NXT UMOUNT®

DESIGN & ENGINEERING GUIDE

PUB2023FEB15

Getting Started

This guide is for professional engineers, designers, installers, and permitting authorities. This guide provides design rules and limitation, connection strengths, and maximum allowable span tables. For assistance with project design and a Bill of Materials, see our U-builder at https://design.unirac.com/

NXT UMOUNT Flush-to-Roof is an extruded aluminum rail system that is engineered to hold most framed solar modules to a roof structure and installed parallel to the planar roof surface.

Some of the features of this product include:

- Integrated system grounding and bonding to UL 2703
- Fully Structural Internal Rail Splice with integrated bonding
- Combination module mid clamp and end clamp with integrated bonding
- System ground wire lug and MLPE mounting clamp with integrated bonding
- Accommodates landscape or portrait module orientations with rail parallel or perpendicular to roof slope
- Compatible with most framed modules with thickness of 30-40mm
- In-Rail and accessory wire management options
- Designed per the ASCE 7-10 and ASCE 7-16 Building Code
- Mechanical and electrical component testing
- Rigorous engineering analysis
- Superior aesthetics
- Optional end caps

Installer Responsibility & Disclaimer

Please review this guide and the NXT UMOUNT Installation Guide thoroughly before installing your NXT UMOUNT system. These guides provide supporting documentation for building permit applications, planning, and assembling the system.

The installer is solely responsible for:

- Complying with all applicable local or national building codes, including code requirements that can be more stringent than the guidelines set forth in this guide;
- Maintaining and enforcing all aspects of a safe working environment;
- Ensuring safe installation of all electrical aspects of the PV array, including proper grounding/bonding;
- Array shading and output analysis;
- Comply with module manufacturer's specification;
- Using only Unirac parts and installer-supplied parts as specified by Unirac (substitution of parts may void the warranty and invalidate the letters of certification in all Unirac publications);
- Ensuring that Unirac and other products are appropriate for the installation and the installation environment;
- Ensuring that the supporting roof, its rafters, connections, and any other structural support members can support the array under all code level loading conditions (this total building assembly is referred to as the building structure);
- Ensuring the attachment to the roof structure is adequate to support loads in your installation location;
- Maintaining the waterproof integrity of the roof, including selection and proper installation of appropriate flashing techniques, if required;
- Ensuring correct and appropriate design parameters are used in determining the design loading used for design of the specific installation. Parameters, such as snow loading, wind speed, exposure and topographic factor should be confirmed with the local building official or a licensed professional engineer.

Unirac shall not be liable for any losses, damages, or injuries that directly or indirectly result from any non-conformance with the above.

Design Methodology

The NXT UMOUNT system was designed based on, and complies with the following codes and specifications:

1. Minimum Design Loads for Buildings and other Structures, ASCE/SEI 7-05, ASCE/SEI 7-10, ASCE/SEI 7-16.
2. 2006-2018 International Building Code, by International Code Council, Inc. w/ Provisions from SEAOC PV-2 2017.
3. 2006-2018 International Residential Code, by International Code Council, Inc. w/ Provisions from SEAOC PV-2 2017.
4. AC428, Acceptance Criteria for Modular Framing Systems Used to Support Photovoltaic (PV) Panels, November 1, 2012 by ICC-ES.
5. 2015 Aluminum Design Manual, by The Aluminum Association, 2015.

Note – The online U-Builder is highly recommended for all qualifying projects. It will provide you with a Bill of Materials, Certification Letter, and Calculations for your project., including maximum allowable rail spans and rail attachment reaction forces on the supporting structure. https://design.unirac.com/

Note – Maximum allowable rail spans are provided in Appendix H of this guide. Values in span tables are based on the same engineering methodology and calculation algorithms used for U-Builder and are provided here for reference.

Rail Spans, Cantilevers and Splice Joints

Each row of modules mount on at least 2 parallel rails and can be oriented up-slope (high profile mode) or cross slope (low profile mode), with modules oriented in portrait or landscape. Modules should be placed such that they overhang the rails symmetrically. Module rows may require mounting on 3 parallel rails to increase spans and/or reduce loads on module clamps.

A *rail span* is the distance between adjacent *rail attachments* (see Appendix F). Maximum allowable rail spans depend on site specific design loads or local code requirements. For maximum allowable spans, reference span tables in this guide or Ubuilder online design tool at https://design.unirac.com/. Rail attachment reaction forces on the supporting structure are provided by the Ubuilder. It is the installer's responsibility to ensuring that the supporting structure and the attachment to the roof structure is adequate to support site specific design loads. The American Wood Counsel provides resources for determining lag bolt connection capacities.

A *rail cantilever* is the length of rail extending past the first or last attachment in a row of modules, unsupported at one end. The maximum rail cantilever length is 1/3 of the adjacent span.

A *rail splice* joint is an assembly where the ends of 2 rails are joined to form a continuous run of rail. The splice bar is centered over the joint where rail ends meet. The joint is secured with 4 bolts (2 per rail) through the splice bar and into the rails. The splice provides electrical bonding continuity across the splice, alignment of rails, and structural continuity across the splice joint. NXT UMOUNT Splices can be installed anywhere within a span. Splice joints can be spanned by a PV module, can be installed at the same location as an attachment, and module clamps can be installed at splice locations.

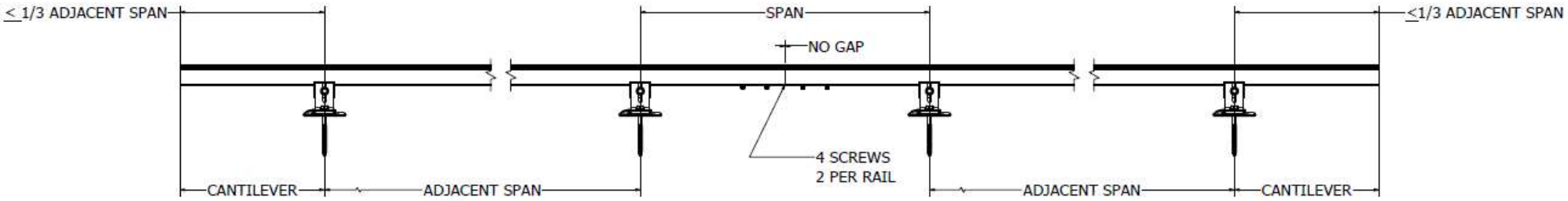


Figure 1: Rail Spans, Cantilevers and Splice Joints

Thermal Expansion Breaks

Thermal expansion breaks are separations between continuous spliced rail lengths to prevent failure of rails, rail/splice connections, attachments or system failure due to thermal expansion or contraction. Determine location of thermal breaks prior to installation of rail attachments. The separation gap between rails must be 0.5" minimum or sufficient for proper installation of modules. A thermal break must not be spanned by a PV module. Installing a module over a thermal break would defeat its goal and could result in damage to the array.

Rails in expansion joint configurations are cantilevered and must follow the cantilever rule on both sides of the expansion joint, which states that the maximum rail cantilever distance is 1/3 of the adjacent span.

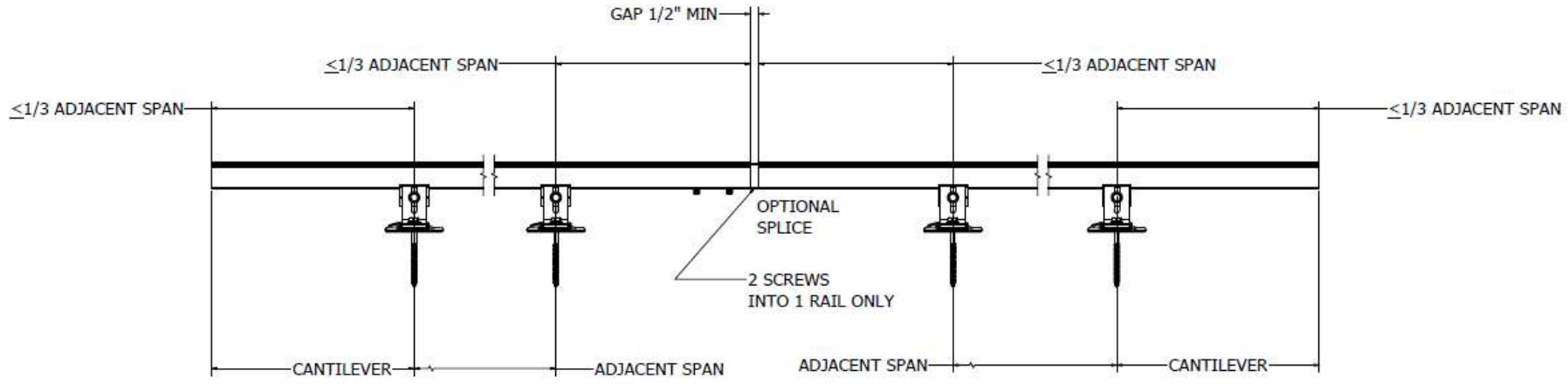


Figure 2: Expansion Joint

Allowable Spliced Rail Lengths

Maximum allowable continuous spliced rail lengths before a thermal expansion break are given in the following tables. These values do not include cantilever. These values apply only to the NXT UMOUNT System. The installer is responsible for determining the maximum temperature difference (ΔT) used to establish maximum spliced rail lengths at the install location. ΔT is the maximum difference in measured temperature of the rail during installation and the extreme high or low temperature of the install location. Alternately, ΔT is the difference between the extreme high and the extreme low for your location. The Extreme Annual Design Conditions table at the following URL can be used as a reference when determining ΔT.
http://ashrae-meteo.info/

CAUTION: As spans increase, so does the maximum reaction force that rails can exerts on roof connections. It's the designer's responsibility to ensure that *Maximum Reaction Forces* do not exceed the shear capacity of the roof connection. See tables below for corresponding reaction forces.

Maximum Continuous Spliced Rail Length for NXT UMOUNT Rail with Stronghold Attachment (ft.)/Maximum Reaction Force (lbs)

	Attachment Spacing		
ΔT	**24"**	**48"**	**72"**
40	66 / 153	92 / 214	114 / 265
50	58 / 168	84 / 244	102 / 296
60	54 / 188	76 / 265	90 / 314
70	50 / 203	68 / 276	78 / 317
80	46 / 214	60 / 279	78 / 363
90	42 / 219	60 / 314	66 / 345
100	42 / 244	52 / 302	64 / 372
120	38 / 265	52 / 363	53 / 369
140	34 / 276	44 / 358	45 / 366

Maximum Continuous Spliced Rail Length for NXT UMOUNT Rail with Flashkit Pro Attachment (ft.)/Maximum Reaction Force (lbs)

	Attachment Spacing		
ΔT	**24"**	**48"**	**72"**
40	74 / 137	100 / 185	126 / 233
50	66 / 153	92 / 213	114 / 264
60	62 / 172	84 / 233	102 / 284
70	54 / 175	76 / 246	90 / 292
80	50 / 185	68 / 252	90 / 334
90	50 / 208	68 / 299	78 / 325
100	46 / 213	60 / 278	78 / 362
120	42 / 233	60 / 334	66 / 367
140	38 / 246	52 / 337	57 / 370

Allowable Spliced Rail Lengths Cont.

STRONGHOLD BUTYL ATTACHMENT WITH #12-14 SCREW, HWH, SS SELF-DR W/ #12 EPDM WASHER

Maximum Continuous Spliced Rail Length for NXT UMOUNT Rail with DTD BUTYL ATT Rafter Connection (ft.)/Maximum Reaction Force (lbs)

	Attachment Spacing		
ΔT	24"	48"	72"
40	54 / 188	76 / 264	90 / 313
50	50 / 217	68 / 296	78 / 339
60	46 / 240	60 / 313	78 / 407
70	42 / 256	52 / 317	66 / 402
80	38 / 264	52 / 362	60 / 418
90	34 / 266	44 / 364	54 / 423
100	34 / 296	44 / 383	48 / 418
120	30 / 313	40 / 418	40 / 418
140	26 / 317	34 / 414	34 / 414

STRONGHOLD BUTYL ATTACHMENT WITH #14-14 SCREW X 3.0 TYPE AB, W/ #14 EPDM WASHER

Maximum Continuous Spliced Rail Length for NXT UMOUNT Rail with DTD BUTYL ATT Rafter Connection (ft.)/Maximum Reaction Force (lbs)

	Attachment Spacing		
ΔT	**24"**	**48"**	**72"**
40	58 / 179	84 / 260	102 / 316
50	54 / 209	68 / 263	90 / 348
60	46 / 213	68 / 316	78 / 362
70	42 / 227	60 / 325	66 / 358
80	42 / 260	52 / 322	66 / 409
90	38 / 265	52 / 382	60 / 418
100	34 / 263	52 / 403	54 / 418
120	34 / 316	44 / 409	45 / 418
140	30 / 325	36 / 390	39 / 423

Allowable Spliced Rail Lengths Cont.

STRONGHOLD BUTYL ATTACHMENT AS DECK ATTACHMENT ON OSB

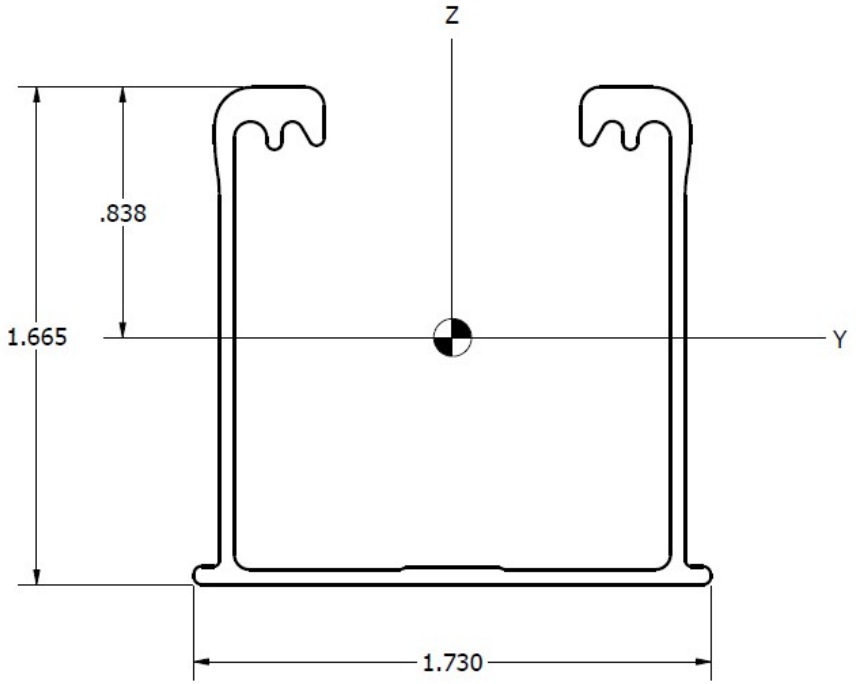
Maximum Continuous Spliced Rail Length For NXT on OSB (ft.)						
	Attachment Spacing					
ΔT	12"	24"	36"	48"	60"	> 60"
40	31	42	57	60	75	78
50	27	38	51	60	65	66
60	25	38	45	52	55	56
70	23	34	39	48	48	48
80	21	30	39	42	42	42
90	21	30	37	37	37	37
100	19	30	33	34	34	34
120	19	26	28	28	28	28
140	17	24	24	24	24	24

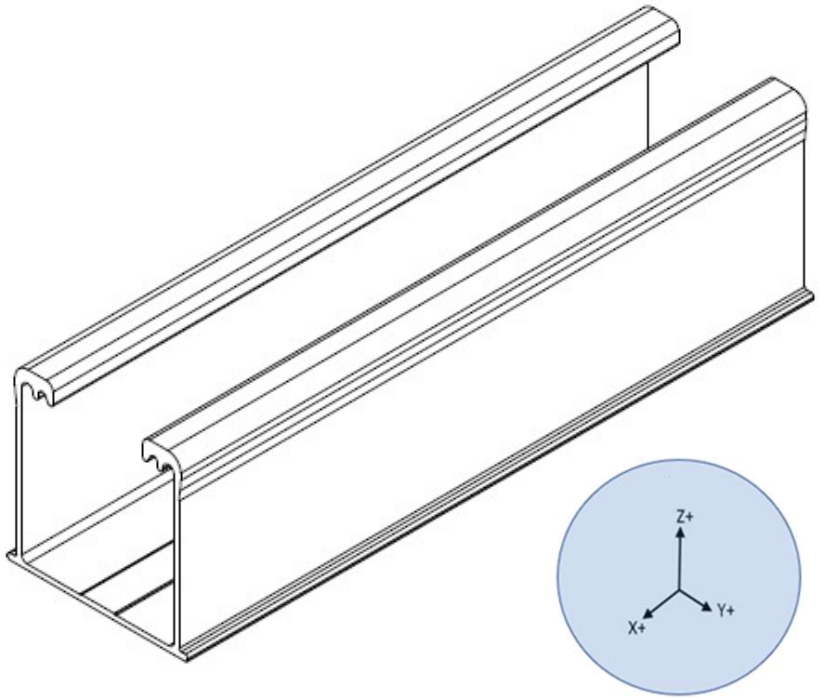
STRONGHOLD BUTYL ATTACHMENT AS DECK ATTACHMENT ON PLYWOOD

Maximum Continuous Spliced Rail Length for NXT on Plywood (ft.)						
	Attachment Spacing					
ΔT	12"	24"	36"	48"	60"	> 60"
40	29	38	45	52	55	66
50	25	34	39	44	55	54
60	23	30	39	44	45	54
70	21	30	33	36	45	42
80	19	26	33	36	35	42
90	19	26	33	36	35	37
100	17	22	27	28	34	34
120	15	22	27	28	28	28
140	15	18	21	24	24	24

NXT UMOUNT Rail Properties

Material: 6000 Series Aluminum Alloys
Ultimate Tensile: 38 ksi, Yield: 35 ksi
Finish: Mill or Dark Anodized



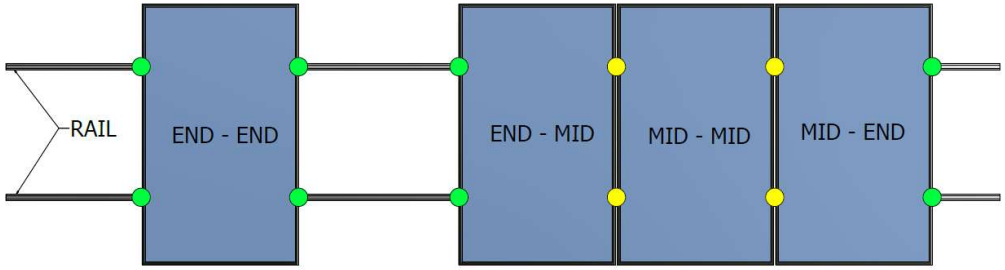


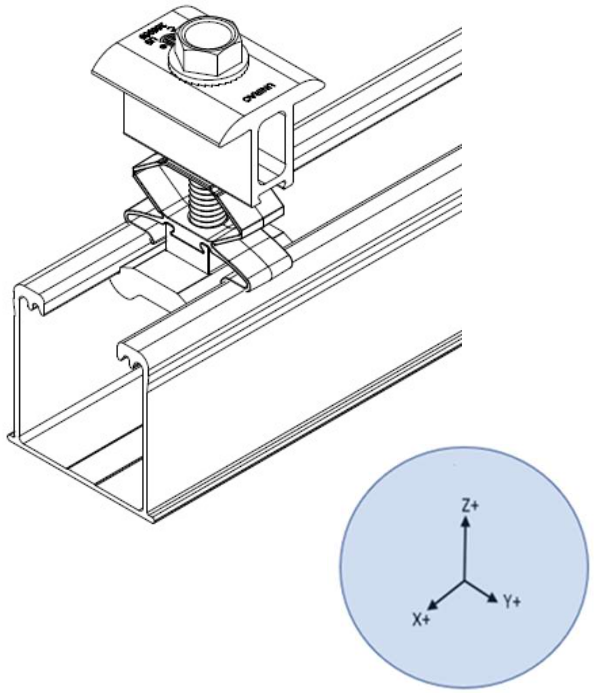
RAIL PROPERTIES

APPROX WEIGHT	0.401	lbs/ft
CROSS SECTION AREA	0.343	in^2
SECTION MODULUS (Y-AXIS)	0.173	in^3
SECTION MODULUS (Z-AXIS)	0.168	in^3
MOMENT OF INERTIA (Y-AXIS)	0.145	in^4
MOMENT OF INERTIA (Z-AXIS)	0.145	in^4
RADIUS OF GYRATION (Y-AXIS)	0.649	in
RADIUS OF GYRATION (Z-AXIS)	0.653	in

Module Clamp Connection Strength – COMBO CLAMPS ONLY

Values in the following table are demand load limitations per module and apply for 2-rail configurations, where modules are secured by 4 clamps. For 3-rail configurations, where modules are secured by 6 clamps, multiple tabulated values by 1.5.





Module Condition Definitions:

END-END: The END-END module shown above, correlating with the loads below, indicates a module that is secured by 4 end clamps on 2 rails.

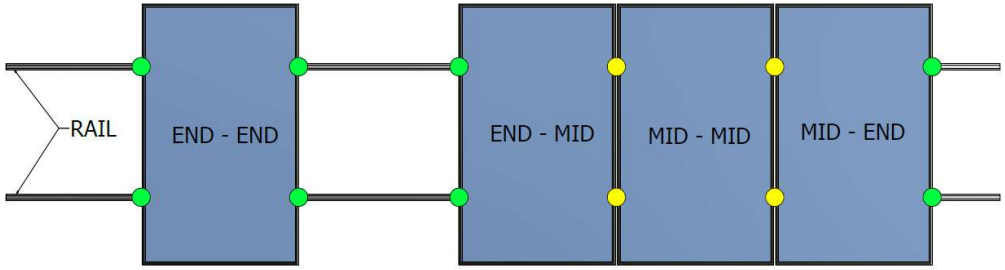
END-MID/MID-END: The END-MID and MID-END modules shown above, correlating with the loads below, indicate modules that are secured by 2 End clamps and 2 Mid clamps on 2 rails.

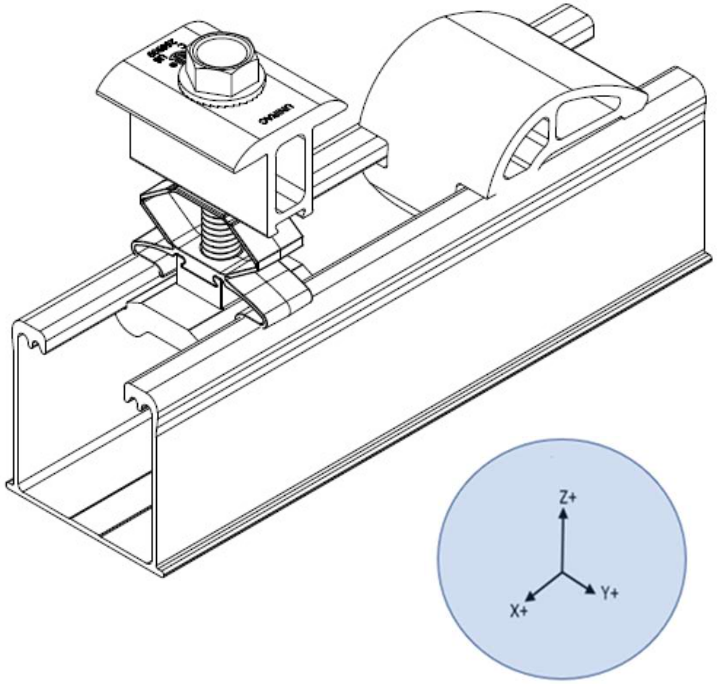
MID-MID: The MID-MID module shown above, correlating with the loads below, indicate a module that is properly secured by 4 Mid clamps on 2 rails.

NXT UMOUNT Combo Clamp Load Limits per Module						
Load Direction	Allowable Load (lbs)			Design Load (lbs)		
	End-End	Mid-End	Mid-Mid	End-End	Mid-End	Mid-Mid
Z+, Tension	2796	2308	1820	4228	3491	2754
Y±, Transverse	652	862	1072	988	1306	1624
X±, Sliding	504	846	1188	760	1278	1796

Module Clamp Connection Strength – COMBINATION OF COMBO CLAMP AND HIDDEN END CLAMP

Values in the following table are demand load limitations per module and apply for 2-rail configurations, where modules are secured by 4 clamps. For 3-rail configurations, where modules are secured by 6 clamps, multiple tabulated values by 1.5.





Module Condition Definitions: Combination of Combo Clamp (as Mid) and Hidden End Clamp (as End)

END-END: The END-END module shown above, correlating with the loads below, indicates a module that is secured by 4 end clamps on 2 rails.

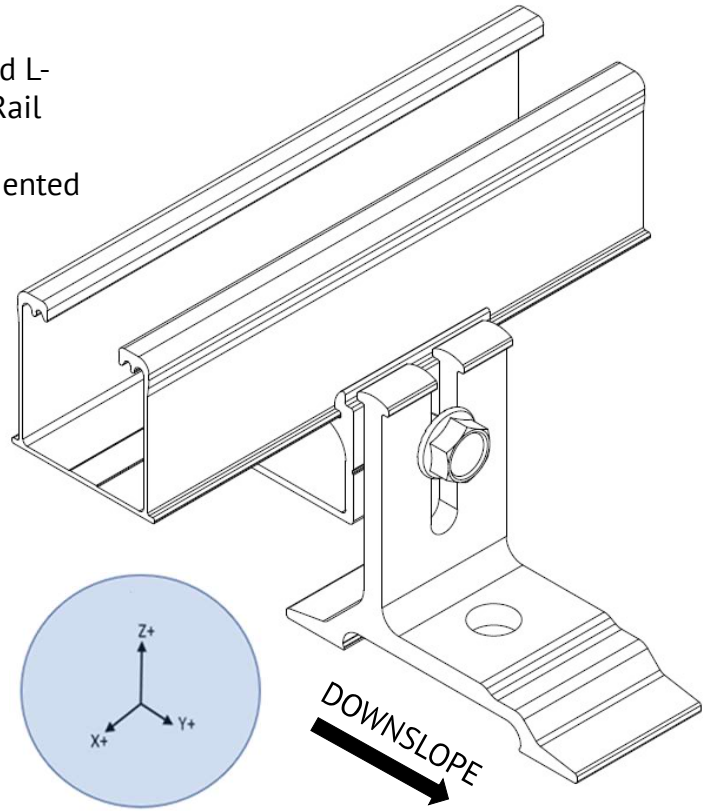
END-MID/MID-END: The END-MID and MID-END modules shown above, correlating with the loads below, indicate modules that are secured by 2 End clamps and 2 Mid clamps on 2 rails.

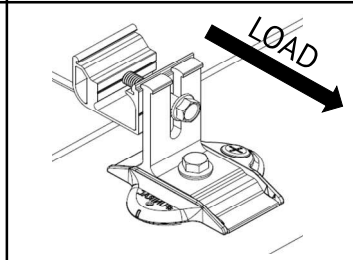
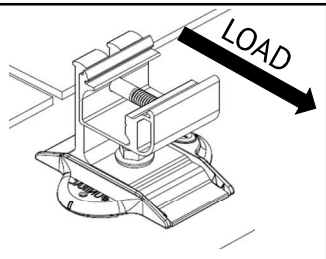
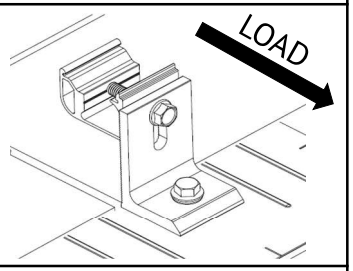
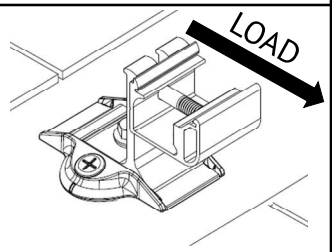
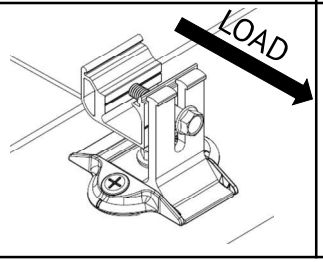
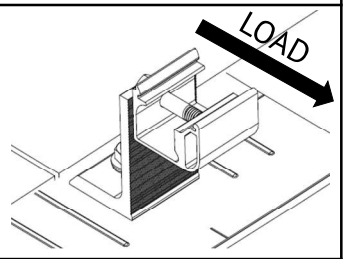
MID-MID: The MID-MID module shown above, correlating with the loads below, indicate a module that is properly secured by 4 Mid clamps on 2 rails.

NXT UMOUNT Combination Combo Clamp + Hidden End Clamp Load Limits per Module						
Load Direction	**Allowable Load (lbs)**			**Design Load (lbs)**		
	End-End	Mid-End	Mid-Mid	End-End	Mid-End	Mid-Mid
Z+, Tension	1844	1832	1820	2792	2773	2754
Y±, Transverse	776	854	1072	1172	1292	1624
X±, Sliding	990	398	1188	1496	600	1796

STRONGHOLD, FLASHKIT PRO, and L-FOOT Rail Attachment Connection Strength

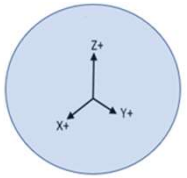
Rail Attachments connect the rail to the supporting roof structure using a Rail Clamp and L-foot. Values in the following table apply to the Stronghold Attachment kit, Stronghold Rail Clamp with Flashkit PRO, and Stronghold Rail Clamp with Unirac Standard L-foot. Rail Clamps may be installed on either side of the Stronghold L-foot. See table for L-foot oriented in Y+ and Y- directions.



	Stronghold Attachment Kit		Flashkit Pro and Standard L-Foot
Y+			
Y-			

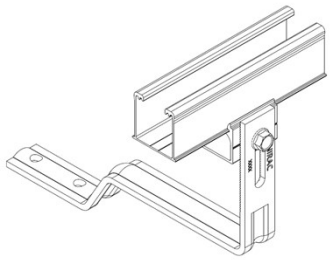
NXT UMOUNT Rail Attachment Connection Strength per Attachment					
Load Direction	X±	Y+	Y-	Z +	Z-
Average Ultimate Load [lbs]	954.0	615.1	668.5	2080.4	2151.8
Design Load [lbs]	564.8	360.4	435.2	1315.6	1395.4
Resistance factor Φ	0.6	0.6	0.7	0.6	0.6
Allowable Load [lbs]	373.4	238.3	287.7	869.8	922.5
Safety Factor Ω	2.6	2.6	2.3	2.4	2.3

SOLARHOOKS Rail Attachment Connection Strength

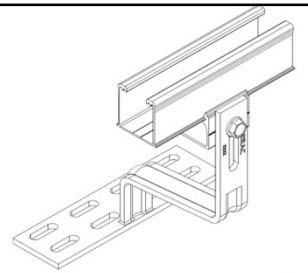


Values in the following table apply to the Stronghold Rail Clamp with SolarHooks for systems installed on tile roofs. Rail Clamps must be installed on the serration side of the Solarhooks.

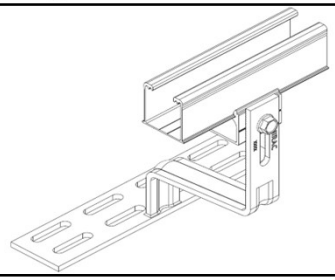
AT1 SolarHooks with NXT UMOUNT Rail Attachment Connection Strength per Attachment				
Load Direction	X±	Y+	Z +	Z-
Average Ultimate Load [lbs]	627	478	833	476
Design Load [lbs]	371	296	516	-
Resistance factor Φ	0.6	0.619	0.619	-
Allowable Load [lbs]	242	196	341	317
Safety Factor Ω	2.6	2.443	2.442	1.5



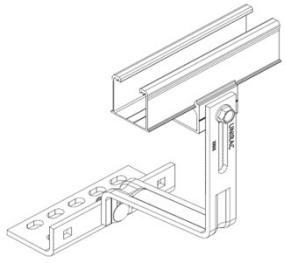
CT1 SolarHooks with NXT UMOUNT Rail Attachment Connection Strength per Attachment				
Load Direction	X±	Y+	Z +	Z-
Average Ultimate Load [lbs]	294	541	926	476
Design Load [lbs]	173.9	362	623	-
Resistance factor Φ	0.6	0.669	0.673	-
Allowable Load [lbs]	113	239	412	317
Safety Factor Ω	2.6	2.260	2.247	1.5



CT2 SolarHooks with NXT UMOUNT Rail Attachment Connection Strength per Attachment				
Load Direction	X±	Y+	Z +	Z-
Average Ultimate Load [lbs]	256	542	848	476
Design Load [lbs]	151.1	369	556	-
Resistance factor Φ	0.6	0.681	0.656	-
Allowable Load [lbs]	98	244	368	317
Safety Factor Ω	2.6	2.222	2.306	1.5



CT5 SolarHooks with NXT UMOUNT Rail Attachment Connection Strength per Attachment				
Load Direction	X±	Y+	Z +	Z-
Average Ultimate Load [lbs]	155	447	1575	476
Design Load [lbs]	114	268	995	-
Resistance factor Φ	0.733	0.601	0.632	-
Allowable Load [lbs]	75	177	658	317
Safety Factor Ω	2.063	2.518	2.394	1.5

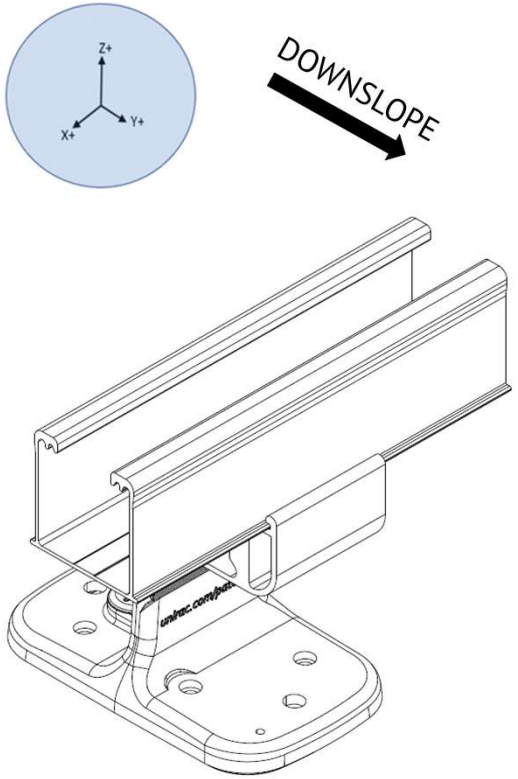


FLASHLOC DUO Rail Attachment Connection Strength

Values in the following table apply to the Stronghold Rail Clamp with FLASHLOC DUO for systems installed on compatible roofing materials and only with Unirac supplied wood screws. Flashloc DUO may be secured to rafters with the provided 2 wood screws or to roof sheathing with 6 wood screws. Rail Clamps must be installed on the serration side of the attachment with the sealant port on the up-slope side. Refer to the Unirac Flashloc DUO Installation Guide and Design and Engineering Guide to complete instructions. For rafter attachment, the installer is responsible for ensuring the attachment to the roof structure is adequate to support loads in your installation location. Tested wood types for sheathing attached systems:

- 24/16 APA rated 7/16" OSB
- 32/24 APA rated 15/32" Plywood

FLASHLOC DUO with NXT UMOUNT Rail Attachment Connection Strength per Attachment				
FLASHLOC DUO for Rafter Mounting				
Load Direction	X±	Y+	Z +	Z-
Average Ultimate Load [lbs]	248	473	1089	1076
Design Load [lbs]	164	289	693	688
Resistance factor Φ	0.7	0.6	0.6	0.6
Allowable Load [lbs]	108	191	458	455
Safety Factor Ω	2.3	2.5	2.4	2.4
FLASHLOC DUO for 15/32" Plywood Sheathing Mounting				
Load Direction	X±	Y+	Z +	Z-
Average Ultimate Load [lbs]	420	298	498	425
Design Load [lbs]	-	192	-	-
Resistance factor Φ	-	0.65	-	-
Allowable Load [lbs]	140	127	166	170
Safety Factor Ω	3	2.35	3	2.5
FLASHLOC DUO for 7/16" OSB Sheathing Mounting				
Load Direction	X±	Y+	Z +	Z-
Average Ultimate Load [lbs]	307	248	406	312
Design Load [lbs]	-	124	-	-
Resistance factor Φ	-	0.5	-	-
Allowable Load [lbs]	102	82	135	124
Safety Factor Ω	3	3.03	3	2.5



STRONGHOLD ATTACHMENT WITH BUTYL Connection Strength

Values in the following table apply to the Stronghold Rail Clamp with STRONGHOLD ATTACHMENT WITH BUTYL for systems installed on compatible roofing materials and only with Unirac supplied wood screws. STRONGHOLD ATTACHMENT WITH BUTYL may be secured to rafters with the provided 2 wood screws or to roof sheathing with 6 wood screws. Rail Clamps must be installed on the serration side of the attachment. Refer to the Unirac NXT UMOUNT Installation Guide and Design and Engineering Guide to complete instructions. For rafter attachment, the installer is responsible for ensuring the attachment to the roof structure is adequate to support loads in your installation location. Tested wood types for sheathing attached systems:

- 24/16 APA rated 7/16" OSB
- 32/24 APA rated 15/32" Plywood

STRONGHOLD ATT W/BUTYL and STRONGHOLD Rail Clamp with NXT UMOUNT Rail Connection Strength per Attachment

STRONGHOLD ATT W/BUTYL for Rafter Mounting using #12 screw

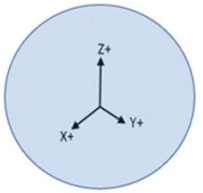
Load Direction	X±	Y-	Y+	Z +	Z-
Average Ultimate Load [lbs]	168	566	733	1604	2206
Design Load [lbs]	-	387	484	-	1501
Resistance factor Φ	-	0.682	0.661	-	0.68
Allowable Load [lbs]	117	256	320	535	992
Safety Factor Ω	1.45	2.2	2.289	3	2.2

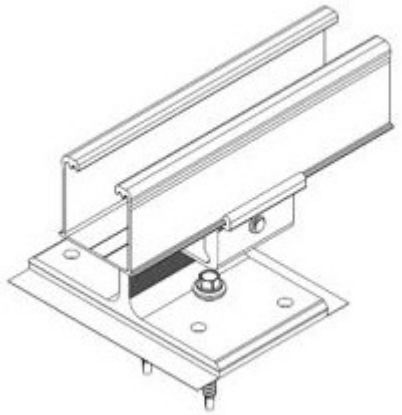
STRONGHOLD ATT W/BUTYL for 15/32" Plywood Sheathing Mounting using #12 screw

Load Direction	X±	Y+	Z +	Z-
Average Ultimate Load [lbs]	420	298	498	425
Design Load [lbs]	-	192	-	-
Resistance factor Φ	-	0.65	-	-
Allowable Load [lbs]	140	127	166	170
Safety Factor Ω	3	2.35	3	2.5

STRONGHOLD ATT W/BUTYL for 7/16" OSB Sheathing Mounting using #12 screw

Load Direction	X±	Y+	Z +	Z-
Average Ultimate Load [lbs]	307	248	406	312
Design Load [lbs]	-	124	-	-
Resistance factor Φ	-	0.5	-	-
Allowable Load [lbs]	102	82	135	124
Safety Factor Ω	3	3.03	3	2.5





STRONGHOLD ATTACHMENT WITH BUTYL Connection Strength

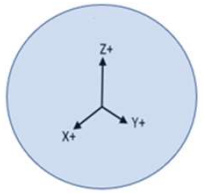
Values in the following table apply to the Stronghold Rail Clamp with STRONGHOLD ATTACHMENT WITH BUTYL for systems installed on compatible roofing materials and only with Unirac supplied wood screws. STRONGHOLD ATTACHMENT WITH BUTYL may be secured to rafters with the provided 2 wood screws or to roof sheathing with 6 wood screws. Rail Clamps must be installed on the serration side of the attachment. Refer to the Unirac NXT UMOUNT Installation Guide and Design and Engineering Guide to complete instructions. For rafter attachment, the installer is responsible for ensuring the attachment to the roof structure is adequate to support loads in your installation location. Tested wood types for sheathing attached systems:

- 24/16 APA rated 7/16" OSB
- 32/24 APA rated 15/32" Plywood

STRONGHOLD ATT W/BUTYL and STRONGHOLD Rail Clamp with NXT UMOUNT Rail Connection Strength per Attachment

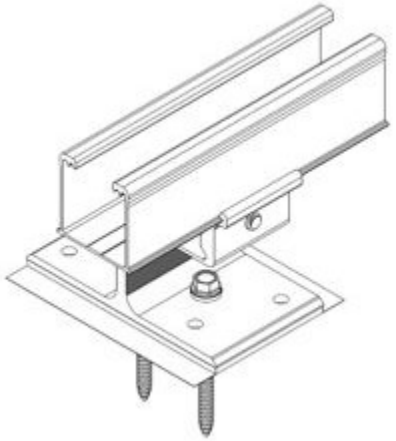
STRONGHOLD ATT W/BUTYL for Rafter Mounting using #14 screw

Load Direction	X±	Y-	Y+	Z +	Z-
Average Ultimate Load [lbs]	168	566	733	2336	2206
Design Load [lbs]	-	387	484	-	1501
Resistance factor Φ	-	0.682	0.661	-	0.68
Allowable Load [lbs]	117	256	320	779	992
Safety Factor Ω	1.45	2.2	2.289	3	2.2



STRONGHOLD ATT W/BUTYL for 15/32" Plywood Sheathing Mounting using #14 screw

Load Direction	X±	Y+	Z +	Z-
Average Ultimate Load [lbs]	420	298	498	425
Design Load [lbs]	-	192	-	-
Resistance factor Φ	-	0.65	-	-
Allowable Load [lbs]	140	127	166	170
Safety Factor Ω	3	2.35	3	2.5



STRONGHOLD ATT W/BUTYL for 7/16" OSB Sheathing Mounting using #14 screw

Load Direction	X±	Y+	Z +	Z-
Average Ultimate Load [lbs]	307	248	406	312
Design Load [lbs]	-	124	-	-
Resistance factor Φ	-	0.5	-	-
Allowable Load [lbs]	102	82	135	124
Safety Factor Ω	3	3.03	3	2.5

Design Criteria for Span Tables:

Values in the maximum allowable rail span tables provided herein are subject to the following general criteria and additional criteria shown on individual span tables sheets. Values in span tables are based on the same engineering methodology and calculation algorithms used for U-Builder and are provided here for reference.

Building Assumptions

- Building Risk Category I, II or III per criteria shown on individual span tables sheets
- Mean Roof Height = 0 – 60 ft per criteria shown on individual span tables sheets
- Roof Pitch: 0°-45°
- Site Elevation: 0 ft

Wind Design Assumptions

- Exposure Category B, C, or D
- Basic Wind Speed = 90 – 180 mph
- Level terrain. Topographic factor, k_{zt} = 1.0
- γ_E = 1.0 for 'Interior' spans, γ_E = 1.5 for 'Exposed' spans (ASCE 7-16 Sec. 29.4.3, Fig. 29.4-7)

Snow Design Assumptions

- Ground Snow Load = 0-70 psf
- Exposure Factor = 1.0
- Thermal Factor = 1.0
- Results based on uniform snow load

Seismic Design Assumptions

- 0.2-s Spectral Response Acceleration, $S_S \leqslant 3$
- Seismic site class A, B, C, or D

Array Assumptions

- Total array dead load: 3 psf
- Module orientation and Rail direction per criteria shown on individual span tables sheets.
- Maximum module dimensions of 40.1" x 67" or 41" x 80" for 60 Cell or 72 cell module types, respectively.
- Minimum distance between modules and roof edge is at least twice the module height above roof surface.
- Modules are parallel to roof surface and maximum height above roof surface is 5" to 10" depending on attachment type.
- Gaps between module rows and columns is 0.5".
- 'Exposed' spans as defined in ASCE 7-16 sec. 29.4.4 shall be used when any part of an exposed module or panel as is attributed to that span.
- The most restrictive of all roof zone spans shall be used when any part of the module is attributed to that span.