULTS

1. Tensile (Uplift) Load Test

A total of three tests were conducted for tensile (uplift) load capacity on August 18, 2021 using a United Universal testing machine. Samples were rigidly attached to the testing machine and an uplift (tensile) load was applied to the mount. The samples were loaded in tension at a constant rate of axial deformation of 0.20 in. /min. without shock until failure occurred; displacement at maximum load was recorded.

Based on the above testing, the average maximum uplift load of the 5" Hex TopTile™ Wood Deck Mount Kit attached to 1/2" Structural I plywood was determined to be 1,247 lbf. Detailed results are provided in Table I and Figure 1. Test setup and mode of failure are provided in Appendix B, Figure B1.

The specific gravity and moisture content of the plywood were tested in accordance with ASTM D2395, Method A (oven-dry). The average specific gravity and average mositure content of the three samples were determined to be 0.408 and 9.3%, respectively.

2. Shear (Lateral) Load Test Parallel to Rafter

A total of three tests were conducted for shear load capacity on August 18, 2021 using a United Universal testing machine. Samples were rigidly attached to the testing machine and a shear load (parallel to the rafter) was applied to the hook. The samples were loaded in compression at a constant rate of axial deformation of 0.20 in. /min. without shock until failure occurred; displacement at maximum load was recorded.

Based on the above testing, the average maximum shear load of the 5" Hex TopTile™ Deck Mount Kit attached to 1/2" Structural I plywood was determined to be 226 lbf. Detailed results are provided in Table II and Figure 2. Test setup and mode of failure are provided in Appendix B, Figure B2.

The specific gravity and moisture content of the plywood were tested in accordance with ASTM D2395, Method A (oven-dry). The average specific gravity and average mositure content of the three samples were determined to be 0.408 and 9.3%, respectively.

Respectfully Submitted,

APPLIED MATERIALS & ENGINEERING, INC.

Armen Tajirian, Ph.D., P.E.
Principal

REGISTERED PROFESSIONAL ENGINEER
ARMEN TAJIRIAN
No 35535
Exp 9/30/~~19~~ 21
CIVIL
STATE OF CALIFORNIA

TABLE I

TENSILE (UPLIFT) LOAD TEST RESULTS

5" HEX TOPTILE™ WOOD DECK MOUNT KIT

(PART # K10461-105)

PROJECT NO.: 1210552C

Test No.	Maximum Tensile Load (lbs)	Displacement at Maximum Load (in.)	Mode of Failure	Plywood Specific Gravity	Plywood Moisture Content (%)
6190	1,189	0.31	Wood Screw Pull-out	0.408	9.3
6191	1,183	0.34		0.407	9.3
6192	1,368	0.36		0.408	9.3
Average	**1,247**	**0.34**	··	**0.408**	**9.3**

TABLE II

LATERAL LOAD TEST RESULTS

5" HEX TOPTILE™ WOOD DECK MOUNT KIT

(PART # K10461-105)

PROJECT NO.: 1210552C

Test No.	Maximum Tensile Load (lbs)	Displacement at Maximum Load (in.)	Mode of Failure	Plywood Specific Gravity	Plywood Moisture Content (%)
6198	260	0.32	Wood Screw Pull-out	0.408	9.3
6199	205	0.32		0.407	9.3
6200	213	0.80		0.408	9.3
Average	**226**	**0.48**	··	**0.408**	**9.3**

REFERENCES

AC13-2010, "*Acceptance Criteria for Joist Hangers and Similar Devices*", ICC Evaluation Service.

AC85-2008, "*Acceptance Criteria for Test Reports*", ICC Evaluation Service.

ASTM D1761-2006, "*Standard Test Methods for Mechanical Fasteners in Wood*", ASTM International.

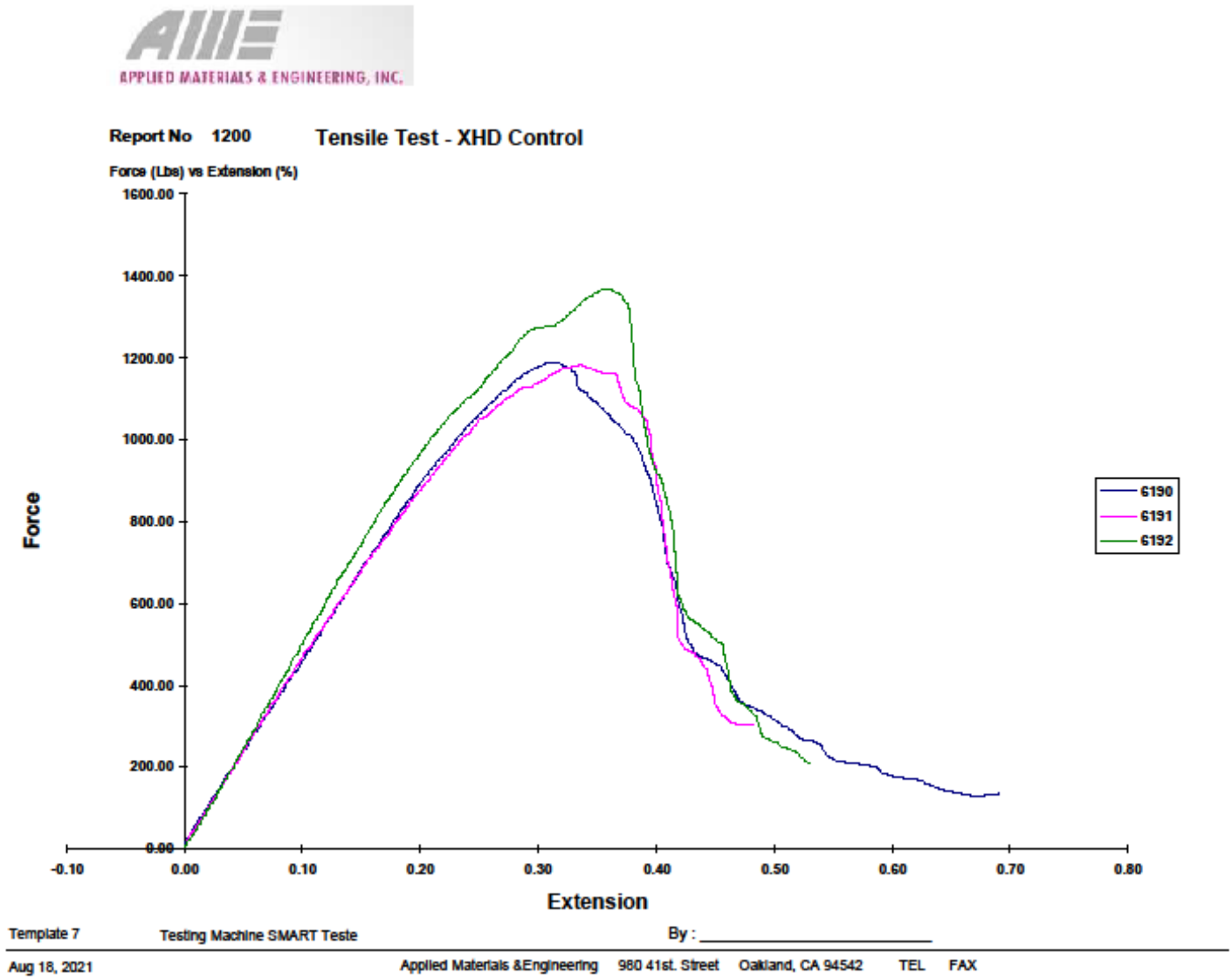

APPLIED MATERIALS & ENGINEERING, INC.
Report No 1200
Tensile Test - XHD Control
Force (Lbs) vs Extension (%)
1600.00
1400.00
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
Force
-0.10
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
Extension
6190
6191
6192
Template 7
Testing Machine SMART Teste
By :
Aug 18, 2021
Applied Materials &Engineering 980 41st. Street Oakland, CA 94542 TEL FAX

Figure 1

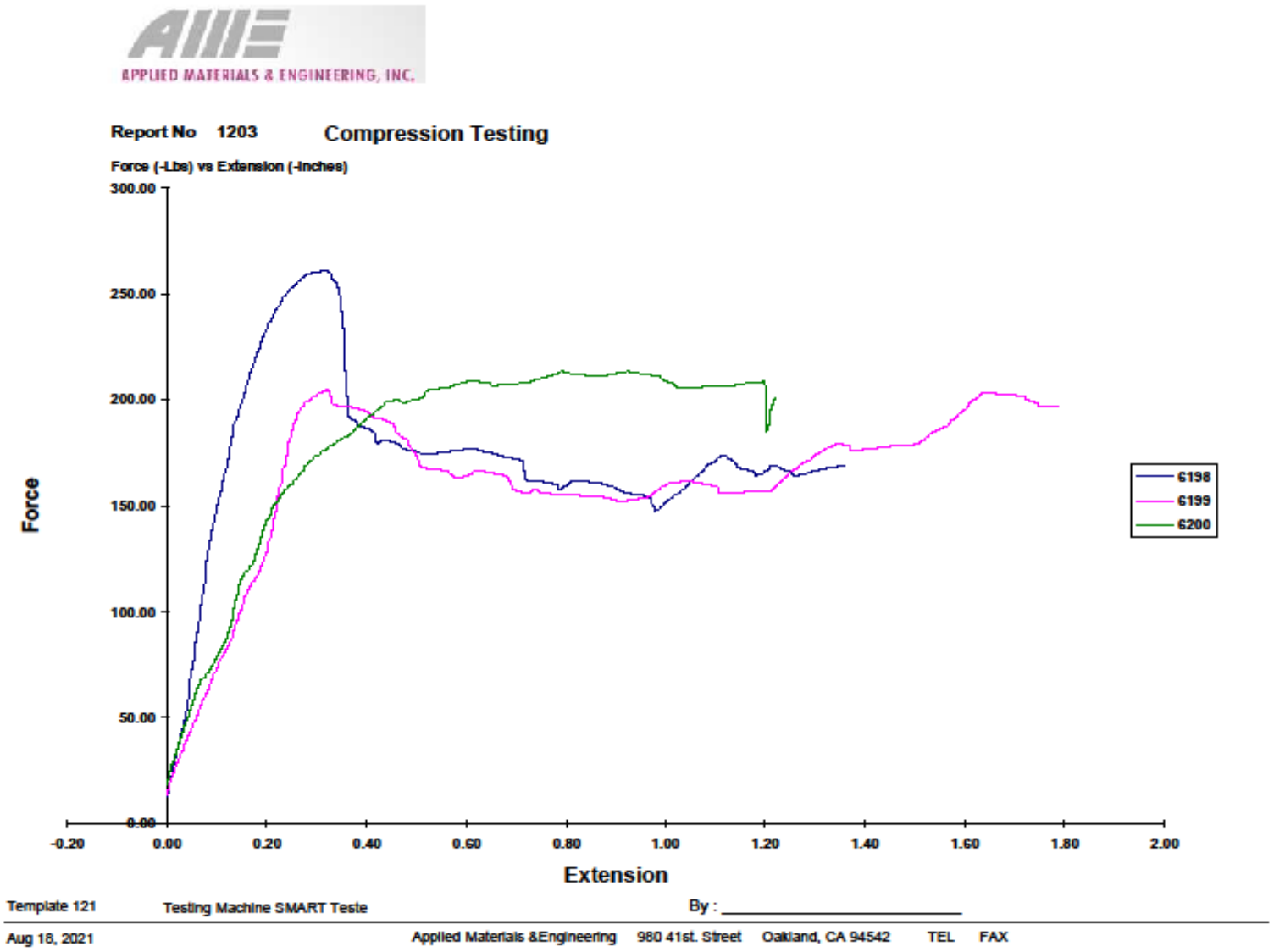

APPLIED MATERIALS & ENGINEERING, INC.
Report No 1203
Compression Testing
Force (-Lbs) vs Extension (-Inches)
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Force
-0.20
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
Extension
6198
6199
6200
Template 121
Testing Machine SMART Teste
By : _____
Aug 18, 2021
Applied Materials &Engineering 980 41st. Street Oakland, CA 94542 TEL FAX

Figure 2

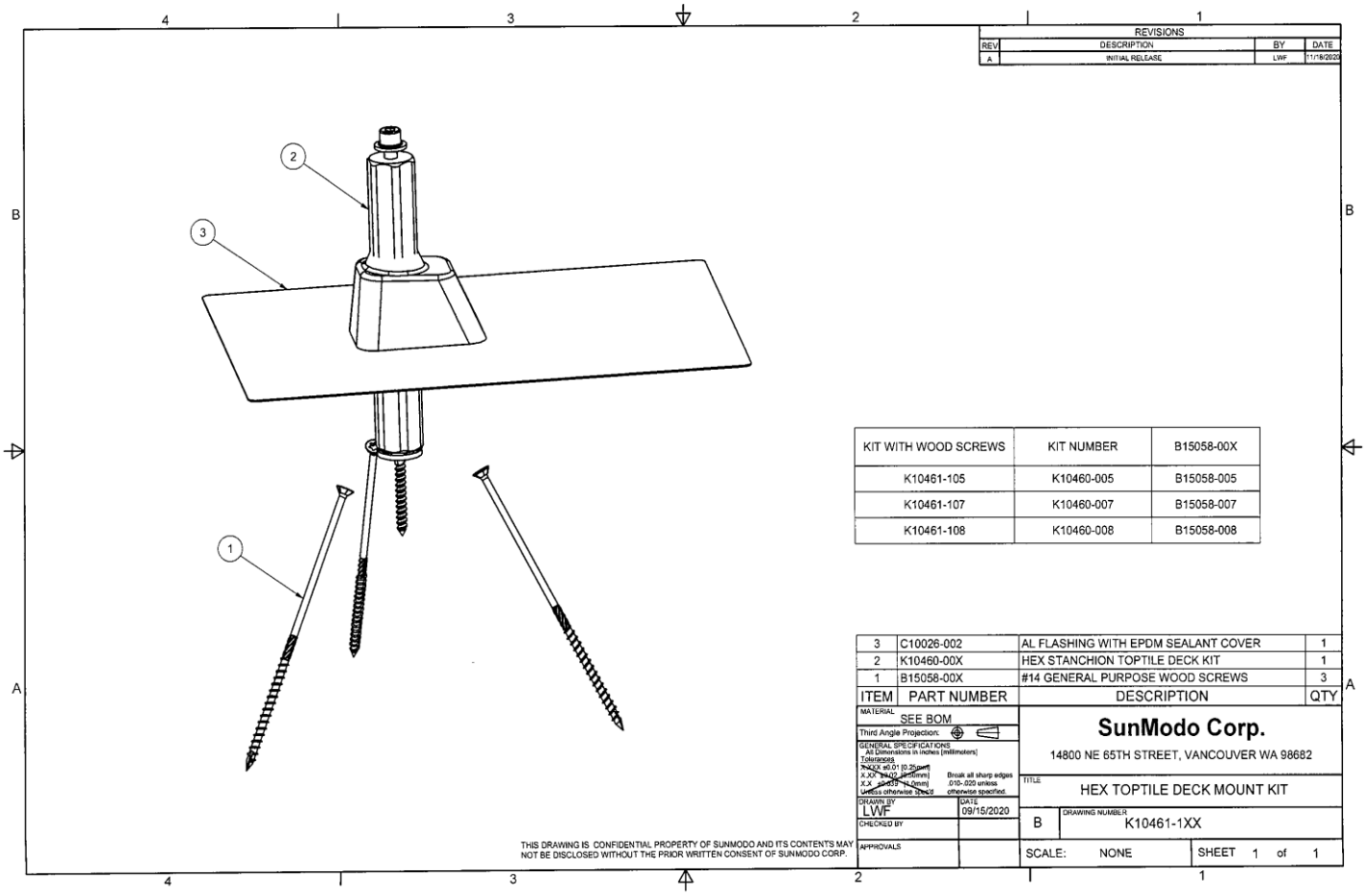
APPENDIX A

FIGURE A1

HEX STANCHION X TOPTILE™ RAFTER KIT SYSTEM

(PART #K10465-105)

PROJECT NUMBER 1210552C



APPENDIX B

FIGURE B1

5" HEX TOPTILE™ WOOD DECK MOUNT KIT
(PART # K10461-105)

TENSILE LOAD TEST SETUP

PROJECT NUMBER 1210552C

Figure B1a. Test set up.

Figure 1b. Typical failure mode.

FIGURE B2

5" HEX TOPTILE™ WOOD DECK MOUNT KIT

(PART # K10468-105)

SHEAR LOAD TEST SETUP

PROJECT NUMBER 1210552C

Figure 2a. Test set up.

Figure 2b. Typical failure mode.

Attachment B:
7" Hex TopTile Deck Mount Kit Test Report

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FAX: (510) 420-8186
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August 19, 2021 Project No.: 1210552C

Mr. Peter Abou Chacra
SUNMODO
14800 NE 65th St
Vancouver, WA 98682 Email: PeterA@sunmodo.com

Subject: 7" Hex TopTile™ Deck Mount Kit
Universal Standard 7" Base Hook mounting systems

Dear Mr. Abou Chacra:

As requested, Applied Materials & Engineering, Inc. (AME) has completed load-testing the 7" Hex TopTile™ Deck Mount Kit (Part #K10461-107) with SunModo's fine-threaded screws; see Appendix A, Figure A1. The purpose of our testing was to evaluate the tension (uplift) and shear load capacity of the 7" Hex TopTile™ Deck Mount Kit attached to 1/2" Structural I plywood.

SAMPLE DESCRIPTION

Mockup samples were delivered to our laboratory on August 18, 2021. Mockup configuration consisted of a 1/2" Structural I plywood test sample reinforced with a 2"x4" wood frame to minimize the flexing of the plywood. The 7" Hex TopTile™ Deck Mount Kit is attached to the plywood using provided product hardware.

TEST PROCEDURES & RESULTS

1. Tensile (Uplift) Load Test

A total of three tests were conducted for tensile (uplift) load capacity on August 18, 2021 using a United Universal testing machine. Samples were rigidly attached to the testing machine and an uplift (tensile) load was applied to the mount. The samples were loaded in tension at a constant rate of axial deformation of 0.20 in. /min. without shock until failure occurred; displacement at maximum load was recorded.

Based on the above testing, the average maximum uplift load of the 7" Hex TopTile™ Wood Deck Mount Kit attached to 1/2" Structural I plywood was determined to be 844 lbf. Detailed results are provided in Table I and Figure 1. Test setup and mode of failure are provided in Appendix B, Figure B1.

The specific gravity and moisture content of the plywood were tested in accordance with ASTM D2395, Method A (oven-dry). The average specific gravity and average mositure content of the three samples were determined to be 0.408 and 9.3%, respectively.

2. Shear (Lateral) Load Test Parallel to Rafter

A total of three tests were conducted for shear load capacity on August 18, 2021 using a United Universal testing machine. Samples were rigidly attached to the testing machine and a shear load (parallel to the rafter) was applied to the hook. The samples were loaded in compression at a constant rate of axial deformation of 0.20 in. /min. without shock until failure occurred; displacement at maximum load was recorded.

Based on the above testing, the average maximum shear load of the 7" Hex TopTile™ Deck Mount Kit attached to 1/2" Structural I plywood was determined to be 184 lbf. Detailed results are provided in Table II and Figure 2. Test setup and mode of failure are provided in Appendix B, Figure B2.

The specific gravity and moisture content of the plywood were tested in accordance with ASTM D2395, Method A (oven-dry). The average specific gravity and average mositure content of the three samples were determined to be 0.408 and 9.3%, respectively.

Respectfully Submitted,

APPLIED MATERIALS & ENGINEERING, INC.

Armen Tajirian, Ph.D., P.E.
Principal

TABLE I

TENSILE (UPLIFT) LOAD TEST RESULTS

7" HEX TOPTILE™ WOOD DECK MOUNT KIT

(PART # K10461-107)

PROJECT NO.: 1210552C

Test No.	Maximum Tensile Load (lbs)	Displacement at Maximum Load (in.)	Mode of Failure	Plywood Specific Gravity	Plywood Moisture Content (%)
6193	937	0.26	Wood Screw Pull-out	0.408	9.3
6194	693	0.24		0.407	9.3
6195	901	0.28		0.408	9.3
Average	**844**	**0.26**	..	**0.408**	**9.3**

TABLE II

LATERAL LOAD TEST RESULTS

7" HEX TOPTILE™ WOOD DECK MOUNT KIT

(PART # K10461-107)

PROJECT NO.: 1210552C

Test No.	Maximum Tensile Load (lbs)	Displacement at Maximum Load (in.)	Mode of Failure	Plywood Specific Gravity	Plywood Moisture Content (%)
6201	196	3.01	Wood Screw Pull-out	0.408	9.3
6202	154	1.93		0.407	9.3
6203	201	2.61		0.408	9.3
Average	**184**	**2.52**	..	**0.408**	**9.3**

REFERENCES

AC13-2010, "*Acceptance Criteria for Joist Hangers and Similar Devices*", ICC Evaluation Service.

AC85-2008, "*Acceptance Criteria for Test Reports*", ICC Evaluation Service.

ASTM D1761-2006, "*Standard Test Methods for Mechanical Fasteners in Wood*", ASTM International.

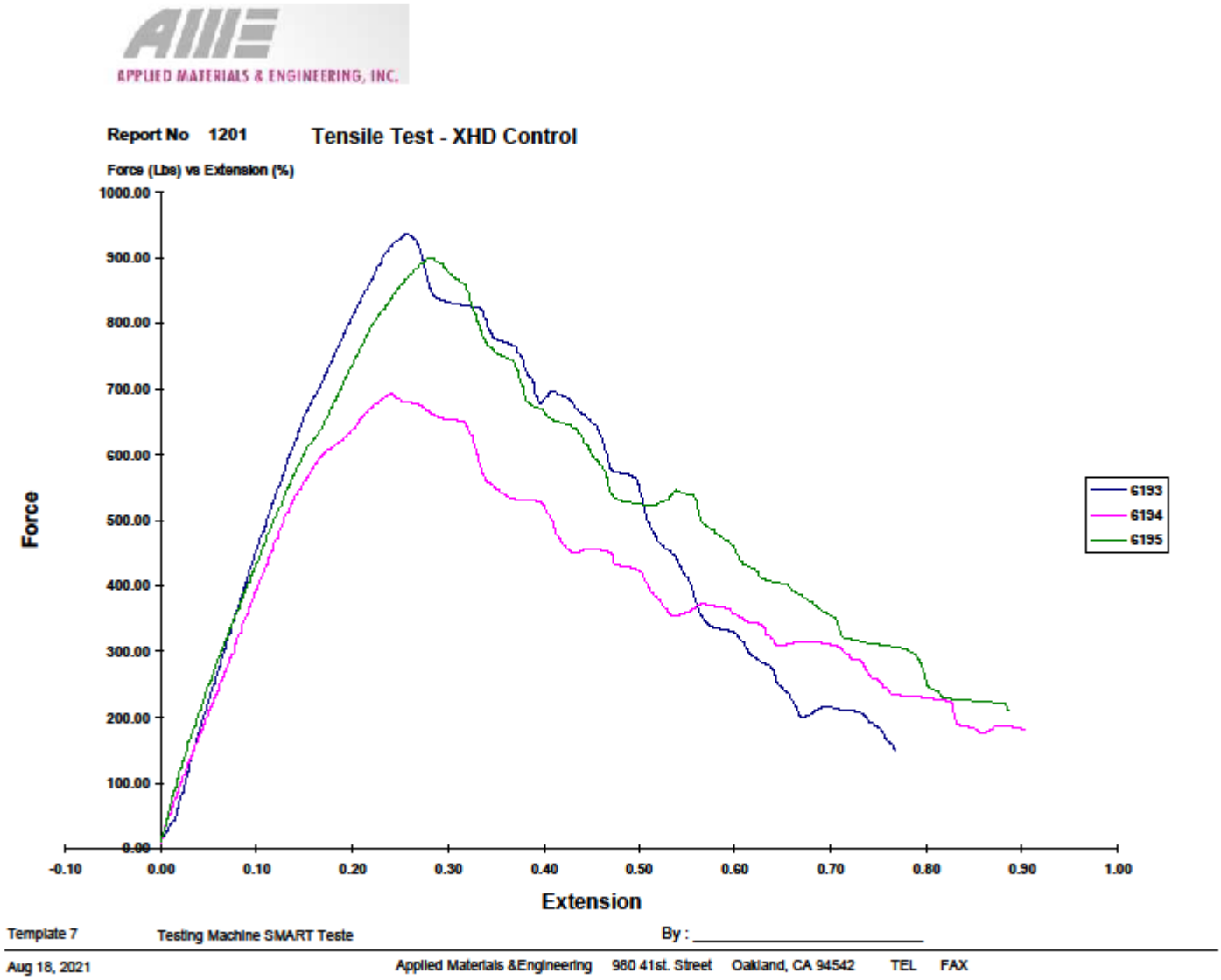

APPLIED MATERIALS & ENGINEERING, INC.
Report No 1201
Tensile Test - XHD Control
Force (Lbs) vs Extension (%)
Force
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
-0.10
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Extension
6193
6194
6195
Template 7
Testing Machine SMART Teste
By :
Aug 18, 2021
Applied Materials &Engineering 980 41st. Street Oakland, CA 94542 TEL FAX

Figure 1

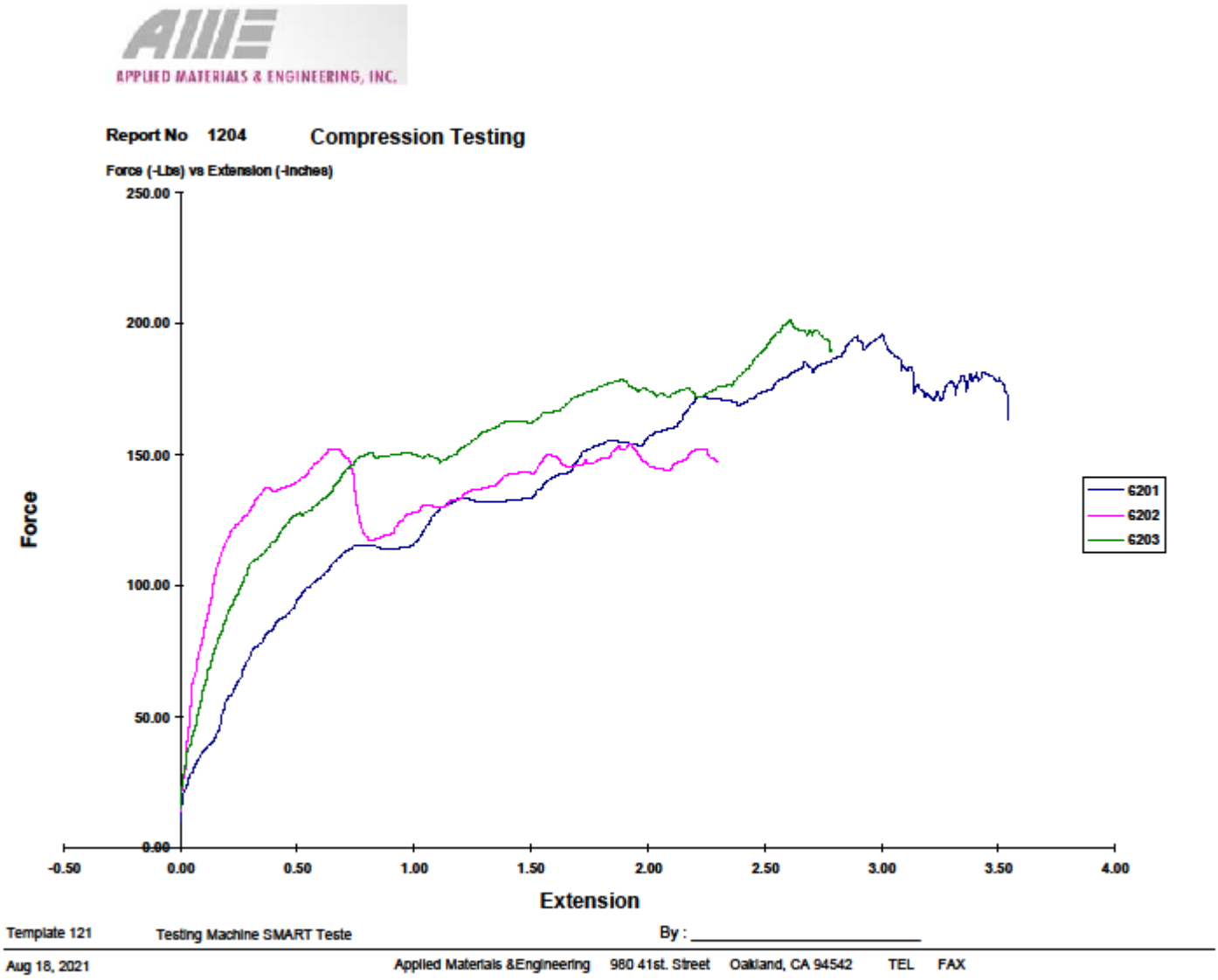

APPLIED MATERIALS & ENGINEERING, INC.
Report No 1204
Compression Testing
Force (-Lbs) vs Extension (-Inches)
250.00
200.00
150.00
100.00
50.00
0.00
Force
-0.50
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
Extension
6201
6202
6203
Template 121
Testing Machine SMART Teste
By :
Aug 18, 2021
Applied Materials &Engineering
980 41st. Street
Oakland, CA 94542
TEL
FAX

Figure 2

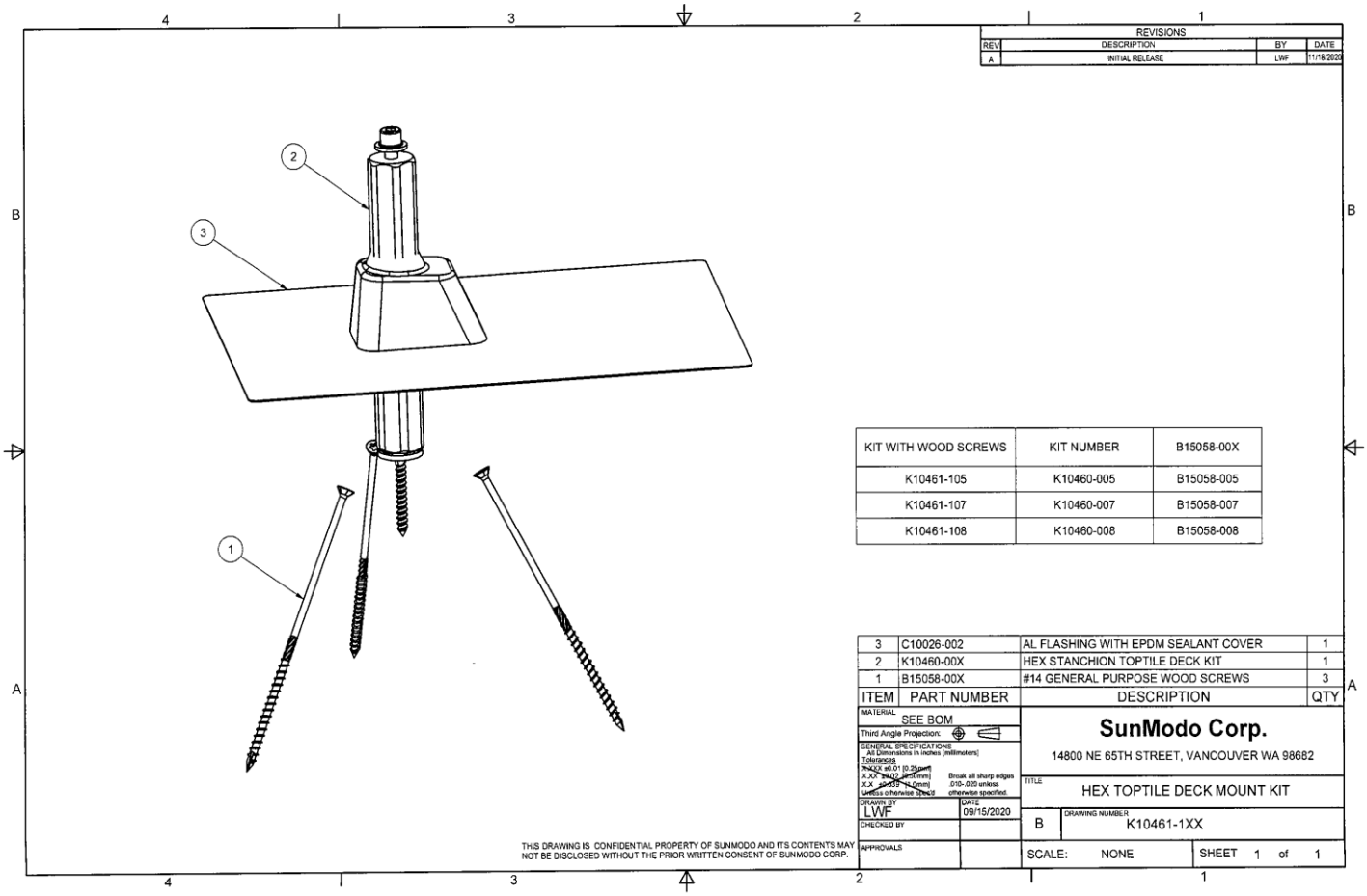
APPENDIX A

FIGURE A1

HEX STANCHION X TOPTILE™ RAFTER KIT SYSTEM

(PART #K10465-107)

PROJECT NUMBER 1210552C



APPENDIX B

FIGURE B1

7" HEX TOPTILE™ WOOD DECK MOUNT KIT
(PART # K10461-107)

TENSILE LOAD TEST SETUP

PROJECT NUMBER 1210552C

Figure B1a. Test set up.

Figure 1b. Typical failure mode.

FIGURE B2

7" HEX TOPTILE™ WOOD DECK MOUNT KIT

(PART # K10468-107)

LATERAL LOAD TEST SETUP

PROJECT NUMBER 1210552C

Figure 2a. Test set up.

Figure 2b. Typical failure mode.