

KNOTWOOD, A DIVISION OF OMNIMAX

SCOPE OF WORK PERFORMANCE TESTING ON 2 IN BY 2 IN AND 2 IN BY 4 IN BATTEN SYSTEMS

REPORT NUMBER J1921.01-119-19 R0

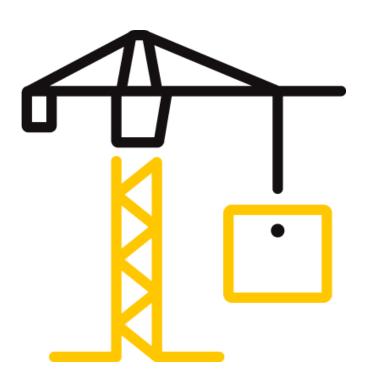
TEST DATE(S) 07/22/19 - 07/29/19

ISSUE DATE 10/08/19

RECORD RETENTION END DATE 07/29/23

PAGES 21

DOCUMENT CONTROL NUMBER ATI 00704 (07/28/17) RT-R-AMER-Test-2858 © 2017 INTERTEK





TEST REPORT FOR KNOTWOOD, A DIVISION OF OMNIMAX

Report No.: J1921.01-119-19 R0 Date: 10/08/19

REPORT ISSUED TO

KNOTWOOD, A DIVISION OF OMNIMAX INTERNATIONAL 30 Technology Parkway South Suite 400 / Suite 600 Peachtree Corners, GA 30092

SECTION 1

SCOPE

Intertek Building & Construction (B&C) was contracted by Knotwood, A Division of Omnimax International, Peachtree Corners, GA, to conduct structural performance testing on their 2 in by 2 in and 2 in by 4 in batten systems. Results obtained are tested values and were secured by using the designated test method. Testing was conducted at the Intertek B&C test facility in York, PA.

Intertek B&C in York, Pennsylvania has demonstrated compliance with ISO/IEC International Standard 17025 and is consequently accredited as a Testing Laboratory (TL-144) by International Accreditation Service, Inc. (IAS).

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

For INTERTEK B&C: Robert G. Spayd **REVIEWED BY:** V. Thomas Mickley, Jr., P.E. **COMPLETED BY: Technician II** Senior Staff Engineer TITLE: TITLE: **SIGNATURE: SIGNATURE:** 10/08/19 10/08/19 DATE: DATE: RGS:vtm/aas

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SECTION 2

TEST METHOD(S)

Per the client's request, the specimens were evaluated using the test methods described in the following:

ANSI/SPRI/FM 4435/ ES-1 2017, Test Standard for Edge Systems Used with Low Slope Roofing Systems

SECTION 3

MATERIAL SOURCE/INSTALLATION

Test samples were provided by the client. Representative samples of the test specimen(s) will be retained by Intertek B&C for a minimum of four years from the test completion date.

The batten systems included a "base" and "cap" section which snapped together. When a batten system was used as a midspan support (intermediate column), its base section was rigidly attached to a stanchion prior to snapping on the cap section.

The batten systems tested as a single span condition were attached at each end to a 1/4 in thick steel section using two, #10 by 1-7/16" tek screws at each support. The center-to-center distance of the attachment locations was 13 ft - 0 in.

The batten systems tested as a two-span condition were attached at each end to a 1/4 in thick steel section and at the midpoint to the cap section of a 2 in by 2 in batten used as an intermediate column using two, #10 by 1-7/16" tek screws at each support. The center-to-center distance of the attachment locations was 7 ft - 0 in.

The supports were rigidly attached to the test frame and were included in the test specimen only to facilitate anchorage of the batten system and were not a tested component. The structural capacity of the supports was not included in the scope of this testing and would need to be evaluated separately.

SECTION 4

LIST OF OFFICIAL OBSERVERS

| NAME | COMPANY |
|------------------------------|--------------|
| Adam J. Schrum | Intertek B&C |
| V. Thomas Mickley, Jr., P.E. | Intertek B&C |



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SECTION 5

TEST PROCEDURE

All testing reported herein was conducted in a laboratory set to maintain temperature in the range of $68 \pm 4^{\circ}$ F and humidity in the range of $50 \pm 5\%$ RH.

The base section of each batten system was attached to the supports. The cap section was then snapped onto the base and equal length chains, located 6 in from each support and 12 in oncenter, were wrapped around the batten system and the load distribution beam. Load was applied to the load distribution beam via a steel cable and an electric winch. Load was applied in both the directions, towards support and away from support, to simulate the effects of wind loads in any direction. Applied load was measured with an in-line 2000 pound load cell. Center-point deflection of the batten was measured with an electronic linear displacement transducer. Load was applied incrementally and held ("sustained") for a minimum of 60 seconds with intermediate load relaxation periods for specimen deflection to stabilize. See Photographs in Section 8 and Drawings in Section 9 for additional details.

SECTION 6

TEST SPECIMEN DESCRIPTION

| PRODUCTS | Base | 2 in cap | 4 in cap | | | |
|----------------------|--|---------------------|---------------------|--|--|--|
| PART NUMBERS | KEB5050M | KEB5050F | KEB10050M | | | |
| MANUFACTURER | OmniMax Internation | al | | | | |
| MATERIAL | 6063-T6 extruded alu | minum | | | | |
| WIDTH | 1-7/8 in | 1-27/32 in | 3-13/16 in | | | |
| HEIGHT | 2 in | 2 in | 2 in | | | |
| WALL THICKNESS | 0.075 in / 0.080 in | 0.058 in / 0.123 in | 0.070 in / 0.090 in | | | |
| SPAN/SPECIMEN LENGTH | Single span 13 ft center-of-support to center-of-support / 14 ft specimen length Two-span 7 ft center-of-support to center-of-support / 15 ft specimen length | | | | | |
| FASTENERS | - Base Section to Support: Two, #10-24 by 1-7/16" Philips drive, trim head, self-drilling tek screws - Base Section to Cap Section: Snap fit - No mechanical connection | | | | | |



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SECTION 7

TEST RESULTS

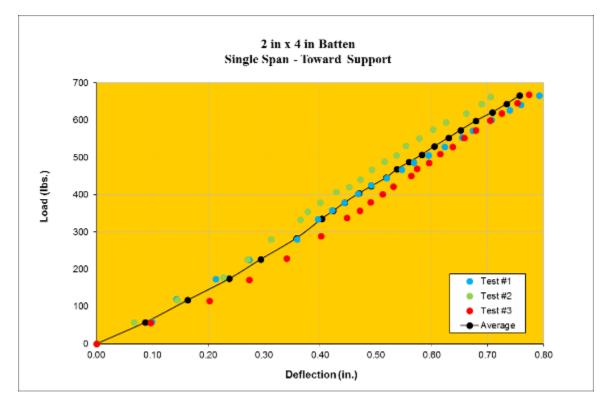
Product: 2 in by 4 in Batten

Span: 13 ft - 0 in (Single Span) Direction of Load: Towards Support Test Dates: 07/24/19 and 07/25/19

| SURFACE | TARGET | TEST N | 0.1 | TEST NO. 2 | | TEST N | 0.3 | AVERAGE | | |
|-----------------------|--------|--------|------------|------------|------------|--------|------------|---------|------------|--|
| LOAD | LOAD | LOAD | DEFLECTION | LOAD | DEFLECTION | LOAD | DEFLECTION | LOAD | DEFLECTION | |
| (lb/ft ²) | (lbf) | (lbf) | (in) | (lbf) | (in) | (lbf) | (in) | (lbf) | (in) | |
| 25 | 54 | 59 | 0.099 | 58 | 0.067 | 57 | 0.097 | 58 | 0.088 | |
| 50 | 108 | 120 | 0.143 | 117 | 0.145 | 115 | 0.202 | 117 | 0.163 | |
| 75 | 163 | 174 | 0.213 | 179 | 0.227 | 171 | 0.273 | 175 | 0.238 | |
| 100 | 217 | 225 | 0.273 | 227 | 0.270 | 229 | 0.340 | 227 | 0.294 | |
| 125 | 271 | 281 | 0.359 | 280 | 0.312 | 289 | 0.402 | 283 | 0.358 | |
| 150 | 325 | 335 | 0.396 | 333 | 0.365 | 338 | 0.448 | 335 | 0.403 | |
| 160 | 347 | 358 | 0.422 | 355 | 0.378 | 357 | 0.471 | 357 | 0.424 | |
| 170 | 368 | 379 | 0.443 | 379 | 0.400 | 380 | 0.490 | 379 | 0.444 | |
| 180 | 390 | 403 | 0.468 | 407 | 0.429 | 401 | 0.512 | 404 | 0.470 | |
| 190 | 412 | 425 | 0.491 | 421 | 0.452 | 422 | 0.531 | 423 | 0.491 | |
| 200 | 433 | 445 | 0.519 | 441 | 0.472 | 451 | 0.563 | 446 | 0.518 | |
| 210 | 455 | 468 | 0.546 | 467 | 0.493 | 470 | 0.573 | 468 | 0.537 | |
| 220 | 477 | 487 | 0.568 | 489 | 0.515 | 486 | 0.595 | 487 | 0.559 | |
| 230 | 498 | 506 | 0.594 | 506 | 0.537 | 510 | 0.615 | 507 | 0.582 | |
| 240 | 520 | 529 | 0.623 | 531 | 0.553 | 529 | 0.637 | 530 | 0.604 | |
| 250 | 542 | 554 | 0.654 | 551 | 0.577 | 553 | 0.658 | 553 | 0.630 | |
| 260 | 563 | 572 | 0.673 | 575 | 0.602 | 573 | 0.679 | 573 | 0.651 | |
| 270 | 585 | 600 | 0.707 | 595 | 0.625 | 599 | 0.704 | 598 | 0.679 | |
| 280 | 607 | 627 | 0.739 | 618 | 0.661 | 619 | 0.725 | 621 | 0.708 | |
| 290 | 628 | 641 | 0.759 | 644 | 0.689 | 646 | 0.753 | 644 | 0.734 | |
| 300 | 650 | 666 | 0.792 | 663 | 0.705 | 669 | 0.774 | 666 | 0.757 | |



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Product: 2 in by 4 in Batten

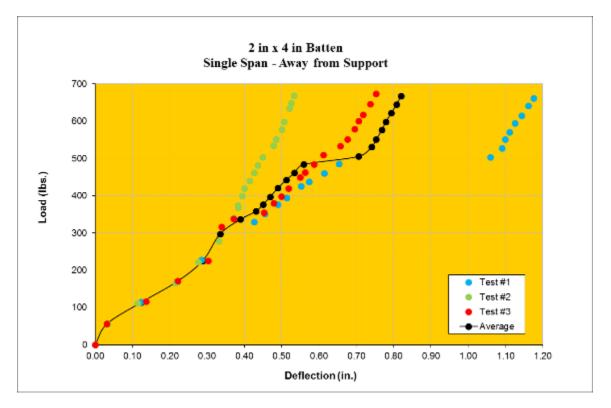
Span: 13 ft - 0 in (Single Span) Direction of Load: Away from Support Test Dates: 07/22/19 - 07/24/19

| SURFACE | TARGET | TEST N | TEST NO. 1 | | TEST NO. 2 | | 0.3 | AVERAGE | |
|-----------------------|--------|--------|--------------------|-----------------|------------|-------|------------|---------|------------|
| LOAD | LOAD | LOAD | DEFLECTION | LOAD DEFLECTION | | LOAD | DEFLECTION | LOAD | DEFLECTION |
| (lb/ft ²) | (lbf) | (lbf) | (in) | (lbf) | (in) | (lbf) | (in) | (lbf) | (in) |
| 25 | 54 | | | 57 | 0.033 | 56 | 0.031 | 57 | 0.032 |
| 50 | 108 | 115 | 0.123 | 112 | 0.114 | 116 | 0.137 | 114 | 0.125 |
| 75 | 163 | | | 166 | 0.215 | 172 | 0.222 | 169 | 0.219 |
| 100 | 217 | 228 | 0.285 | 222 | 0.277 | 226 | 0.303 | 225 | 0.288 |
| 125 | 271 | | | 278 | 0.331 | 317 | 0.339 | 298 | 0.335 |
| 150 | 325 | 330 | 0.426 | 341 | 0.371 | 338 | 0.371 | 336 | 0.389 |
| 160 | 347 | 351 | 0.455 | 368 | 0.383 | 355 | 0.453 | 358 | 0.430 |
| 170 | 368 | 376 | 0.489 | 374 | 0.383 | 380 | 0.479 | 377 | 0.450 |
| 180 | 390 | 394 | 0.514 | 399 | 0.394 | 398 | 0.499 | 397 | 0.469 |
| 190 | 412 | 425 | 0.552 | 419 | 0.400 | 419 | 0.518 | 421 | 0.490 |
| 200 | 433 | 437 | 0.573 | 440 | 0.414 | 450 | 0.550 | 442 | 0.512 |
| 210 | 455 | 460 | 0.614 | 461 | 0.426 | 463 | 0.563 | 461 | 0.534 |
| 220 | 477 | 486 | 0.654 | 482 | 0.436 | 484 | 0.587 | 484 | 0.559 |
| 230 | 498 | 503 | 1.059 ¹ | 504 | 0.449 | 510 | 0.612 | 506 | 0.707 |
| 240 | 520 | 527 | 1.090 | 534 | 0.477 | 533 | 0.657 | 531 | 0.741 |
| 250 | 542 | 551 | 1.099 | 551 | 0.485 | 551 | 0.676 | 551 | 0.753 |
| 260 | 563 | 571 | 1.111 | 578 | 0.500 | 579 | 0.695 | 576 | 0.769 |
| 270 | 585 | 594 | 1.125 | 598 | 0.506 | 601 | 0.706 | 598 | 0.779 |
| 280 | 607 | 615 | 1.143 | 634 | 0.521 | 617 | 0.718 | 622 | 0.794 |
| 290 | 628 | 641 | 1.161 | 648 | 0.526 | 646 | 0.737 | 645 | 0.808 |
| 300 | 650 | 661 | 1.175 | 669 | 0.533 | 674 | 0.753 | 668 | 0.820 |

¹ Cap section began to separate from base section however, the specimen was still able to hold the test load.



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Product: 2 in by 2 in Batten Span: 7 ft - 0 in (Two-Span) Direction of Load: Towards Support

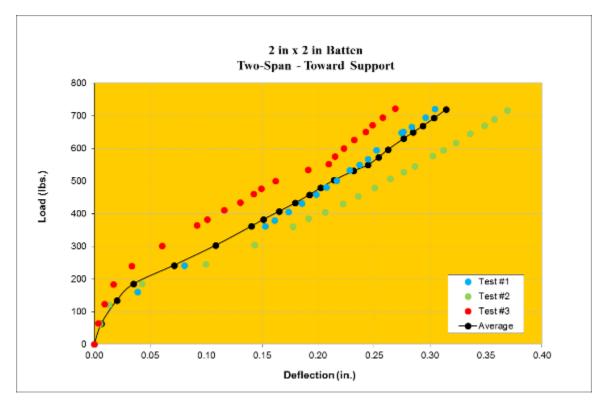
Test Dates: 07/25/19 and 07/26/19

| SURFACE | TARGET | TEST N | 0.1 | TEST N | 0. 2 | TEST NO. 3 | | AVERAGE | |
|-------------------------------|---------------|---------------|--------------------|---------------|--------------------|---------------|--------------------|---------------|--------------------|
| LOAD (lb/ft ²) | LOAD (lbf) | LOAD (lbf) | DEFLECTION (in) | LOAD (lbf) | DEFLECTION (in) | LOAD (lbf) | DEFLECTION (in) | LOAD (lbf) | DEFLECTION (in) |
| 25 | 58 | 62 | 0.011 | 63 | 0.005 | 65 | 0.004 | 63 | 0.006 |
| 50 | 117 | 160 | 0.039 | 121 | 0.013 | 123 | 0.009 | 135 | 0.020 |
| 75 | 175 | 186 | 0.046 | 185 | 0.043 | 184 | 0.017 | 185 | 0.035 |
| 100 | 233 | 241 | 0.081 | 245 | 0.100 | 240 | 0.034 | 242 | 0.071 |
| 125 | 292 | 302 | 0.122 | 305 | 0.143 | 302 | 0.061 | 303 | 0.108 |
| 150 | 350 | 362 | 0.153 | 360 | 0.178 | 364 | 0.092 | 362 | 0.141 |
| 160 | 373 | 380 | 0.161 | 385 | 0.192 | 383 | 0.101 | 383 | 0.151 |
| 170 | 397 | 406 | 0.174 | 405 | 0.206 | 411 | 0.116 | 407 | 0.165 |
| 180 | 420 | 432 | 0.186 | 431 | 0.222 | 435 | 0.131 | 433 | 0.179 |
| 190 | 443 | 459 | 0.198 | 454 | 0.236 | 460 | 0.143 | 458 | 0.192 |
| 200 | 467 | 481 | 0.208 | 480 | 0.251 | 477 | 0.149 | 479 | 0.202 |
| 210 | 490 | 502 | 0.217 | 507 | 0.265 | 500 | 0.162 | 503 | 0.214 |
| 220 | 513 | 533 | 0.228 | 527 | 0.277 | 534 | 0.191 | 531 | 0.232 |
| 230 | 537 | 549 | 0.237 | 546 | 0.287 | 552 | 0.210 | 549 | 0.244 |
| 240 | 560 | 567 | 0.245 | 577 | 0.303 | 575 | 0.215 | 573 | 0.254 |
| 250 | 583 | 594 | 0.252 | 595 | 0.312 | 600 | 0.223 | 596 | 0.262 |
| 260 | 607 | 648 | 0.275 | 617 | 0.323 | 626 | 0.232 | 630 | 0.277 |
| 270 | 630 | 651 | 0.276 | 646 | 0.336 | 651 | 0.243 | 649 | 0.285 |
| 280 | 653 | 666 | 0.284 | 670 | 0.349 | 671 | 0.249 | 669 | 0.294 |
| 290 | 677 | 695 | 0.296 | 689 | 0.358 | 695 | 0.258 | 693 | 0.304 |
| 300 | 700 | 720 | 0.305 | 716 | 0.369 | 722 | 0.269 | 719 | 0.314 |

Note: Reported deflections are the average of the midspan deflections from spans 1 and 2.



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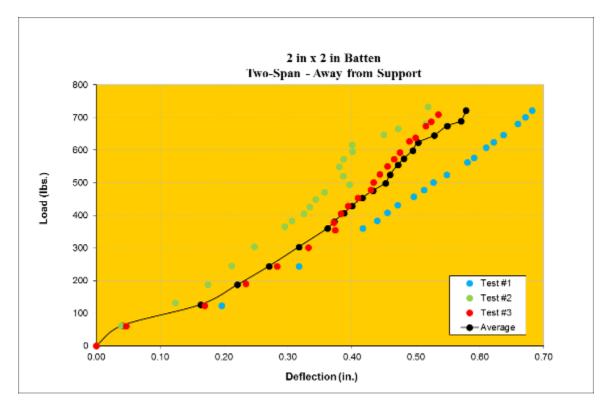
Product: 2 in by 2 in Batten Span: 7 ft - 0 in (Two-Span) Direction of Load: Away from Support Test Date: 07/26/19 and 07/29/19

| SURFACE | | | TEST NO. 1 | | TEST NO. 2 | | TEST NO. 3 | | AVERAGE | |
|------------------|-------|---------------|--------------------|---------------|--------------------|---------------|--------------------|---------------|--------------------|--|
| LOAD (lb/ft²) | (lbf) | LOAD (lbf) | DEFLECTION (in) | LOAD (lbf) | DEFLECTION (in) | LOAD (lbf) | DEFLECTION (in) | LOAD (lbf) | DEFLECTION (in) | |
| 25 | 58 | 63 | 0.036 | 62 | 0.039 | 61 | 0.047 | 62 | 0.041 | |
| 50 | 117 | 124 | 0.197 | 131 | 0.124 | 124 | 0.170 | 126 | 0.163 | |
| 75 | 175 | 184 | 0.254 | 188 | 0.175 | 190 | 0.234 | 187 | 0.221 | |
| 100 | 233 | 244 | 0.317 | 245 | 0.212 | 244 | 0.283 | 244 | 0.271 | |
| 125 | 292 | 303 | 0.372 | 304 | 0.248 | 302 | 0.332 | 303 | 0.317 | |
| 150 | 350 | 360 | 0.417 | 366 | 0.295 | 355 | 0.374 | 360 | 0.362 | |
| 160 | 373 | 383 | 0.440 | 383 | 0.306 | 378 | 0.372 | 381 | 0.372 | |
| 170 | 397 | 408 | 0.456 | 406 | 0.325 | 406 | 0.383 | 407 | 0.388 | |
| 180 | 420 | 431 | 0.472 | 426 | 0.334 | 429 | 0.394 | 429 | 0.400 | |
| 190 | 443 | 457 | 0.497 | 450 | 0.343 | 453 | 0.409 | 453 | 0.416 | |
| 200 | 467 | 478 | 0.513 | 471 | 0.357 | 478 | 0.430 | 476 | 0.433 | |
| 210 | 490 | 501 | 0.528 | 494 | 0.396 | 502 | 0.434 | 499 | 0.452 | |
| 220 | 513 | 525 | 0.549 | 521 | 0.386 | 526 | 0.444 | 524 | 0.459 | |
| 230 | 537 | 563 | 0.580 | 549 | 0.380 | 551 | 0.456 | 554 | 0.472 | |
| 240 | 560 | 577 | 0.591 | 572 | 0.387 | 573 | 0.466 | 574 | 0.481 | |
| 250 | 583 | 608 | 0.610 | 596 | 0.401 | 593 | 0.475 | 599 | 0.495 | |
| 260 | 607 | 625 | 0.622 | 617 | 0.400 | 628 | 0.490 | 623 | 0.504 | |
| 270 | 630 | 647 | 0.637 | 648 | 0.450 | 639 | 0.500 | 645 | 0.529 | |
| 280 | 653 | 681 | 0.659 | 666 | 0.472 | 674 | 0.515 | 674 | 0.549 | |
| 290 | 677 | 701 | 0.671 | 681 | 0.516 | 687 | 0.524 | 690 | 0.570 | |
| 300 | 700 | 722 | 0.682 | 733 | 0.519 | 709 | 0.535 | 721 | 0.579 | |

Note: Reported deflections are the average of the midspan deflections from spans 1 and 2.



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SECTION 8

PHOTOGRAPHS



Photo No. 1 2 in by 4 in Batten, Single Span, Load Away from Support - Test Setup



Photo No. 2 2 in by 4 in Batten, Single Span, Load Towards Support - Test Setup



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Photo No. 3 2 in by 2 in Batten, Two-Span, Load Away from Support - Test Setup



Photo No. 4 2 in by 2 in Batten, Two-Span, Load Towards Support - Test Setup



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Photo No. 5 Typical Base Section to Intermediate Support Connection (Two-Span Test Setup)



Photo No. 6 Typical Base Section to Support Connection (Single and Two-Span Test Setup)



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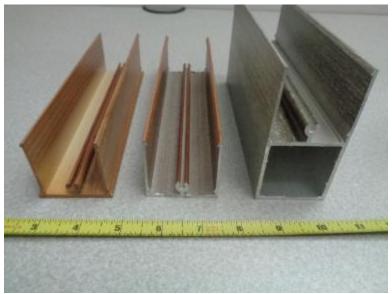


Photo No. 7 Batten Components (from Left to Right); Base Section, 2 in Cap Section, 4 in Cap Section



Photo No. 8 Typical Batten to Support Fastener



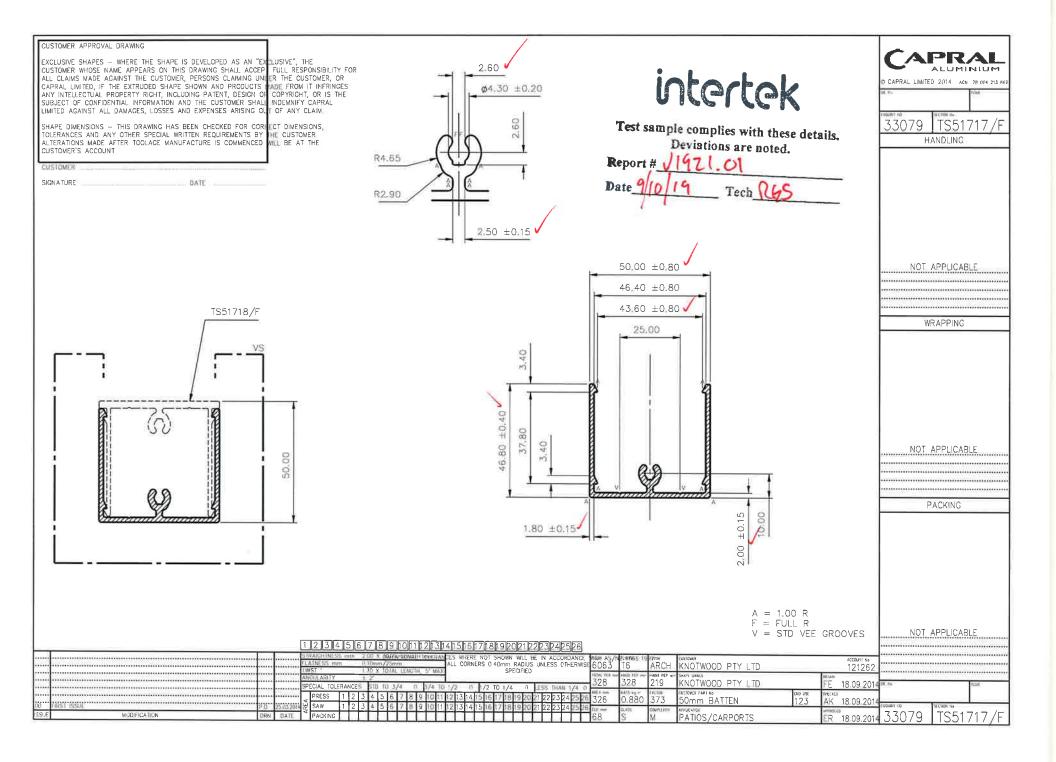
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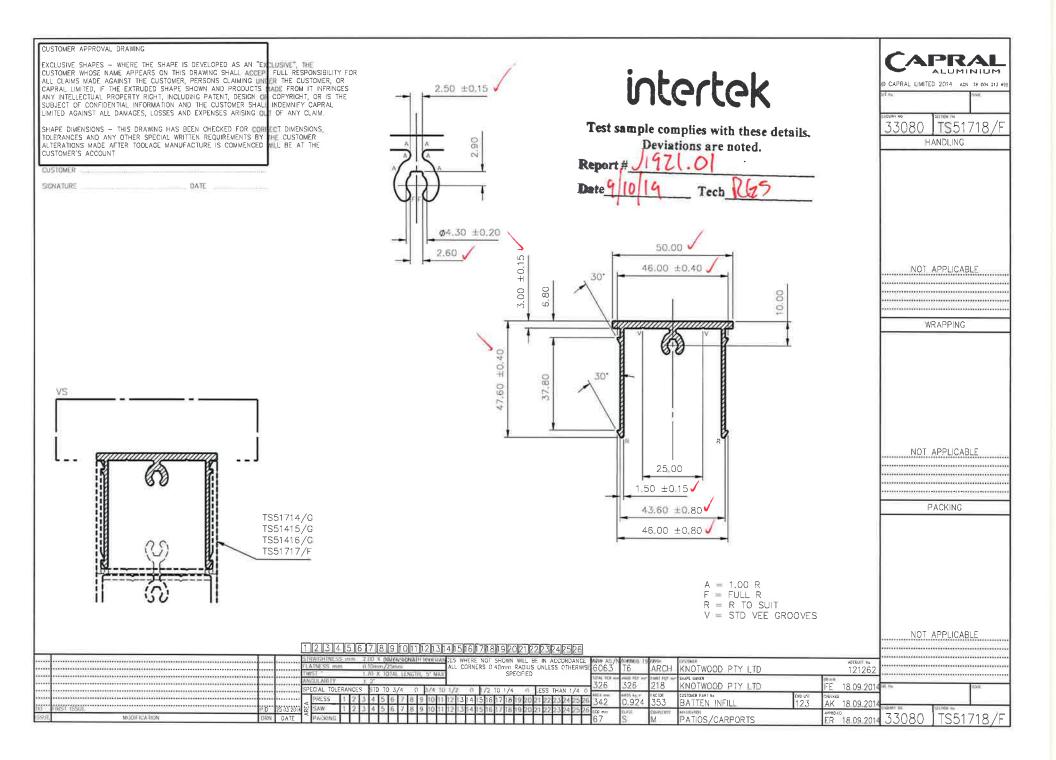
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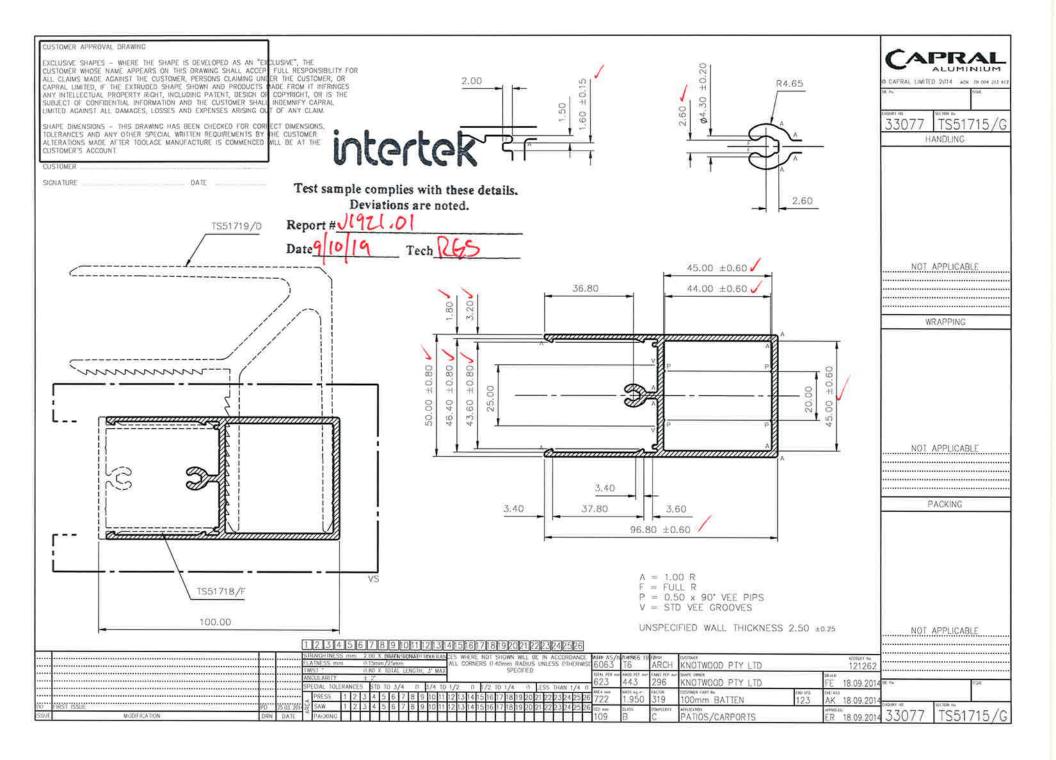
SECTION 9

DRAWINGS

The "As-Built" drawings for the 2 in by 2 in and 2 in by 4 in batten systems which follow have been reviewed by Intertek B&C and are representative of the project reported herein. Project construction was verified by Intertek B&C per the drawings included in this report. Any deviations are documented herein or on the drawings.









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SECTION 10

REVISION LOG

| REVISION # | DATE | PAGES | REVISION |
|-------------------|----------|-------|-----------------------|
| 0 | 10/08/19 | N/A | Original Report Issue |