

Third Party Load Testing AceClamp Products



Linear Testing per T-0101 Rev (A)

(Parallel to the Roof Panel Seam)

| Clamp Tested | Panel Type | Panel Material | Panel Thickness | Torque in-lbs. | Max. Linear Resistance Lbs | Safety Factor = 2 | Panel Failure |
|--------------|------------------------------------|----------------|-----------------|----------------|----------------------------|-------------------|---------------|
| ML | Firestone UC6 & UC3 | Steel | 22ga | 175 | 1382 | 691 | N |
| ML | Firestone UC6 & UC3 | Steel | 24ga | 175 | 1363 | 682 | N |
| ML | Firestone UC6 & UC3 | AL | 32ga | 135 | 1666 | 833 | Y* |
| ML | IMETCO Series 300 | Steel | 22ga | 175 | 1060 | 530 | N |
| ML | IMETCO Series 300 | Steel | 24ga | 175 | 1350 | 675 | N |
| ML | Englert A1000 | Steel | 24ga | 175 | 685 | 343 | N |
| A2 | Arch Sheet metal Prod ML-100 | Steel | 24ga | 195 | 937 | 469 | N |
| A2 | Arch Sheet metal Prod ML-150 | Steel | 24ga | 240 | 857 | 429 | N |
| A2 | Arch Sheet metal Prod SL-150 | Steel | 24ga | 195 | 736 | 368 | N |
| A2-N | Arch Sheet metal Prod SL-175 | Steel | 24ga | 175 | 800 | 400 | N |
| A2 | Englert A1000 | Steel | 24ga | 195 | 958 | 479 | N |
| A2 | Havelock Legacy Single-Lock | Steel | 26ga | 195 | 937 | 469 | N |
| A2-N | Havelock Legacy Snap Lock | Steel | 26ga | 195 | 847 | 424 | N |
| A2-N | Merchant Evans Classic Rib 305 | AL | 0.04 in | 165 | 949 | 475 | N |
| A2 | Merchant Evans Traditional Rib 306 | AL | 0.04 in | 165 | 590 | 295 | N |
| A2 | MORIN SLR | Steel | 24ga | 195 | 1320 | 660 | N |
| A2-N | Wayne Building Prod 1" Snap Seam | Steel | 24ga | 165 | 847 | 424 | N |
| A2-Nw | Classic 1.0" WeatherLock Plus | Steel | 24ga | 160 | 578 | 289 | N |
| A2-Nw | Westform Snap-Lock | Steel | 24ga | 175 | 698 | 349 | N |
| A2-Nw | Westform Snap-Lock | Steel | 26ga | 175 | 627 | 314 | N |
| A2-Nw | Westform Prolock | Steel | 24ga | 120 | 827 | 413 | N |
| A2-N | Englert S2000 | AL | 0.032 | 130 | 668 | 334 | N |
| A2 | Metal Sales Magna Loc | Steel | 24ga | 195 | 944 | 474 | N |

Vertical Testing per T-0101 Rev (A)

(Perpendicular to the Roof Panel Seam)

| Clamp Tested | Panel Type | Panel Material | Panel Thickness | Torque in-lbs. | Max Load - Lbs. | Safety Factor = 2 | Panel Failure |
|--------------|------------------------|----------------|-----------------|----------------|-----------------|-------------------|---------------|
| ML | Single-Lock | Steel | 22ga | 175 | 998 | 499 | N |
| ML | Single-Lock | Steel | 24ga | 175 | 924 | 462 | N |
| ML | Dbbl-Lock | AL | 0.032 in. | 135 | 1138 | 569 | N |
| ML | Dbbl-Lock | AL | 0.04 in. | 135 | 974 | 487 | N |
| ML | Snap-Lock | Steel | 24ga | 175 | 685 | 343 | N |
| ML | Garland R-Mer Span | Steel | 22ga | 175 | 1198 | 599 | N |
| ML | IMETCO Series 300 | Steel | 22ga | 175 | 998 | 499 | N |
| ML | Morin-Zip | AL | 0.04 in. | 135 | 1744 | 872 | N |
| ML | Morin-Zip | AL | 0.04 in. | 135 | 1843 | 922 | Y* |
| ML | Merchant Evans Zip-Rib | Galvalume | 22ga | 175 | 1503 | 752 | N |
| ML | Merchant Evans Zip-Rib | AL | 0.032 in. | 135 | 1042 | 521 | N |
| ML | Merchant Evans Zip-Rib | AL | 0.04 in. | 135 | 1023 | 512 | N |
| ML | Merchant Evans Zip-Rib | AL | 0.05 in. | 150 | 1080 | 540 | N |
| A2-N | Berridge Cee Lock | Steel | 24ga | 195 | 1200 | 600 | N |
| A2 | Butler MR-24 | Steel | 24ga | 195 | 1571 | 786 | N |
| A2-N | Englert S2000 | AL | 0.032 | 130 | 694 | 347 | N |
| A2 | Metal Sales Magna Loc | Steel | 24ga | 195 | 878 | 394 | N |



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Vertical Testing per T-0101 Rev (A) Continued (Perpendicular to the Roof Panel Seam)

| Clamp Tested | Panel Type | Panel Material | Panel Thickness | Torque in-lbs. | Max Load - Lbs. | Safety Factor = 2 | Panel Failure |
|--------------|----------------------------------|----------------|-----------------|----------------|-----------------|-------------------|---------------|
| A2 | Havelock Legacy Single-Lock | Steel | 26ga | 195 | 1006 | 503 | N |
| A2-N | Havelock Legacy Snap Lock | Steel | 26ga | 195 | 980 | 490 | N |
| A2 Mini | Merchant Evans Zip-Lok | Zinc | 0.8 mm | 165 | 1476 | 738 | N |
| A2 | Merchant Evans Zip-Lok | Steel | 24ga | 195 | 752 | 376 | N |
| A2 | MORIN SWL | Steel | 24ga | 195 | 958 | 479 | N |
| A2 | MORIN SLR | Steel | 24ga | 195 | 1376 | 688 | N |
| A2-N | Wayne Building Prod 1" Snap Seam | Steel | 24ga | 165 | 758 | 379 | N |
| A2-Brass | Taylor 12" Easy Lock | Copper | 16oz CU | 125 | 400 | 200 | Y* |
| A2-Nw | Classic 1.0" WeatherLock Plus | Steel | 24ga | 160 | 698 | 349 | N |
| A2-Nw | Westform Snap-Lock | Steel | 24ga | 175 | 815 | 408 | N |
| A2-Nw | Westform Snap-Lock | Steel | 26ga | 175 | 735 | 368 | N |
| A2-Nw | Westform Prolock | Steel | 24ga | 120 | 833 | 417 | * |

* Screws securing panel to plywood pulled out during test. AceClamp still attached to the seam. Test data 12/11/18.

Linear Testing per T-0101 Rev (A) - Snow Rails (Tested brackets and clamps on two parallel SSMR ribs)

| Clamp Assembly | Panel Type | Panel Material | Panel Thickness | Torque in-lbs. | Max Load - | Panel Failure | Comments |
|----------------|--------------------|----------------|-----------------|----------------|------------|---------------|----------------------------|
| SP1D | Butler MR-24 | Steel | 24ga | 195 | 2644 | N | |
| SP1 | Butler MR-24 | Steel | 24ga | 195 | 1227 | N | |
| SP1D | MORIN SCR | Steel | 24ga | 195 | 2946 | N | SS Screw required at ridge |
| SP1D | Merchant Evans 305 | Steel | 24ga | 195 | 2487 | N | |
| Z2-2 | Merchant Evans 305 | Steel | 24ga | 175 | 2174 | N | |

The purpose of this test is to determine “force-to-lift” rail at increasing bolt torque specs.

| Test Sample: AceClamp serrated washer | Torque - in. lbs. | Load - lb. | Failure |
|---|-------------------|------------|---------|
| The assumption is that wind uplift loads can lift a PV panel off the bottom spacer or off the rail. We tested to find the load required to lift the panel at varying torque loads. Engineering data can relate the vertical load to the wind uplift loading based on the ASCE 7-10 or local code wind tables. | 10 | 142 | No |
| | 20 | 160 | No |
| | 30 | 330 | No |
| | 40 | 490 | No |
| | 50 | 550 | No |
| | 60 | 590 | No |

*AL and CU panel failures due to seam separation or panel pulling over screws fastening to plywood deck. AceClamps still intact.

