

Allowable Loads for Joist Hangers with Gaps

As a requirement of the building codes, Simpson Strong-Tie® joist and truss hangers are tested in accordance with approved standards which define how to construct the test setup, how to load the assembly, and how to interpret the results. The test standards and Acceptance Criteria for these hangers, ASTM D7147 and ICC-ES AC13, require that they be tested with a $\frac{1}{8}$ " gap between the end of the carried member and the carrying member. Therefore, for hangers to achieve the full published allowable loads, the same conditions must be met in the field, i.e., that gaps between the carried member and carrying member not exceed $\frac{1}{8}$ ".

Testing performed by Simpson Strong-Tie has indicated that joist and truss hanger allowable loads are decreased when larger gaps are present. The amount of decrease in allowable load depends on the size of the gap, the type of hanger used and the type and location of fasteners. Figures 1 and 2 below illustrate two ways in which gaps affect performance.

Figure 1 – Rotational Effects of Joist Hanger Gaps on Download Capacity (Side View)

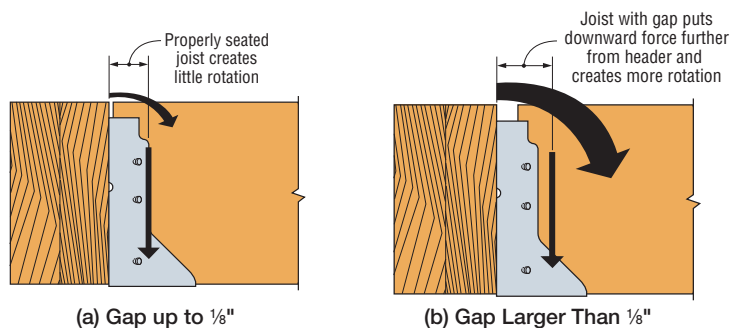
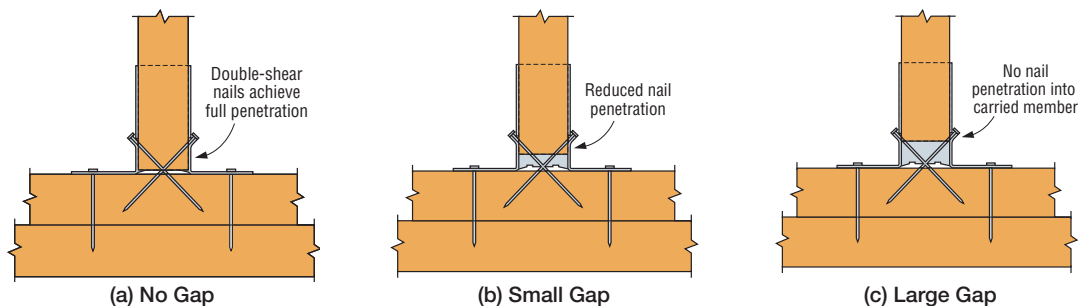


Figure 2 – Effects of Gaps on Double-Shear Nailing for Uplift Capacity (Top View)



If a gap larger than $\frac{1}{8}$ " exists between the end of a carried member and the girder, the reduced capacity of the connection must be evaluated. Testing was performed to establish allowable loads or reduction factors for common truss hangers with gaps up to $\frac{3}{8}$ ". This information is shown in Tables 1, 2 and 3. Testing was also performed to determine possible field remedies and repair scenarios when needed for a gap condition. Based on these additional tests, some possible repair options are provided on pp. 5 and 6 for use by the truss designer or another design professional.

Recommended action for hangers with gaps larger than $\frac{1}{8}$ "

- In all cases involving a gap between the end of a carried truss and the girder that exceeds $\frac{1}{8}$ ", the truss manufacturer should be notified to ensure that the truss is not adversely affected by the gap. In addition, all field remedies and repairs for gaps must be designed and approved by the truss designer or another design professional.
- For gaps up to $\frac{3}{8}$ ", refer to the allowable loads in Tables 1 (DF/SP) and 2 (SPF/HF) for face-mount hangers and reduction factors in Table 3 for additional hangers. (**Note:** Allowable loads for HTU hangers with gaps up to $\frac{1}{2}$ " are given in Table 6.) If the reduced allowable loads for a gap greater than $\frac{1}{8}$ " meet or exceed the design loads (download and uplift) for the hanger, the hanger is adequate and requires no repair to carry the loads. If any design load exceeds the corresponding allowable load, a repair or field modification is required to meet the design loads. See pp. 5 and 6 for some possible repair options.
- For gaps greater than $\frac{3}{8}$ " ($\frac{1}{2}$ " for the HTU series), a repair is required unless otherwise approved. See p. 5 for some possible repair options.

Allowable Loads for Joist Hangers with Gaps

Table 1 — DF/SP Allowable Loads

Model No.	Up to 1/8" Gap Between the Joist and Header ¹					Up to 3/8" Gap Between the Joist and Header ¹				
	Uplift ² (160)	Floor (100)	Snow (115)	Roof (125)	Wind ³ (160)	Uplift ² (160)	Floor (100)	Snow (115)	Roof (125)	Wind ³ (160)
Single 2x Sizes										
LUS24	435	670	765	820	1,045	225	640	655	655	660
LUS26	1,165	865	990	1,070	1,355	445	830	860	860	860
MUS26	930	1,295	1,480	1,560	1,560	645	1,295	1,480	1,560	1,560
HUS26	1,320	2,735	3,095	3,235	3,235	790	2,370	2,580	2,580	2,580
HGUS26	1,040	4,355	4,875	5,230	5,390	725	2,660	2,680	2,680	2,680
LUS28	1,165	1,100	1,260	1,350	1,725	445	1,055	1,075	1,075	1,075
MUS28	1,320	1,730	1,975	2,125	2,255	935	1,730	1,975	2,050	2,050
HUS28	1,760	4,095	4,095	4,095	4,095	1,305	3,295	3,295	3,295	3,295
HGUS28	1,650	7,275	7,275	7,275	7,275	1,190	4,155	4,155	4,155	4,155
LUS210	1,165	1,335	1,530	1,640	2,090	445	1,275	1,310	1,310	1,310
HUS210	2,635	5,450	5,795	5,830	5,830	1,450	3,135	3,135	3,135	3,135
THA29 Face Mount (Max.)	465	2,295	2,305	2,305	2,305	360	1,505	1,505	1,505	1,505
Double 2x Sizes										
HHUS26-2	1,320	2,830	3,190	3,415	4,250	740	2,580	2,965	3,225	3,440
HGUS26-2	2,155	4,355	4,875	5,230	5,575	805	2,930	2,955	2,955	2,955
HHUS28-2	1,760	4,265	4,810	5,155	5,980	1,350	3,885	4,465	4,710	4,710
HGUS28-2	3,235	7,460	7,460	7,460	7,460	1,125	4,775	4,775	4,775	4,775
HHUS210-2	3,550	5,705	6,435	6,485	6,485	1,370	4,790	4,790	4,790	4,790
HGUS210-2	4,095	9,100	9,100	9,100	9,100	1,270	5,590	5,590	5,590	5,590
Triple 2x Sizes										
HGUS26-3	2,155	4,355	4,875	5,230	5,575	520	2,930	2,955	2,955	2,955
HGUS28-3	3,235	7,460	7,460	7,460	7,460	1,125	4,775	4,775	4,775	4,775
HHUS210-3	3,405	5,640	6,380	6,485	6,485	1,370	4,790	4,790	4,790	4,790
HGUS210-3	4,095	9,100	9,100	9,100	9,100	1,270	5,590	5,590	5,590	5,590
Quadruple 2x Sizes										
HGUS26-4	2,155	4,355	4,875	5,230	5,575	815	2,930	2,955	2,955	2,955
HGUS28-4	3,235	7,460	7,460	7,460	7,460	1,125	4,775	4,775	4,775	4,775
HHUS210-4	3,405	5,640	6,380	6,485	6,485	1,315	4,735	4,790	4,790	4,790
HGUS210-4	4,095	9,100	9,100	9,100	9,100	1,270	5,590	5,590	5,590	5,590
HGUS212-4	5,205	11,915	13,330	14,290	14,350	1,810	7,720	8,880	9,295	9,295
HGUS214-4	5,360	13,860	14,350	14,350	14,350	2,205	9,325	9,655	9,655	9,655
4x Sizes										
HHUS46	1,320	2,830	3,190	3,415	4,250	740	2,580	2,580	2,580	2,580
HGUS46	2,155	4,355	4,875	5,230	5,575	1,390	2,930	2,955	2,955	2,955
HUS48	1,320	1,580	1,790	1,930	2,415	790	1,250	1,250	1,250	1,250
HHUS48	1,760	4,265	4,810	5,155	5,980	1,350	3,885	4,465	4,710	4,710
HGUS48	3,235	7,460	7,460	7,460	7,460	1,925	4,775	4,775	4,775	4,775
HHUS410	3,550	5,705	6,435	6,485	6,485	1,370	4,790	4,790	4,790	4,790
HGUS410	4,095	9,100	9,100	9,100	9,100	2,170	5,590	5,590	5,590	5,590
HGUS412	5,205	11,915	13,330	14,290	14,350	3,090	7,720	8,880	9,295	9,295
HGUS414	5,360	13,860	14,350	14,350	14,350	3,765	9,325	9,655	9,655	9,655
THA418 Face Mount (Max.)	1,855	3,695	3,695	3,695	3,695	630	1,835	1,835	1,835	1,835
THA422 Face Mount (Max.)	1,855	3,695	3,695	3,695	3,695	585	2,135	2,135	2,290	2,135

1. For hanger gaps between 1/8" and 3/8", use allowable downloads for 3/8" gap. Uplift load may be interpolated between 1/8" and 3/8" values.
2. Uplift loads have been increased for earthquake or wind loading with no further increase allowed. Reduce where other loads govern.
3. Wind (160) is a download rating.
4. Refer to *Wood Construction Connectors* catalog or strongtie.com for required fastener quantity and size.

Allowable Loads for Joist Hangers with Gaps

Table 2 — SPF/HF Allowable Loads

Model No.	Up to 1/8" Gap Between the Joist and Header ¹					Up to 3/8" Gap Between the Joist and Header ¹				
	Uplift ² (160)	Floor (100)	Snow (115)	Roof (125)	Wind ³ (160)	Uplift ² (160)	Floor (100)	Snow (115)	Roof (125)	Wind ³ (160)
Single 2x Sizes										
LUS24	360	495	565	605	770	185	475	485	485	485
LUS26	865	635	725	785	1,000	330	610	635	635	635
MUS26	810	955	1,090	1,180	1,350	560	955	1,090	1,180	1,350
HUS26	1,150	2,350	2,660	2,780	2,780	690	2,035	2,315	2,315	2,315
HGUS26	1,005	3,755	4,205	4,495	5,320	700	2,295	2,615	2,615	2,615
LUS28	865	810	925	1,000	1,270	330	775	800	800	800
MUS28	1,150	1,270	1,455	1,575	1,955	815	1,270	1,455	1,585	1,775
HUS28	1,480	3,520	3,520	3,520	3,520	1,095	2,835	2,835	2,835	2,835
HGUS28	1,485	6,010	6,255	6,255	6,255	1,070	3,435	3,570	3,570	3,570
LUS210	865	985	1,120	1,215	1,500	330	940	970	970	970
HUS210	2,220	4,685	4,985	5,015	5,015	1,220	2,695	2,695	2,695	2,695
THA29 Face Mount (Max.)	465	1,965	2,250	2,250	2,250	320	1,490	1,500	1,500	1,500
Double 2x Sizes										
HHUS26-2	1,135	2,435	2,745	2,935	3,655	635	2,220	2,550	2,770	2,960
HGUS26-2	2,155	3,755	4,205	4,495	5,255	695	2,525	2,750	2,750	2,750
HHUS28-2	1,515	3,670	4,135	4,435	5,145	1,160	3,345	3,840	4,050	4,050
HGUS28-2	2,780	6,415	6,415	6,415	6,415	965	4,105	4,105	4,105	4,105
HHUS210-2	2,450	4,835	5,490	5,575	5,575	1,180	4,120	4,120	4,120	4,120
HGUS210-2	3,520	7,460	7,825	7,825	7,825	1,090	4,805	4,805	4,805	4,805
Triple 2x Sizes										
HGUS26-3	2,155	3,755	4,205	4,495	5,255	445	2,525	2,750	2,750	2,750
HGUS28-3	2,780	6,415	6,415	6,415	6,415	965	4,105	4,105	4,105	4,105
HHUS210-3	3,055	4,905	5,535	5,575	5,575	1,180	4,120	4,120	4,120	4,120
HGUS210-3	3,520	7,825	7,825	7,825	7,825	1,090	4,805	4,805	4,805	4,805
Quadruple 2x Sizes										
HGUS26-4	2,155	3,755	4,205	4,495	5,255	815	2,525	2,750	2,750	2,750
HGUS28-4	2,780	6,415	6,415	6,415	6,415	965	4,105	4,105	4,105	4,105
HHUS210-4	2,930	4,850	5,485	5,575	5,575	1,180	4,120	4,120	4,120	4,120
HGUS210-4	3,520	7,825	7,825	7,825	7,825	1,090	4,805	4,805	4,805	4,805
HGUS212-4	4,730	10,280	12,420	12,420	12,420	1,645	6,660	7,660	8,045	8,045
HGUS214-4	4,915	11,960	12,420	12,420	12,420	2,025	8,050	8,360	8,360	8,360
4x Sizes										
HHUS46	1,135	2,435	2,745	2,935	3,655	635	2,220	2,220	2,220	2,220
HGUS46	2,155	3,755	4,205	4,495	5,255	1,390	2,525	2,750	2,750	2,750
HUS48	1,135	1,360	1,540	1,660	2,075	680	1,075	1,075	1,075	1,075
HHUS48	1,515	3,670	4,135	4,435	5,145	1,160	3,345	3,840	4,050	4,050
HGUS48	2,780	6,415	6,415	6,415	6,415	1,655	4,105	4,105	4,105	4,105
HHUS410	3,265	4,905	5,535	5,575	5,575	1,180	4,120	4,120	4,120	4,120
HGUS410	3,520	7,825	7,825	7,825	7,825	1,865	4,805	4,805	4,805	4,805
HGUS412	4,730	10,280	12,420	12,420	12,420	2,810	6,625	8,005	8,005	8,005
HGUS414	4,915	11,960	12,420	12,420	12,420	3,450	8,005	8,315	8,315	8,315
THA418 Face Mount (Max.)	1,670	3,330	3,535	3,535	3,535	540	1,580	1,580	1,580	1,580
THA422 Face Mount (Max.)	1,670	3,330	3,535	3,535	3,535	505	1,835	1,835	1,970	1,835

1. For hanger gaps between 1/8" and 3/8", use allowable downloads for 3/8" gap. Uplift load may be interpolated between 1/8" and 3/8" values.
 2. Uplift loads have been increased for earthquake or wind loading with no further increase allowed. Reduce where other loads govern.
 3. Wind (160) is a download rating.
 4. Refer to *Wood Construction Connectors* catalog or strongtie.com for required fastener quantity and size.

Allowable Loads for Joist Hangers with Gaps

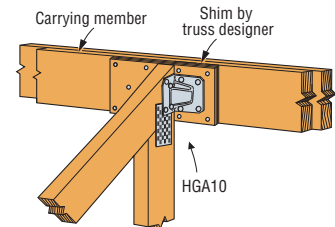
Table 3 — Allowable Load Reduction Factors

Hanger	3/8" Gap Between Joist and Header	
	Uplift	Download
ITS	1.00	0.83
IUS	1.00	0.83
MIT	0.90	0.85
HIT	0.90	0.73
MIU	0.90	0.84
BA	0.79	0.93
THA29 Top Flange (Max.)	0.35	0.90
THA418 Top Flange (Max.)	0.34	0.50
THA422 Top Flange (Max.)	0.32	0.58

1. See current *Wood Construction Connectors* catalog for hanger allowable loads up to 1/8" gap between the joist and header.
2. For hanger gaps between 1/8" and 3/8", multiply the allowable download from the current *Wood Construction Connectors* catalog by the tabulated load reduction factor.

Light repair options for gaps up to 3/8"

When the reduced allowable load for hangers with a gap larger than 1/8" (see Tables 1, 2 and 3) is less than the design load, a supplemental connector may be added to the top or bottom chord to obtain additional download and uplift, as shown in Tables 4 and 5 below. The allowable loads (uplift and download) of the supplemental connector and the reduced allowable load for the hanger can be added together to meet or exceed the design load.



Note: All truss members not shown for clarity.

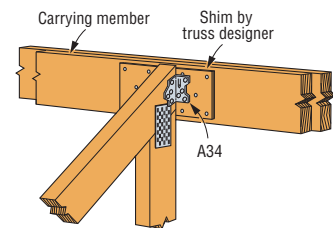


Table 4 — Supplemental Connector to Top Chord^{1, 2}

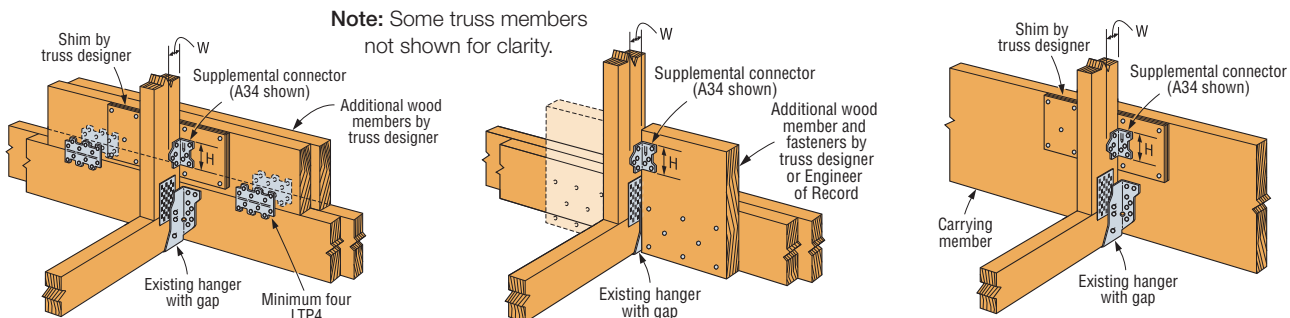
Minimum Carrying Member ³	Model No.	Fasteners		DF/SP Allowable Loads				SPF/HF Allowable Loads			
		Carried Member	Carrying Member	Uplift ⁵ (160)	Floor (100)	Snow (115)	Roof (125)	Uplift ⁵ (160)	Floor (100)	Snow (115)	Roof (125)
2x4	A34	(4) 0.131" x 1 1/2"	(4) 0.131" x 1 1/2"	545	395	450	480	480	340	385	415
		(4) SD9112	(4) SD9112	640	640	640	640	550	550	550	550
2x6	HGA10 ⁴	(4) SDS1/4" x 1 1/2"	(4) SDS1/4" x 3"	1,165	750	865	940	1,000	645	745	810

1. A shim to match the gap size is required between the connector and the top chord. Shim material and attachment shall be specified by a truss designer or another design professional. Refer to shim detail notes on p. 5.
2. Other supplemental connectors may be used as determined by the designer.
3. Minimum carrying member shown is required to provide enough connection area for the supplemental connector.
4. HGA10 requires minimum two-ply girder.
5. Uplift loads have been increased for earthquake or wind loading with no further increase allowed. Reduce where other loads govern.

Table 5 — Supplemental Connector to Bottom Chord or Support Beam^{1, 2}

Model No.	Dimensions (in.)		Fasteners		DF/SP Allowable Loads				SPF/HF Allowable Loads			
	Height (H)	Width (W)	Carried Member	Carrying Member	Uplift ³ (160)	Floor (100)	Snow (115)	Roof (125)	Uplift ³ (160)	Floor (100)	Snow (115)	Roof (125)
A34	2 1/2	1 7/16	(4) 0.131" x 1 1/2"	(4) 0.131" x 1 1/2"	545	395	450	480	480	340	385	415
LS50	4 7/8	2 1/4	(4) 0.148" x 1 1/2"	(4) 0.148" x 1 1/2"	560	475	540	560	480	410	465	480
LS70	6 3/8	2 1/4	(5) 0.148" x 1 1/2"	(5) 0.148" x 1 1/2"	645	590	645	645	555	510	555	555
HGA10	3 1/2	2	(4) SDS1/4" x 1 1/2"	(4) SDS1/4" x 3"	1,165	750	865	940	1,000	645	745	810

1. A shim to match the gap size is required behind the connector, unless otherwise noted. Shim material and attachment shall be specified by a truss designer or another design professional. Refer to shim detail notes on p. 5.
2. Other supplemental connectors may be used as determined by the designer.
3. Uplift loads have been increased for earthquake or wind loading with no further increase allowed. Reduce where other loads govern.



Allowable Loads for Joist Hangers with Gaps

Repair options for gaps larger than 3/8" or higher load requirements

The following are repair options for hangers with a gap larger than 3/8", or conditions where the design load requirements for the hanger require a repair beyond a supplemental connector (as shown on p. 4):

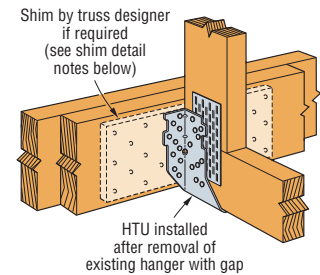
HTU Option: Remove existing LUS, MUS, HUS or HHUS hanger and install the same size HTU hanger in its place. Allowable loads for HTU hangers for gaps up to 1/2" are given in Table 6. If the gap is 1/2" or less and the HTU allowable loads with 1/2" max. gap meet the design loads, no shim is required behind the HTU.

Shim Option: Remove existing hanger, install continuous shim or blocking behind truss to reduce gap to 1/8" or less, then install new hanger that meets the design load requirements. See shim detail notes below.

Table 6 — HTU Joist Hanger in Place of Removed Existing LUS, MUS, HUS, or HHUS Joist Hanger¹

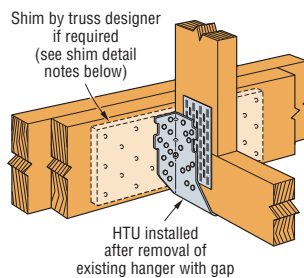
Model No.	Fasteners		DF/SP Allowable Loads				SPF/HF Allowable Loads			
	Carried Member	Carrying Member	Uplift ⁴ (160)	Floor (100)	Snow (115)	Roof (125)	Uplift ⁴ (160)	Floor (100)	Snow (115)	Roof (125)
HTU Allowable Loads with 1/2" Max. Gap^{2,3}										
HTU26	(20) 0.148"	(20) 0.162" x 3 1/2"	1,215	2,940	3,320	3,580	1,045	1,850	2,090	2,285
HTU28	(26) 0.148"	(26) 0.162" x 3 1/2"	1,920	3,820	4,315	4,655	1,695	2,865	3,235	3,490
HTU210	(32) 0.148"	(32) 0.162" x 3 1/2"	3,255	4,705	5,020	5,020	2,800	3,530	3,765	3,765
HTU26-2	(20) 0.148"	(20) 0.162" x 3 1/2"	1,910	2,940	3,320	3,500	1,645	2,205	2,205	2,205
HTU28-2	(26) 0.148"	(26) 0.162" x 3 1/2"	3,035	3,820	4,315	4,655	2,610	2,865	3,235	3,490
HTU210-2	(32) 0.148"	(32) 0.162" x 3 1/2"	3,855	4,705	5,310	5,730	3,315	3,530	3,980	4,300

- The existing LUS, MUS, HUS or HHUS joist hanger must be removed with care so as to not cause damage to the wood members. The loads shown for the HTU require attachment of the HTU into wood that is not split or damaged.
- Loads shown are the HTU Alternate Allowable Loads for 1/2" Maximum Hanger Gap. Refer to the current *Wood Construction Connectors* catalog for the Standard Allowable Loads (1/8" Maximum Hanger Gap).
- Loads shown are for maximum nailing. Refer to the current *Wood Construction Connectors* catalog for minimum nailing loads.
- Uplift loads have been increased for earthquake or wind loading with no further increase allowed. Reduce where other loads govern.



HTU Option with Shim

Note: All truss members not shown for clarity.



Shim Detail

Shim detail notes

A shim may be installed between the carried truss and girder truss to reduce a gap to 1/8" or less provided:

- The size, material and attachment of the shim must be designed by the truss designer or another design professional.
- The shim must be an engineered lumber material with a specific gravity equal to or greater than the specific gravity of the truss to which it is attached.
- Fasteners used to attach the shim must be independent of the hanger fasteners so that the shim and truss act as a single unit, and required loads are transferred.
- Shim fastener spacing and edge distances shall be in accordance with the National Design Specification for Wood Construction.

Allowable Loads for Joist Hangers with Gaps

Example — joist hanger installed with a 3/8" gap

Given: HUS26 installed with a 3/8" gap.
Carried truss is DF with 2,900 lb. download and 1,100 lb. uplift.

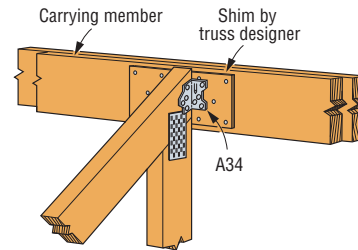
Per Table 1: Reduced allowable download (@ 125) = 2,695 lb. < 2,900 lb.
Reduced allowable uplift (@ 160) = 790 lb. < 1,100 lb.

Need additional 455 lb. download and 310 lb. uplift.

Solution 1 — Truss with end vertical

Select supplemental connector to attach to girder top chord (with shim) from Table 4.

Model No.	DF Allowable Loads	
	Uplift (160)	Roof (125)
A34	545	480
HUS26 with 3/8" gap	790	2,695
Combined Total	1,335 > 1,100 ok	3,175 > 2,900 ok

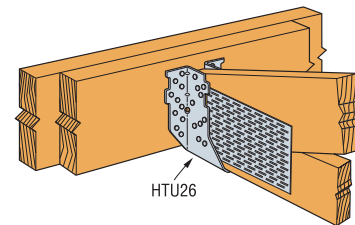


Note: All truss members not shown for clarity.

Solution 2 — Truss without end vertical

Remove HUS26 and install HTU26 in its place.

Per Table 6: HTU26 download with 1/2" max. gap = 3,580 lb. > 2,900 lb. ok.
HTU26 uplift with 1/2" max. gap = 1,215 lb. > 1,100 lb. ok.
No shim required behind HTU26.



Note: Other options could work. The actual field remedy or repair must be designed and approved by the truss designer. All shims and scabs must be designed by the truss designer.

Guidelines for preventing gaps

Considerations from BCSI (Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses), Section BCSI-B2:

- Check that building dimensions match the construction plans.
- Check that supporting headers, beams, walls and lintels are accurately and securely installed.
- Check that load-bearing supports are plumb and properly braced.
- Check trusses for correct dimensions.
- Take any corrective action on these items prior to truss installation.

General Simpson Strong-Tie recommendations:

- Watch for gaps during installation. Check to see if the gap can be reduced to within tolerance by balancing the gap between both ends of the carried member.
- Shim out gaps prior to hanger installation. If the truss framing into a beam or girder falls short by more than 1/8", a shim may be installed to the beam or girder to fill the gap, prior to installing the hanger (shim design and approval by the truss designer or Engineer of Record).
- HTU hangers have published alternate allowable loads for gaps up to 1/2" to allow for greater construction tolerances.