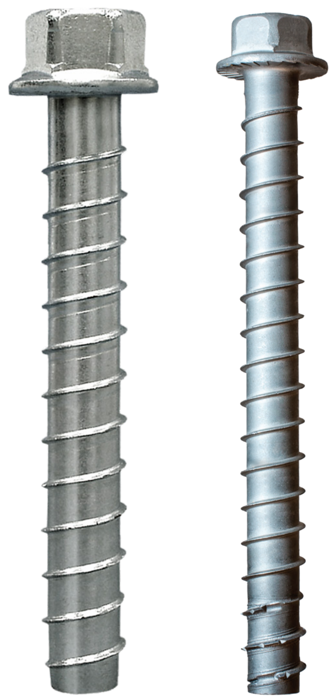
Titen HD® Design Information — Concrete



Titen HD

Stainless Steel Titen HD

- Titen HD (THD) has been qualified per ACI 355.2 and AC193. In order to design the Titen HD in accordance with ACI 318 Chapter 17, the design information is published in the Simpson Strong-Tie Catalog for Anchoring, Fastening, Restoration and Strengthening Systems for Concrete and Masonry and in ICC-ES ESR-2713 (Titen HD Carbon Steel) or IAPMO ER-493 (Titen HD Stainless Steel). In addition, the design values are included in the Simpson Strong-Tie Anchor Designer Software; it is strongly encouraged that the designer utilizes this software when designing concrete anchorage solutions.
- To provide the designer quick reference tables, Simpson Strong-Tie has provided the tables contained within this Technical Engineering Bulletin. The tables provide either a Design Strength level capacity or an Allowable Tension Load capacity. The footnotes of each table further explain how the Design Strength capacities were calculated and what factors were used to calculate the Allowable Load capacities. For additional information, please refer to Anchor Designer software and/or contact Simpson Strong-Tie.
- This technical engineering bulletin also provides strength design values for ⅝" and ¾" diameter carbon steel Titen HD anchors that have been reused in temporary applications; see pages 19 – 23. In order for carbon steel Titen HD to be reused and the reduced design values to be applicable, Titen HD anchor must be checked and pass Titen HD Thread Gauge prior to each reuse.

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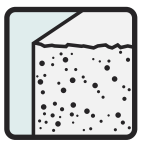
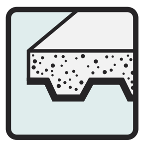
Icons and Nomenclature

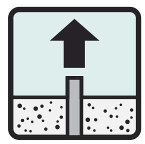
In order to facilitate easier identification of performance data, the following icon system has been incorporated into the sections of the technical bulletin with multiple load tables. These icons will appear in the heading of the table to promote easier visual identification of the type of load, insert type and substrate addressed in the table. Icons are intended for quick identification. All specific information regarding suitability should be read from the table itself.



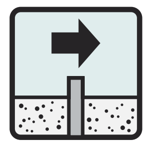
Normal-Weight Concrete



Normal-Weight/ Lightweight Concrete over Metal Deck



Tension Load



Shear Load

Valid for International Building Code

c_{ac}	Critical Edge Distance
$c_{ac,deck,top}$	Critical Edge Distance (Topside of Concrete-Filled Profile Steel Deck Assemblies)
c_{min}	Minimum Edge Distance
$c_{min,deck,top}$	Minimum Edge Distance (Topside of Concrete-Filled Profile Steel Deck Assemblies)
f'_c	Concrete Compressive Strength
h_{nom}	Nominal Embedment Depth
h_{min}	Minimum Concrete Thickness
$h_{min,deck}$	Minimum Concrete Thickness (Topside of Concrete-Filled Profile Steel Deck Assemblies)

Titen HD® Design Information — Concrete

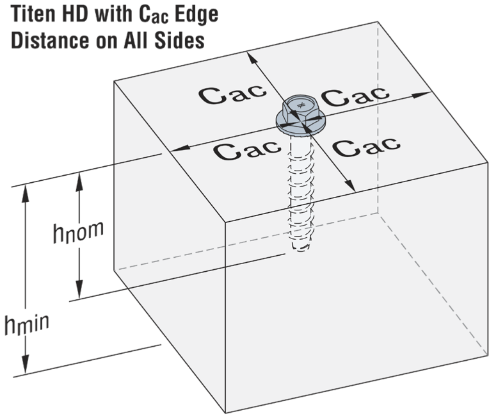
SIMPSON Strong-Tie

Titen HD® Carbon Steel Tension Design Strength in Normal-Weight Concrete (f'_c = 2,500 psi)

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness h_{min} (in.)	Critical Edge Distance c_{ac} (in.)	Minimum Edge Distance c_{min} (in.)	Tension Design Strength (lb.)							
					Edge Distances = c_{ac} on all sides				Edge Distances = c_{min} on one side and c_{ac} on three sides			
					SDC A-B		SDC C-F		SDC A-B		SDC C-F	
					Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked
¼	1⅝	3¼	3	1½	1,265	715	950	540	660	630	495	470
	2½	3½	6	1½	2,110	1,240	1,580	930	660	965	495	725
⅜	2½	4	2 11/16	1¾	1,755	805	1,315	600	1,350	805	1,015	600
	3¼	5	3⅝	1¾	2,900	1,755	2,175	1,315	1,810	1,290	1,360	970
½	3¼	5	3 9/16	1¾	2,810	1,990	2,105	1,495	1,765	1,265	1,325	950
	4	6¼	4½	1¾	4,035	2,855	3,025	2,140	2,285	1,620	1,710	1,220
⅝	4	6	4½	1¾	3,990	1,975	2,995	1,480	2,250	1,610	1,690	1,210
	5½	8½	6⅜	1¾	6,375	3,620	4,780	2,715	3,390	2,405	2,540	1,805
¾	5½	8¾	6⅜	1¾	6,760	3,945	5,070	2,960	3,355	2,395	2,515	1,795
	6¼	10	7 5/16	1¾	8,355	4,675	6,265	3,510	3,990	2,835	2,990	2,125

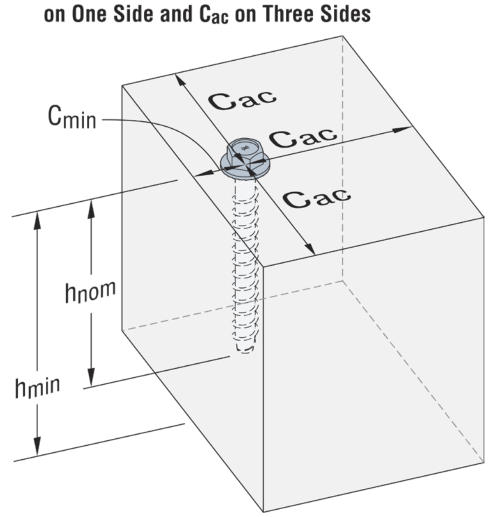
1. Tension design strengths (SD level) are based on the strength design provisions of ACI 318-19 Chapter 17.
2. Tabulated values are for a single anchor with no influence of another anchor.
3. Interpolation between embedment depths is not permitted.
4. Strength reduction factor, ϕ, is based on using a load combination from ACI 318-19 Section 5.3.
5. The tension design strength listed for SDC (Seismic Design Category) A-B may also be used in SDC C-F when the tension component of the strength-level seismic design load on the anchor does not exceed 20% of the total factored tension load on the anchor associated with the same load combination.
6. When designing anchorages in SDC C-F, the designer shall consider the ductility requirements of ACI 318-19 Section 17.10.
7. Tension design strengths in SDC C-F have been adjusted by 0.75 factor in accordance with ACI 318-19 Section 17.10.5.4.
8. The Designer of Record is responsible for the foundation design.

Titen HD with C_{ac} Edge Distance on All Sides



Flat Slab

Titen HD with C_{min} Edge Distance on One Side and C_{ac} on Three Sides



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* See page 3 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

SIMPSON Strong-Tie

Titen HD® Carbon Steel Allowable Tension Loads in Normal-Weight Concrete (f'_c = 2,500 psi) — Static Load

*

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness h_{min} (in.)	Critical Edge Distance c_{ac} (in.)	Minimum Edge Distance c_{min} (in.)	Allowable Tension Load (lb.)			
					Edge Distances = c_{ac} on all sides		Edge Distances = c_{min} on one side and c_{ac} on three sides	
					Uncracked	Cracked	Uncracked	Cracked
¼	1⅝	3¼	3	1½	905	510	470	450
	2½	3½	6	1½	1,505	885	470	690
⅜	2½	4	2 11/16	1¾	1,255	575	965	575
	3¼	5	3⅝	1¾	2,070	1,255	1,295	920
½	3¼	5	3 9/16	1¾	2,005	1,420	1,260	905
	4	6¼	4½	1¾	2,880	2,040	1,630	1,155
⅝	4	6	4½	1¾	2,850	1,410	1,605	1,150
	5½	8½	6⅜	1¾	4,555	2,585	2,420	1,720
¾	5½	8¾	6⅜	1¾	4,830	2,820	2,395	1,710
	6¼	10	7 5/16	1¾	5,970	3,340	2,850	2,025

See footnotes and graphics on page 6.

Titen HD® Carbon Steel Allowable Tension Loads in Normal-Weight Concrete (f'_c = 2,500 psi) — Wind Load

*

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness h_{min} (in.)	Critical Edge Distance c_{ac} (in.)	Minimum Edge Distance c_{min} (in.)	Allowable Tension Load (lb.)			
					Edge Distances = c_{ac} on all sides		Edge Distances = c_{min} on one side and c_{ac} on three sides	
					Uncracked	Cracked	Uncracked	Cracked
¼	1⅝	3¼	3	1½	760	430	395	380
	2½	3½	6	1½	1,265	745	395	580
⅜	2½	4	2 11/16	1¾	1,055	485	810	485
	3¼	5	3⅝	1¾	1,740	1,055	1,085	775
½	3¼	5	3 9/16	1¾	1,685	1,195	1,060	760
	4	6¼	4½	1¾	2,420	1,715	1,370	970
⅝	4	6	4½	1¾	2,395	1,185	1,350	965
	5½	8½	6⅜	1¾	3,825	2,170	2,035	1,445
¾	5½	8¾	6⅜	1¾	4,055	2,365	2,015	1,435
	6¼	10	7 5/16	1¾	5,015	2,805	2,395	1,700

See footnotes and graphics on page 6.

Titen HD® Carbon Steel Allowable Tension Loads in Normal-Weight Concrete (f'_c = 2,500 psi) — Seismic Load

*

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness h_{min} (in.)	Critical Edge Distance c_{ac} (in.)	Minimum Edge Distance c_{min} (in.)	Allowable Tension Load (lb.)							
					Edge Distances = c_{ac} on all sides				Edge Distances = c_{min} on one side and c_{ac} on three sides			
					SDC A-B		SDC C-F		SDC A-B		SDC C-F	
					Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked
¼	1⅝	3¼	3	1½	885	500	665	380	460	440	345	330
	2½	3½	6	1½	1,475	870	1,105	650	460	675	345	510
⅜	2½	4	2 11/16	1¾	1,230	565	920	420	945	565	710	420
	3¼	5	3⅝	1¾	2,030	1,230	1,525	920	1,265	905	950	680
½	3¼	5	3 9/16	1¾	1,965	1,395	1,475	1,045	1,235	885	930	665
	4	6¼	4½	1¾	2,825	2,000	2,120	1,500	1,600	1,135	1,195	855
⅝	4	6	4½	1¾	2,795	1,385	2,095	1,035	1,575	1,125	1,185	845
	5½	8½	6⅜	1¾	4,465	2,535	3,345	1,900	2,375	1,685	1,780	1,265
¾	5½	8¾	6⅜	1¾	4,730	2,760	3,550	2,070	2,350	1,675	1,760	1,255
	6¼	10	7 5/16	1¾	5,850	3,275	4,385	2,455	2,795	1,985	2,095	1,490

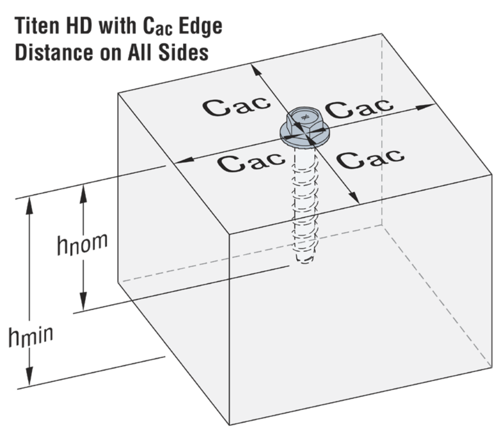
See footnotes and graphics on page 6.

* See page 3 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

SIMPSON Strong-Tie

1. Static allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 17 using a conversion factor of $\alpha = 1.4$. The conversion factor α is based on the load combination 1.2D + 1.6L assuming 50% dead load and 50% live load: 1.2(0.5) + 1.6(0.5) = 1.4.
2. Wind allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 17 using a conversion factor of $\alpha = 1/0.6 = 1.67$. The conversion factor α is based on the load combination assuming 100% wind load.
3. Seismic allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 17 using a conversion factor of $\alpha = 1/0.7 = 1.43$. The conversion factor α is based on the load combination assuming 100% seismic load.
4. Tabulated values are for a single anchor with no influence of another anchor.
5. Interpolation between embedment depths is not permitted.
6. The allowable tension load listed for SDC (Seismic Design Category) A-B may also be used in SDC C-F when the tension component of the strength-level seismic design load on the anchor does not exceed 20% of the total factored tension load on the anchor associated with the same load combination.
7. When designing anchorages in SDC C-F, the designer shall consider the ductility requirements of ACI 318-19 Section 17.10.
8. Tension design strengths in SDC C-F have been adjusted by 0.75 factor in accordance with ACI 318-19 Section 17.10.5.4.
9. The Designer of Record is responsible for the foundation design.



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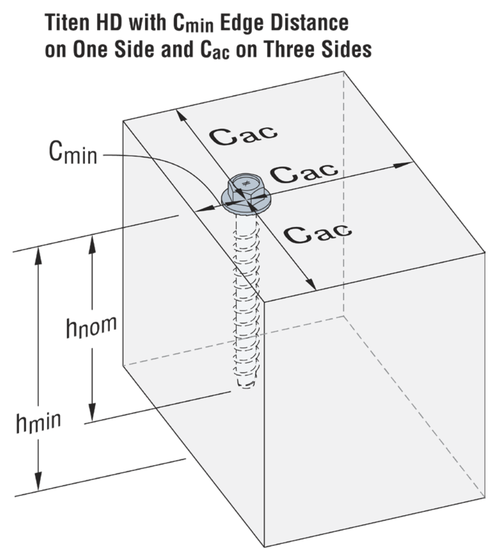


Flat Slab

Titen HD® Design Information — Concrete

SIMPSON Strong-Tie

Titen HD® Carbon Steel Tension Design Strength in Soffit of Normal-Weight or Sand-Lightweight Concrete-Filled Profile Steel Deck Assemblies (f'_c = 3,000 psi)

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Minimum End Distance c_{min} (in.)	Tension Design Strength (lb.)							
			Lower Flute				Upper Flute			
			SDC A-B		SDC C-F		SDC A-B		SDC C-F	
			Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked
¼	1⅝	2½	645	275	485	205	1,010	425	760	320
	2½	4	830	350	620	260	1,855	775	1,390	585
⅜	1⅞	2½	535	245	400	185	710	325	535	245
	2½	3⅝	1,240	565	930	425	—	—	—	—
½	2	2⅝	840	590	630	440	1,580	1,105	1,185	830
	3½	5¼	1,890	1,325	1,420	995	—	—	—	—

Titen HD® Carbon Steel Allowable Tension Loads in Soffit of Normal-Weight or Sand-Lightweight Concrete-Filled Profile Steel Deck Assemblies (f'_c = 3,000 psi) — Static Load

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Minimum End Distance c_{min} (in.)	Allowable Tension Load (lb.)			
			Lower Flute		Upper Flute	
			Uncracked	Cracked	Uncracked	Cracked
¼	1⅝	2½	460	195	720	305
	2½	4	595	250	1,325	555
⅜	1⅞	2½	380	175	505	230
	2½	3⅝	885	405	—	—
½	2	2⅝	600	420	1,130	790
	3½	5¼	1,350	945	—	—

Titen HD® Carbon Steel Allowable Tension Loads in Soffit of Normal-Weight or Sand-Lightweight Concrete-Filled Profile Steel Deck Assemblies (f'_c = 3,000 psi) — Wind Load

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Minimum End Distance c_{min} (in.)	Allowable Tension Load (lb.)			
			Lower Flute		Upper Flute	
			Uncracked	Cracked	Uncracked	Cracked
¼	1⅝	2½	385	165	605	255
	2½	4	500	210	1,115	465
⅜	1⅞	2½	320	145	425	195
	2½	3⅝	745	340	—	—
½	2	2⅝	505	355	950	665
	3½	5¼	1,135	795	—	—

1. Tension design strengths (SD level) are based on the strength design provisions of ACI 318-19 Chapter 17.
2. Static allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 17 using a conversion factor of $\alpha = 1.4$. The conversion factor α is based on the load combination 1.2D + 1.6L assuming 50% dead load and 50% live load: 1.2(0.5) + 1.6(0.5) = 1.4.
3. Wind allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 17 using a conversion factor of $\alpha = 1/0.6 = 1.67$. The conversion factor α is based on the load combination assuming 100% wind load.
4. Tabulated values are for a single anchor with no influence of another anchor.
5. Interpolation between embedment depths is not permitted.
6. Strength reduction factor, ϕ, is based on using a load combination from ACI 318-19 Section 5.3.
7. The tension design strength listed for SDC (Seismic Design Category) A-B may also be used in SDC C-F when the tension component of the strength-level seismic design load on the anchor does not exceed 20% of the total factored tension load on the anchor associated with the same load combination.
8. When designing anchorages in SDC C-F, the designer shall consider the ductility requirements of ACI 318-19 Section 17.10.
9. Tension design strengths in SDC C-F have been adjusted by 0.75 factor in accordance with ACI 318-19 Section 17.10.5.4.
10. Installation must comply with Figures 1 and 2 on page 8.

* See page 3 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

SIMPSON Strong-Tie

Titen HD® Carbon Steel Allowable Tension Loads in Soffit of Normal-Weight or Sand-Lightweight Concrete-Filled Profile Steel Deck Assemblies (f'_c = 3,000 psi) — Seismic Load

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Minimum End Distance c_{min} (in.)	Allowable Tension Load (lb.)							
			Lower Flute				Upper Flute			
			SDC A-B		SDC C-F		SDC A-B		SDC C-F	
			Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked
¼	1⅝	2½	450	195	340	145	705	300	530	225
	2½	4	580	245	435	180	1,300	545	975	410
⅜	1⅞	2½	375	170	280	130	495	230	375	170
	2½	3⅝	870	395	650	300	—	—	—	—
½	2	2⅝	590	415	440	310	1,105	775	830	580
	3½	5¼	1,325	930	995	695	—	—	—	—

1. Seismic allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 17 using a conversion factor of $\alpha = 1/0.7 = 1.43$. The conversion factor α is based on the load combination assuming 100% seismic load.
2. Tabulated values are for a single anchor with no influence of another anchor.
3. Interpolation between embedment depths is not permitted.
4. The allowable tension load listed for SDC (Seismic Design Category) A-B may also be used in SDC C-F when the tension component of the strength-level seismic design load on the anchor does not exceed 20% of the total factored tension load on the anchor associated with the same load combination.
5. When designing anchorages in SDC C-F, the designer shall consider the ductility requirements of ACI 318-19 Section 17.10.
6. Tension design strengths in SDC C-F have been adjusted by 0.75 factor in accordance with ACI 318-19 Section 17.10.5.4.
7. Installation must comply with Figures 1 and 2.

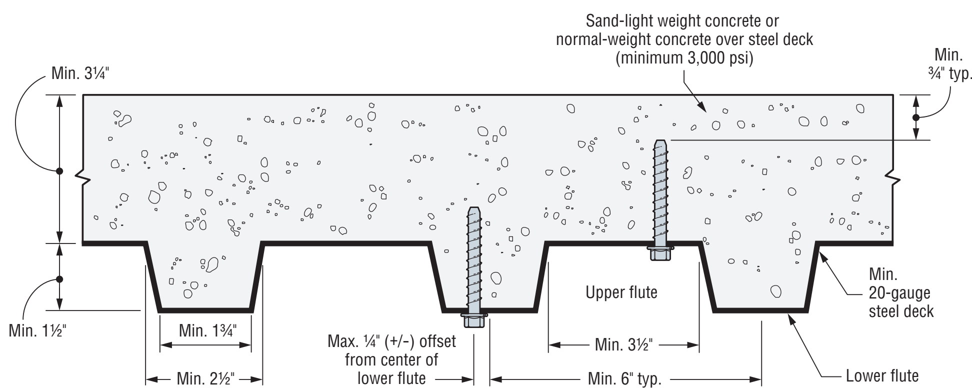


Figure 1 - Installation of ¼" Shank Diameter Screw Anchor into the Soffit of Concrete-Filled Profile Steel Deck Floor and Roof Assemblies (1" = 25.4 mm)

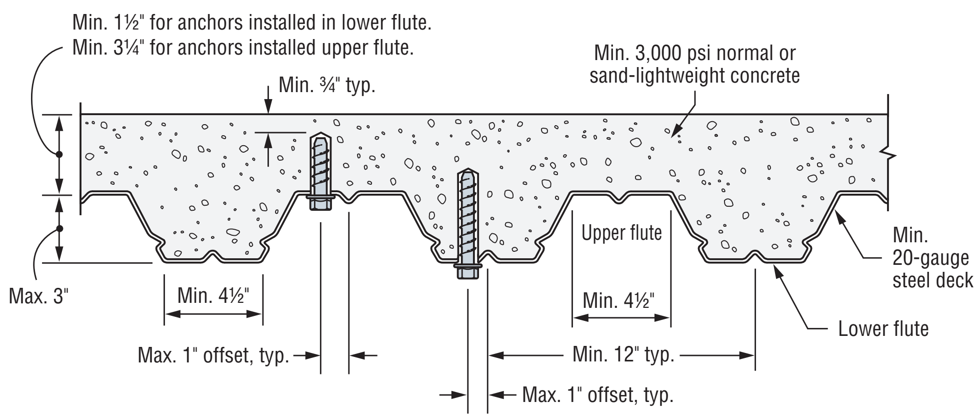


Figure 2 - Installation of ⅜" and ½" Shank Diameter Screw Anchors into the Soffit of Concrete-Filled Profile Steel Deck Floor and Roof Assemblies (1" = 25.4 mm)

* See page 3 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

SIMPSON Strong-Tie®

Titen HD® Carbon Steel Tension Design Strengths in Topside of Normal-Weight Concrete-Filled Profile Steel Deck Assemblies (f'_c = 2,500 psi)

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness $h_{min,deck}$ (in.)	Critical Edge Distance $c_{ac,deck,top}$ (in.)	Minimum Edge Distance $c_{min,deck,top}$ (in.)	Tension Design Strength (lb.)							
					Edge Distances = $c_{ac,deck,top}$ on all sides				Edge Distances = $c_{min,deck,top}$ on one side and $c_{ac,deck,top}$ on three sides			
					SDC A-B		SDC C-F		SDC A-B		SDC C-F	
					Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked
¼	1⅝	2½	3¾	3½	1,265	715	950	540	1,180	715	885	540
⅜	2½	3¼	7¼	3	1,755	805	1,315	600	760	805	570	600
½	3¼	4½	9	2½	2,810	1,990	2,105	1,495	860	1,555	645	1,165
	4	4½	9	2½	4,035	2,855	3,025	2,140	1,355	1,930	1,020	1,445

1. Tension design strengths (SD level) are based on the strength design provisions of ACI 318-19 Chapter 17.
2. Tabulated values are for a single anchor with no infuence of another anchor.
3. Interpolation between embedment depths is not permitted.
4. Strength reduction factor, ϕ, is based on using a load combination from ACI 318-19 Section 5.3.
5. The tension design strength listed for SDC (Seismic Design Category) A-B may also be used in SDC C-F when the tension component of the strength-level seismic design load on the anchor does not exceed 20% of the total factored tension load on the anchor associated with the same load combination.
6. When designing anchorages in SDC C-F, the designer shall consider the ductility requirements of ACI 318-19 Section 17.10.
7. Tension design strengths in SDC C-F have been adjusted by 0.75 factor in accordance with ACI 318-19 Section 17.10.5.4.
8. For installation in topside of sand-lightweight concrete-filled profile steel deck assemblies, tabulated values must be multiplied by 0.68.
9. Installation must comply with Figure 1.

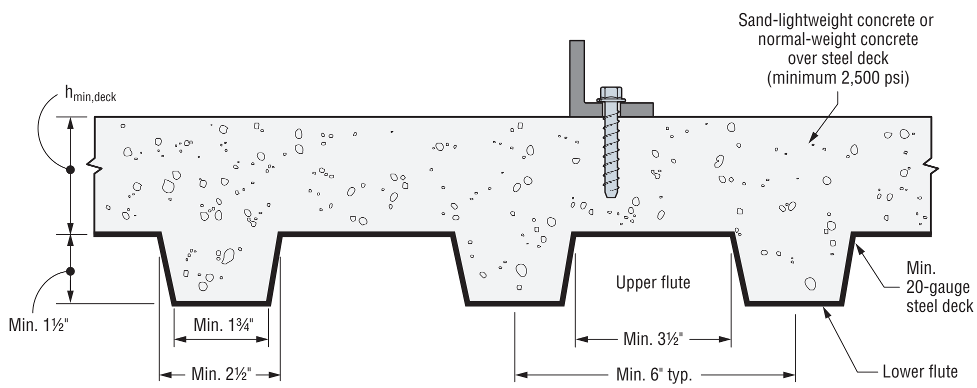


Figure 1 - Installation of ¼", ⅜" and ½" Shank Diameter Screw Anchors in the Topside of Concrete-Filled Profile Steel Deck Floor and Roof Assemblies (1" = 25.4 mm)

* See page 3 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

SIMPSON Strong-Tie

Titen HD® Carbon Steel Allowable Tension Loads in Topside of Normal-Weight Concrete-Filled Profile Steel Deck Assemblies (f'_c = 2,500 psi) — Static Load

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness $h_{min,deck}$ (in.)	Critical Edge Distance $c_{ac,deck,top}$ (in.)	Minimum Edge Distance $c_{min,deck,top}$ (in.)	Allowable Tension Load (lb.)			
					Edge Distances = $c_{ac,deck,top}$ on all sides		Edge Distances = $c_{min,deck,top}$ on one side and $c_{ac,deck,top}$ on three sides	
					Uncracked	Cracked	Uncracked	Cracked
¼	1⅝	2½	3¾	3½	905	510	845	510
⅜	2½	3¼	7¼	3	1,255	575	545	575
½	3¼	4½	9	2½	2,005	1,420	615	1,110
	4	4½	9	2½	2,880	2,040	970	1,380

Titen HD® Carbon Steel Allowable Tension Loads in Topside of Normal-Weight Concrete-Filled Profile Steel Deck Assemblies (f'_c = 2,500 psi) — Wind Load

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness $h_{min,deck}$ (in.)	Critical Edge Distance $c_{ac,deck,top}$ (in.)	Minimum Edge Distance $c_{min,deck,top}$ (in.)	Allowable Tension Load (lb.)			
					Edge Distances = $c_{ac,deck,top}$ on all sides		Edge Distances = $c_{min,deck,top}$ on one side and $c_{ac,deck,top}$ on three sides	
					Uncracked	Cracked	Uncracked	Cracked
¼	1⅝	2½	3¾	3½	760	430	710	430
⅜	2½	3¼	7¼	3	1,055	485	455	485
½	3¼	4½	9	2½	1,685	1,195	515	935
	4	4½	9	2½	2,420	1,715	815	1,160

Titen HD® Carbon Steel Allowable Tension Loads in Topside of Normal-Weight Concrete-Filled Profile Steel Deck Assemblies (f'_c = 2,500 psi) — Seismic Load

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness $h_{min,deck}$ (in.)	Critical Edge Distance $c_{ac,deck,top}$ (in.)	Minimum Edge Distance $c_{min,deck,top}$ (in.)	Tension Design Strength (lb.)							
					Edge Distances = $c_{ac,deck,top}$ on all sides				Edge Distances = $c_{min,deck,top}$ on one side and $c_{ac,deck,top}$ on three sides			
					SDC A-B		SDC C-F		SDC A-B		SDC C-F	
					Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked
¼	1⅝	2½	3¾	3½	885	500	665	380	825	500	620	380
⅜	2½	3¼	7¼	3	1,230	565	920	420	530	565	400	420
½	3¼	4½	9	2½	1,965	1,395	1,475	1,045	600	1,090	450	815
	4	4½	9	2½	2,825	2,000	2,120	1,500	950	1,350	715	1,010

1. Static allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 19 using a conversion factor of $\alpha = 1.4$. The conversion factor α is based on the load combination 1.2D + 1.6L assuming 50% dead load and 50% live load: 1.2(0.5) + 1.6(0.5) = 1.4.
2. Wind allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 19 using a conversion factor of $\alpha = 1/0.6 = 1.67$. The conversion factor α is based on the load combination assuming 100% wind load.
3. Seismic allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 19 using a conversion factor of $\alpha = 1/0.7 = 1.43$. The conversion factor α is based on the load combination assuming 100% seismic load.
4. Tabulated values are for a single anchor with no infuence of another anchor.
5. Interpolation between embedment depths is not permitted.
6. The allowable tension load listed for SDC (Seismic Design Category) A-B may also be used in SDC C-F when the tension component of the strength-level seismic design load on the anchor does not exceed 20% of the total factored tension load on the anchor associated with the same load combination.
7. When designing anchorages in SDC C-F, the designer shall consider the ductility requirements of ACI 318-19 Section 17.10.
8. Tension design strengths in SDC C-F have been adjusted by 0.75 factor in accordance with ACI 318-19 Section 17.10.5.4.
9. For installation in topside of sand-lightweight concrete-filled profile steel deck assemblies, tabulated values must be multiplied by 0.68.
10. Installation must comply with Figure 1 on page 9.

* See page 3 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

SIMPSON Strong-Tie®

Tension and Shear Strength Design Data for Titen HD® Carbon Steel in 4-inch Thick Uncracked Concrete[2,3,4,5,6]

Characteristic	Symbol	Unit	½-inch-diameter Titen HD
Installation Information			
Nominal Diameter	d_a	in	½
Drill Bit Diameter	d_{bit}	in	½
Installation Torque	T_{inst}	ft-lbf	65
Maximum Impact Wrench Torque Rating	$T_{impact,max}$	ft-lbf	150
Minimum Hole Depth	h_{hole}	in	2½
Nominal Embedment	h_{nom}	in	2¼
Effective Embedment	h_{ef}	in	1½
Minimum Concrete Thickness	h_{min}	in	4
Critical Edge Distance	c_{cr}	in	6
Minimum Edge Distance	c_{min}	in	2½
Minimum Spacing	s_{min}	in	4
Characteristic Tension Strength Design Values			
Anchor Category	1, 2 or 3	-	1
Tension Resistance of Steel	N_{sa}	lbf	20,130
Strength Reduction Factor – Tension Steel Failure	ϕ_{sa}	-	0.65
Effectiveness Factor – Uncracked Concrete	k_{uncr}	-	24
Modification Factor	$\Psi_{c,N}$	-	1.0
Strength Reduction Factor – Concrete Breakout Failure in Tension	ϕ_{cb}	-	0.65
Pullout Resistance – Uncracked Concrete	$N_{p,uncr}$	lbf	N/A[1]
Characteristic Shear Strength Design Values			
Anchor Category	1, 2 or 3	-	1
Shear Resistance of Steel	V_{sa}	lbf	6,445
Strength Reduction Factor – Shear Steel Failure	ϕ_{sa}	-	0.60
Load Bearing Length of Anchor in Shear	l_e	in	1.50
Strength Reduction Factor – Concrete Breakout Failure in Shear	ϕ_{cb}	-	0.70
Coefficient for Pryout Strength	k_{cp}	-	1.0
Strength Reduction Factor – Concrete Pryout Failure	ϕ_{cb}	-	0.70

1. Pullout strength is not reported since concrete breakout controls.
2. Refer to ICC-ES ESR-2713 for additional information on use and installation.
3. The characteristic data values summarizes results from an accredited 3rd party Independent Testing and Evaluation Agency. Testing was performed in accordance with ICC-ES Acceptance Criteria for Mechanical Anchors in Concrete Elements, AC193 Table 4.1 test numbers 1, 12 and 13 in order to establish basic anchor performance in uncracked concrete.
4. Use of the anchor in cracked concrete and/or seismic application is outside the scope of this table.
5. The data in this table may be used to calculate anchor design strength in accordance with ACI 318-19 Chapter 17.
6. The data in this table is outside the scope of the ICC-ES Evaluation Report ESR-2713 for Titen HD.

Tension and Shear Design Strengths and Allowable Loads for Titen HD® Carbon Steel in 4-inch Thick Uncracked Normal-Weight Concrete (f'_c = 2,500 psi) *

Load Direction	Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness h_{min} (in.)	Critical Edge Distance c_{ac} (in.)	Loads when Edge Distance = c_{ac} on all sides (lb.)				Loads when Edge Distance = 2½ on one side and c_{ac} on three sides (lb.)			
					SD Level	ASD Level: Dead Load	ASD Level: Live Load	ASD Level: Wind Load	SD Level	ASD Level: Dead Load	ASD Level: Live Load	ASD Level: Wind Load
Tension	½	2¼	4	6	1,435	1,195	895	860	595	500	375	360
Shear					1,545	1,285	965	925	645	535	400	385

1. Tension and shear design strengths (SD level) are based on the strength design provisions of ACI 318-19 Chapter 17.
2. Tabulated values are for a single anchor with no influence of another anchor.
3. Strength reduction factor, ϕ, is based on using a load combination from ACI 318-19 Section 5.3.
4. Concrete to remain uncracked for the life of the anchorage.
5. Seismic application is outside the scope of this table.
6. Allowable level load values are calculated based on the strength design provision of ACI 318-19 Chapter 17 using a conversion factor of α = 1.2 for dead load, 1.6 for live load and $1/0.6$ = 1.67 for wind load.

* See page 3 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

SIMPSON Strong-Tie®

Shear Strength Design Data for ⅛-inch and ⅜-inch-diameter Titen HD® Carbon Steel with 1-inch Nominal Embedment Depth

Characteristic	Symbol	Unit	¼-inch-diameter Titen HD	⅜-inch-diameter Titen HD
Installation Information				
Nominal Diameter	d_a	in	¼	⅜
Drill Bit Diameter	d_{bit}	in	¼	⅜
Minimum Hole Depth	h_{hole}	in	1	1
Nominal Embedment	h_{nom}	in	1	1
Effective Embedment	h_{ef}	in	0.663	0.492
Minimum Concrete Thickness	h_{min}	in	3¼	4
Critical Edge Distance	c_{cr}	in	3	2¹¹⁄₁₆
Minimum Edge Distance	c_{min}	in	1.33	0.98
Minimum Spacing	s_{min}	in	2.66	1.97
Characteristic Shear Strength Design Values				
Shear Resistance of Steel in Uncracked Concrete	$V_{sa,uncr}$	lbf	1,045	1,075
Shear Resistance of Steel in Cracked Concrete	$V_{sa,cr}$	lbf	705	345
Strength Reduction Factor – Shear Steel Failure	ϕ_{sa}	-	0.6	
Load Bearing Length of Anchor in Shear	l_e	in	0.663	0.492
Strength Reduction Factor – Concrete Breakout Failure in Shear	ϕ_{cb}	-	0.45	
Effectiveness Factor - Uncracked Concrete	k_{uncr}	-	24	
Effectiveness Factor - Cracked Concrete	k_{cr}	-	17	
Coefficient for Pryout Strength	k_{cp}	-	1	
Strength Reduction Factor – Concrete Pryout Failure	ϕ_{cp}	-	0.45	

1. The characteristic data values summarizes results from IAS accredited laboratory. Testing was performed in accordance with ICC-ES Acceptance Criteria for Mechanical Anchors in Concrete Elements, AC193 Appendix A5 for shallow embedded anchors in uncracked and cracked concrete.
2. Use of the anchor in seismic application is outside the scope of this table.
3. The data in this table is limited to dry, interior, non-structural applications.
4. The data in this table may be used to calculate anchor design shear strength in accordance with ACI 318-19 Chapter 17.
5. The data in this table is outside the scope of the ICC-ES Evaluation Report ESR-2713 for Titen HD.

Titen HD® Design Information — Concrete

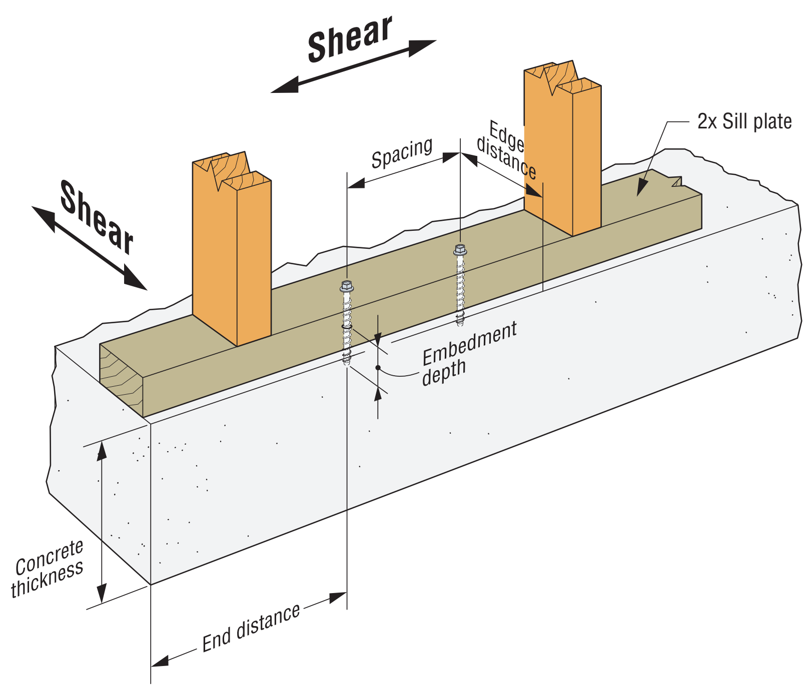
SIMPSON Strong-Tie

Shear Design Strengths and Allowable Loads for ¼-inch and ⅜-inch-diameter Titen HD® Carbon Steel with 1-inch Nominal Embedment Depth

IBC *

Anchor Dia. (in.)	Nom. Emb. Depth h_{nom} (in.)	Conc. Thick. h_{min} (in.)	Edge/End Dist. C_{min} (in.)	Spacing S_{min} (in.)	Uncracked Concrete				Cracked Concrete			
					SD Level	ASD Level: Dead Load	ASD Level: Live Load	ASD Level: Wind Load	SD Level	ASD Level: Dead Load	ASD Level: Live Load	ASD Level: Wind Load
¼	1	3¼	2¾	5½	265	220	165	155	205	170	125	100
			12	3								
⅜	1	4	2¾	5½	185	155	115	110	130	105	80	75
			12	3								

1. Shear design strengths are based on the strength design provisions of ACI 318-19 Chapter 17.
2. Tabulated values are for single anchor with no influence of another anchor.
3. Tabulated values are for anchor to concrete connection based on minimum concrete thickness, minimum edge distance and minimum spacing listed. The capacity of fixture must be evaluated separately.
4. Seismic application is outside the scope of this table.
5. Tabulated values are limited to dry, interior, non-structural applications.
6. Concrete shall be normal weight concrete.
7. Concrete strength shall be greater than or equal to f'_c = 2,500 psi.
8. Allowable level load values are calculated by using a conversion factor α = 1.2 for dead load, 1.6 for live load and $1/0.6$ = 1.67 for wind load.
9. The figure below illustrates 2x sill plate application. Tabulated values may be used to attach other types of fixtures. Height of the fixture shall not exceed thickness of 2x sill plate (1½ inches).



* See page 3 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

SIMPSON Strong-Tie

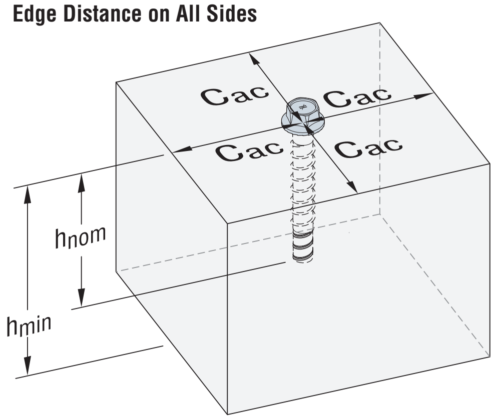
Titen HD® Stainless Steel Tension Design Strengths in Normal-Weight Concrete (f'_c = 2,500 psi)

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness h_{min} (in.)	Critical Edge Distance c_{ac} (in.)	Minimum Edge Distance c_{min} (in.)	Tension Design Strength (lb.)							
					Edge Distances = c_{ac} on all sides				Edge Distances = c_{min} on one side and c_{ac} on three sides			
					SDC A-B		SDC C-F		SDC A-B		SDC C-F	
					Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked
¼	2⅛	3½	3	1½	775	315	580	235	410	315	310	235
	3	4⅜	3	1½	1,525	550	1,145	415	975	550	730	415
⅜	2½	4	4½	1¾	1,455	1,090	1,090	815	590	985	445	740
	3¼	5	5½	1¾	2,275	1,570	1,705	1,175	865	1,105	650	825
½	3¼	5	6	1¾	2,225	1,295	1,670	975	750	1,015	560	760
	4	6¼	5¾	1¾	3,085	2,185	2,310	1,640	1,240	1,345	930	1,010
⅝	4	6	6	1¾	2,485	1,940	1,860	1,455	1,015	1,245	760	930
	5½	8½	6⅜	1¾	5,305	3,760	3,980	2,820	2,370	1,985	1,775	1,490
¾	5½	8¾	6¾	1¾	5,720	3,600	4,290	2,700	2,370	1,925	1,775	1,440
	6¼	10	7⅜	1¾	7,365	5,730	5,525	4,295	3,115	2,885	2,335	2,160

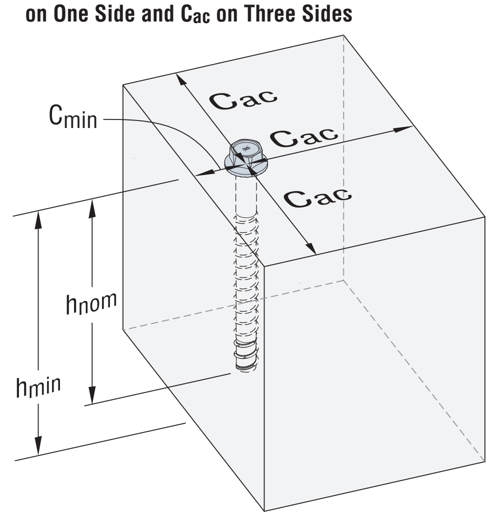
1. Tension design strengths (SD level) are based on the strength design provisions of ACI 318-19 Chapter 17.
2. Tabulated values are for a single anchor with no infuence of another anchor.
3. Interpolation between embedment depths is not permitted.
4. Strength reduction factor, ϕ, is based on using a load combination from ACI 318-19 Section 5.3.
5. The tension design strength listed for SDC (Seismic Design Category) A-B may also be used in SDC C-F when the tension component of the strength-level seismic design load on the anchor does not exceed 20% of the total factored tension load on the anchor associated with the same load combination.
6. When designing anchorages in SDC C-F, the designer shall consider the ductility requirements of ACI 318-19 Section 17.10.
7. Tension design strengths in SDC C-F have been adjusted by 0.75 factor in accordance with ACI 318-19 Section 17.10.5.4.
8. The Designer of Record is responsible for the foundation design.

Titen HD Stainless Steel with C_{ac} Edge Distance on All Sides



Flat Slab

Titen HD Stainless Steel with C_{min} Edge Distance on One Side and C_{ac} on Three Sides



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* See page 3 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

SIMPSON Strong-Tie

Titen HD® Stainless Steel Allowable Tension Loads in Normal-Weight Concrete (f'_c = 2,500 psi) — Static Load

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness h_{min} (in.)	Critical Edge Distance c_{ac} (in.)	Minimum Edge Distance c_{min} (in.)	Allowable Tension Load (lb.)			
					Edge Distances = c_{ac} on all sides		Edge Distances = c_{min} on one side and c_{ac} on three sides	
					Uncracked	Cracked	Uncracked	Cracked
¼	2⅛	3½	3	1½	555	225	295	225
	3	4⅜	3	1½	1,090	395	695	395
⅜	2½	4	4½	1¾	1,040	780	420	705
	3¼	5	5½	1¾	1,625	1,120	620	790
½	3¼	5	6	1¾	1,590	925	535	725
	4	6¼	5¾	1¾	2,205	1,560	885	960
⅝	4	6	6	1¾	1,775	1,385	725	890
	5½	8½	6⅜	1¾	3,790	2,685	1,695	1,420
¾	5½	8¾	6¾	1¾	4,085	2,570	1,695	1,375
	6¼	10	7⅜	1¾	5,260	4,095	2,225	2,060

See footnotes and graphics on page 16.

Titen HD® Stainless Steel Allowable Tension Loads in Normal-Weight Concrete (f'_c = 2,500 psi) — Wind Load

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness h_{min} (in.)	Critical Edge Distance c_{ac} (in.)	Minimum Edge Distance c_{min} (in.)	Allowable Tension Load (lb.)			
					Edge Distances = c_{ac} on all sides		Edge Distances = c_{min} on one side and c_{ac} on three sides	
					Uncracked	Cracked	Uncracked	Cracked
¼	2⅛	3½	3	1½	465	190	245	190
	3	4⅜	3	1½	915	330	585	330
⅜	2½	4	4½	1¾	875	655	355	590
	3¼	5	5½	1¾	1,365	940	520	665
½	3¼	5	6	1¾	1,335	775	450	610
	4	6¼	5¾	1¾	1,850	1,310	745	805
⅝	4	6	6	1¾	1,490	1,165	610	745
	5½	8½	6⅜	1¾	3,185	2,255	1,420	1,190
¾	5½	8¾	6¾	1¾	3,430	2,160	1,420	1,155
	6¼	10	7⅜	1¾	4,420	3,440	1,870	1,730

See footnotes and graphics on page 16.

Titen HD® Stainless Steel Allowable Tension Loads in Normal-Weight Concrete (f'_c = 2,500 psi) — Seismic Load

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness $h_{min,deck}$ (in.)	Critical Edge Distance $c_{ac,deck,top}$ (in.)	Minimum Edge Distance $c_{min,deck,top}$ (in.)	Tension Design Strength (lb.)							
					Edge Distances = c_{ac} on all sides				Edge Distances = c_{min} on one side and c_{ac} on three sides			
					SDC A-B		SDC C-F		SDC A-B		SDC C-F	
					Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked
¼	2⅛	3½	3	1½	545	220	405	165	285	220	215	165
	3	4⅜	3	1½	1,070	385	800	290	685	385	510	290
⅜	2½	4	4½	1¾	1,020	765	765	570	415	690	310	520
	3¼	5	5½	1¾	1,595	1,100	1,195	825	605	775	455	580
½	3¼	5	6	1¾	1,560	905	1,170	685	525	710	390	530
	4	6¼	5¾	1¾	2,160	1,530	1,615	1,150	870	940	650	705
⅝	4	6	6	1¾	1,740	1,360	1,300	1,020	710	870	530	650
	5½	8½	6⅜	1¾	3,715	2,630	2,785	1,975	1,660	1,390	1,245	1,045
¾	5½	8¾	6¾	1¾	4,005	2,520	3,005	1,890	1,660	1,350	1,245	1,010
	6¼	10	7⅜	1¾	5,155	4,010	3,865	3,005	2,180	2,020	1,635	1,510

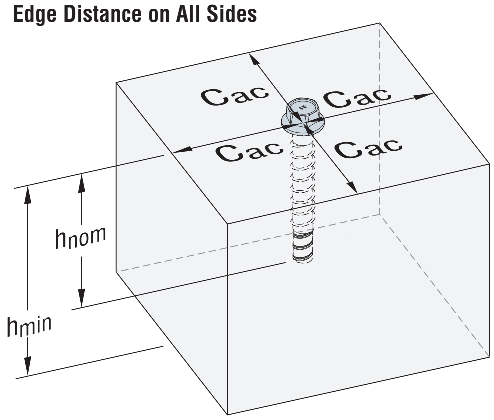
See footnotes and graphics on page 16.

* See page 3 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

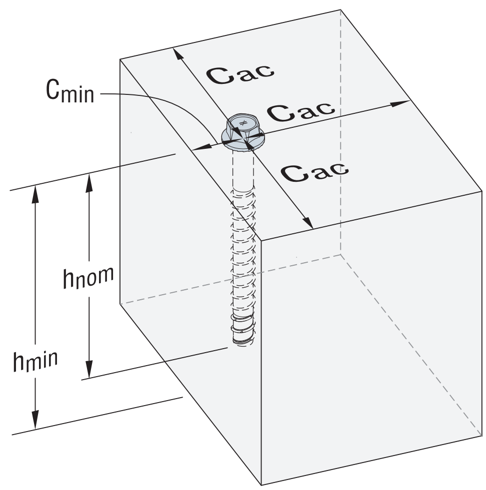
1. Static allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 17 using a conversion factor of $\alpha = 1.4$. The conversion factor α is based on the load combination 1.2D + 1.6L assuming 50% dead load and 50% live load: 1.2(0.5) + 1.6(0.5) = 1.4.
2. Wind allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 17 using a conversion factor of $\alpha = 1/0.6 = 1.67$. The conversion factor α is based on the load combination assuming 100% wind load.
3. Seismic allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 17 using a conversion factor of $\alpha = 1/0.7 = 1.43$. The conversion factor α is based on the load combination assuming 100% seismic load.
4. Tabulated values are for a single anchor with no influence of another anchor.
5. Interpolation between embedment depths is not permitted.
6. The allowable tension load listed for SDC (Seismic Design Category) A-B may also be used in SDC C-F when the tension component of the strength-level seismic design load on the anchor does not exceed 20% of the total factored tension load on the anchor associated with the same load combination.
7. When designing anchorages in SDC C-F, the designer shall consider the ductility requirements of ACI 318-19 Section 17.10.
8. Tension design strengths in SDC C-F have been adjusted by 0.75 factor in accordance with ACI 318-19 Section 17.10.5.4.
9. The Designer of Record is responsible for the foundation design.

Titen HD Stainless Steel with C_{ac} Edge Distance on All Sides



Flat Slab

Titen HD Stainless Steel with C_{min} Edge Distance on One Side and C_{ac} on Three Sides



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Titen HD® Design Information — Concrete

SIMPSON Strong-Tie

Titen HD® Stainless Steel Tension Design Strengths in Topside of Normal-Weight Concrete-Filled Profile Steel Deck Assemblies (f'_c = 2,500 psi)

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness $h_{min,deck}$ (in.)	Critical Edge Distance $c_{ac,deck,top}$ (in.)	Minimum Edge Distance $c_{min,deck,top}$ (in.)	Tension Design Strength (lb.)							
					Edge Distances = $c_{ac,deck,top}$ on all sides				Edge Distances = $c_{min,deck,top}$ on one side and $c_{ac,deck,top}$ on three sides			
					SDC A-B		SDC C-F		SDC A-B		SDC C-F	
					Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked
¼	2⅛	2½	3	1½	775	315	580	235	410	315	310	235
⅜	2½	3¼	4½	1¾	1,455	1,090	1,090	815	590	985	445	740
½	3¼	3¾	7½	1¾	2,225	1,295	1,670	975	600	1,015	450	760

1. Tension design strengths (SD level) are based on the strength design provisions of ACI 318-19 Chapter 17.
2. Tabulated values are for a single anchor with no infuence of another anchor.
3. Interpolation between embedment depths is not permitted.
4. Strength reduction factor, ϕ, is based on using a load combination from ACI 318-19 Section 5.3.
5. The tension design strength listed for SDC (Seismic Design Category) A-B may also be used in SDC C-F when the tension component of the strength-level seismic design load on the anchor does not exceed 20% of the total factored tension load on the anchor associated with the same load combination.
6. When designing anchorages in SDC C-F, the designer shall consider the ductility requirements of ACI 318-19 Section 17.10.
7. Tension design strengths in SDC C-F have been adjusted by 0.75 factor in accordance with ACI 318-19 Section 17.10.5.4.
8. For installation in topside of sand-lightweight concrete-filled profile steel deck assemblies, tabulated values must be multiplied by 0.68.
9. Installation must comply with Figure 1.

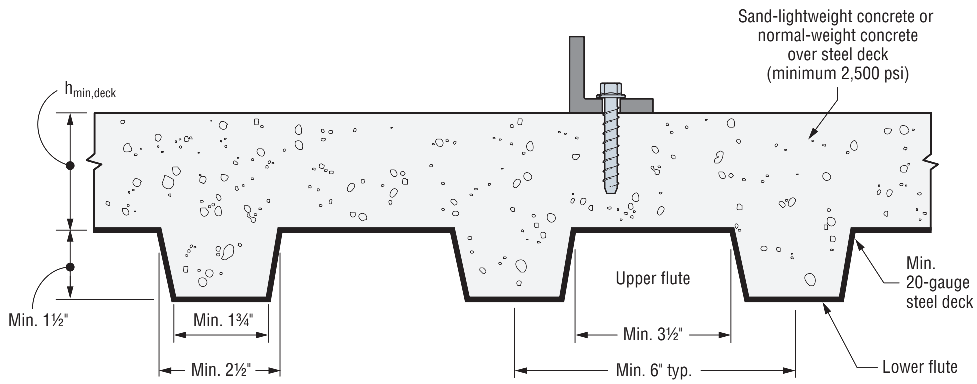


Figure 1 - Installation of ¼", ⅜" and ½" Shank Diameter Screw Anchors in the Topside of Concrete-Filled Profile Steel Deck Floor and Roof Assemblies (1" = 25.4 mm)

* See page 3 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

SIMPSON Strong-Tie

Titen HD® Stainless Steel Allowable Tension Loads in Topside of Normal-Weight Concrete-Filled Profile Steel Deck Assemblies (f'_c = 2,500 psi) — Static Load

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness $h_{min,deck}$ (in.)	Critical Edge Distance $c_{ac,deck,top}$ (in.)	Minimum Edge Distance $c_{min,deck,top}$ (in.)	Allowable Tension Load (lb.)			
					Edge Distances = $c_{ac,deck,top}$ on all sides		Edge Distances = $c_{min,deck,top}$ on one side and $c_{ac,deck,top}$ on three sides	
					Uncracked	Cracked	Uncracked	Cracked
¼	2⅛	2½	3	1½	555	225	295	225
⅜	2½	3¼	4½	1¾	1,040	780	420	705
½	3¼	3¾	7½	1¾	1,590	925	430	725

Titen HD® Stainless Steel Allowable Tension Loads in Topside of Normal-Weight Concrete-Filled Profile Steel Deck Assemblies (f'_c = 2,500 psi) — Wind Load

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness $h_{min,deck}$ (in.)	Critical Edge Distance $c_{ac,deck,top}$ (in.)	Minimum Edge Distance $c_{min,deck,top}$ (in.)	Allowable Tension Load (lb.)			
					Edge Distances = $c_{ac,deck,top}$ on all sides		Edge Distances = $c_{min,deck,top}$ on one side and $c_{ac,deck,top}$ on three sides	
					Uncracked	Cracked	Uncracked	Cracked
¼	2⅛	2½	3	1½	465	190	245	190
⅜	2½	3¼	4½	1¾	875	655	355	590
½	3¼	3¾	7½	1¾	1,335	775	360	610

Titen HD® Stainless Steel Allowable Tension Loads in Topside of Normal-Weight Concrete-Filled Profile Steel Deck Assemblies (f'_c = 2,500 psi) — Seismic Load

IBC *

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Min. Concrete Thickness $h_{min,deck}$ (in.)	Critical Edge Distance $c_{ac,deck,top}$ (in.)	Minimum Edge Distance $c_{min,deck,top}$ (in.)	Tension Design Strength (lb.)							
					Edge Distances = $c_{ac,deck,top}$ on all sides				Edge Distances = $c_{min,deck,top}$ on one side and $c_{ac,deck,top}$ on three sides			
					SDC A-B		SDC C-F		SDC A-B		SDC C-F	
					Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked	Uncracked	Cracked
¼	2⅛	2½	3	1½	545	220	405	165	285	220	215	165
⅜	2½	3¼	4½	1¾	1,020	765	765	570	415	690	310	520
½	3¼	3¾	7½	1¾	1,560	905	1,170	685	420	710	315	530

1. Static allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 17 using a conversion factor of $\alpha = 1.4$. The conversion factor α is based on the load combination 1.2D + 1.6L assuming 50% dead load and 50% live load: 1.2(0.5) + 1.6(0.5) = 1.4.
2. Wind allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 17 using a conversion factor of $\alpha = 1/0.6 = 1.67$. The conversion factor α is based on the load combination assuming 100% wind load.
3. Seismic allowable tension loads are calculated based on the strength design provision of ACI 318-19 Chapter 17 using a conversion factor of $\alpha = 1/0.7 = 1.43$. The conversion factor α is based on the load combination assuming 100% seismic load.
4. Tabulated values are for a single anchor with no infuence of another anchor.
5. Interpolation between embedment depths is not permitted.
6. The allowable tension load listed for SDC (Seismic Design Category) A-B may also be used in SDC C-F when the tension component of the strength-level seismic design load on the anchor does not exceed 20% of the total factored tension load on the anchor associated with the same load combination.
7. When designing anchorages in SDC C-F, the designer shall consider the ductility requirements of ACI 318-19 Section 17.10.
8. Tension design strengths in SDC C-F have been adjusted by 0.75 factor in accordance with ACI 318-19 Section 17.10.5.4.
9. For installation in topside of sand-lightweight concrete-filled profile steel deck assemblies, tabulated values must be multiplied by 0.68.
10. Installation must comply with Figure 1 on page 17.

* See page 3 for an explanation of the load table icons.

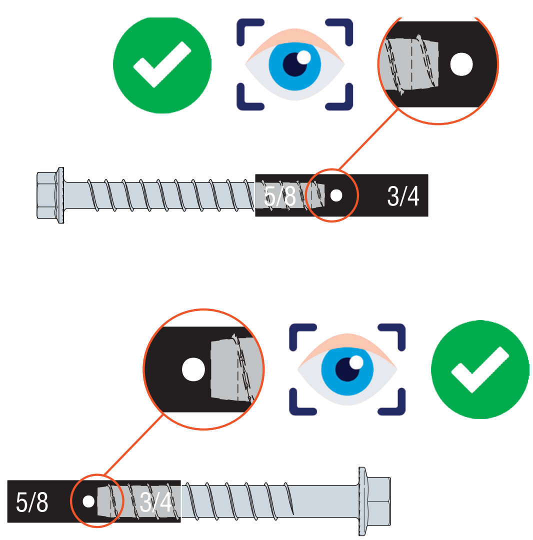
Titen HD® Thread Gauge

The Titen HD Thread Gauge allows users to check thread wear on previously installed carbon steel THD anchors to determine suitability for reuse in temporary applications. The dual-sided design can gauge both ⅝" and ¾" diameter carbon steel Titen HD anchors. The gauge is designed for a quick and easy check to assess if a THD anchor can be used again.

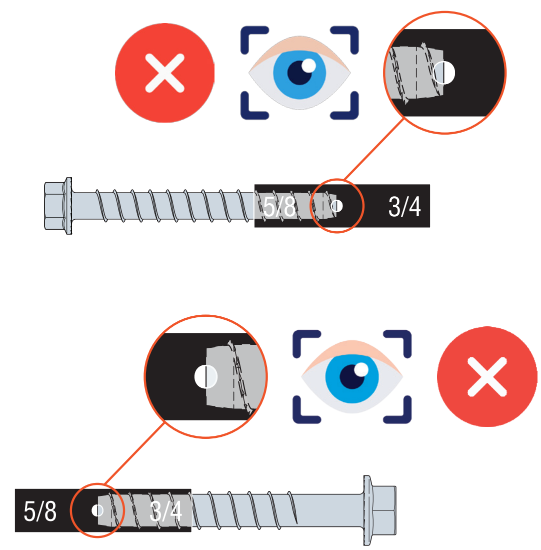
To use, insert the THD anchor into the appropriate end of the gauge. If any part of the anchor passes through the witness hole in the center of the gauge, it is not suitable to be used again. If the THD anchor does not pass into the witness hole, it can be used. If you see any part of the THD anchor when you look through the witness hole, you must discard the THD anchor immediately. Do not reuse the THD anchor if any part of the anchor is visible in the witness hole.

See pages 20-23 for reused Titen HD design data.

Suitable for Reuse



Not Suitable for Reuse



Note: ⅝" diameter Titen HD must be inserted on the side of Titen HD Thread Gauge marked with ⅝.

Similarly, ¾" diameter Titen HD must be inserted on the side of Titen HD Thread Gauge marked with ¾.

Reused Titen HD® Technical Information

SIMPSON Strong-Tie®

Reused Titen HD® Carbon Steel Installation Parameters and Strength Design Data for Temporary Applications[1,6]

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.)			
			⅝		¾	
Installation Parameters						
Drill Bit Diameter	d_{bit}	in.	⅝		¾	
Baseplate Clearance Hole Diameter	d_h	in.	¾		⅞	
Maximum Installation Torque[2]	$T_{inst,max}$	ft-lbf	100		150	
Maximum Impact Wrench Torque Rating[3]	$T_{impact,max}$	ft-lbf	340		385	
Minimum Hole Depth	h_{hole}	in.	4½	6	4½	6¾
Nominal Embedment Depth	h_{nom}	in.	4	5½	4	6¼
Effective Embedment Depth	h_{ef}	in.	2.97	4.24	2.94	4.86
Critical Edge Distance	c_{ac}	in.	4½	6⅜	6	7 5/16
Minimum Edge Distance	c_{min}	in.	1¾		1¾	
Minimum Spacing	s_{min}	in.	3		2¾	3
Minimum Concrete Thickness	h_{min}	in.	6	8½	6	10
Wrench Size	-	in.	15/16		1⅛	
Steel Strength in Tension						
Tension Resistance of Steel	N_{sa}	lb.	30,360		45,540	
Strength Reduction Factor – Steel Failure[4]	ϕ_{sa}	-	0.65			
Concrete Breakout Strength in Tension						
Effectiveness Factor – Uncracked Concrete	k_{uncr}	-	24		24	
Modification Factor	$\psi_{c,N}$	-	1.0			
Strength Reduction Factor – Concrete Breakout Failure[4]	ϕ_{cb}	-	0.65			
Pullout Strength in Tension						
Pullout Resistance – Uncracked Concrete (f'_c = 2,500 psi)	$N_{p,uncr}$	lb.	4,740[5]	9,010[5]	5,495[5]	9,400[5]
Strength Reduction Factor – Concrete Pullout Failure[4]	ϕ_p	-	0.65			
Steel Strength in Shear						
Shear Resistance of Steel	V_{sa}	lb.	10,000		13,150	
Strength Reduction Factor – Steel Failure[4]	ϕ_{sa}	-	0.60			
Concrete Breakout Strength in Shear						
Outside Diameter	d_a	in.	0.625		0.750	
Load Bearing Length of Anchor in Shear	ℓ_e	in.	2.97	4.24	2.94	4.86
Strength Reduction Factor – Concrete Breakout Failure[4]	ϕ_{cb}	-	0.70			
Concrete Pryout Strength in Shear						
Coefficient for Pryout Strength	k_{cp}	-	2.0			
Strength Reduction Factor – Concrete Pryout Failure[4]	ϕ_{cp}	-	0.70			

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-19 Chapter 17, ACI 318-14 Chapter 17 and ACI 318-11 Appendix D.
2. $T_{inst,max}$ is the maximum permitted installation torque for the embedment depth range covered by this table using a torque wrench. Exceeding the maximum torque can reduce its holding capacity.
3. $T_{impact,max}$ is the maximum permitted torque rating for impact wrenches for the embedment depth range covered by this table.
4. The strength reduction factor applies when the load combinations from the IBC or ACI 318 are used and the requirements of ACI 318-19 17.5.3, ACI 318-14 17.3.3 or ACI 318-11 D.4.3, as applicable, are met. If the load combinations of ACI 318-11 Appendix C are used, the appropriate strength reduction factor must be determined in accordance with ACI 318-11 D.4.4.
5. Adjust the characteristic pullout resistance for other concrete compressive strengths by multiplying the tabular value by $(f'_{c,specified} / 2,500)^{0.5}$.
6. Installation parameters are for reused Titen HD that have passed a check using the Simpson Strong-Tie® Titen HD Thread Gauge.

Reused Titen HD® Technical Information

SIMPSON Strong-Tie

Reused Titen HD® Carbon Steel Design Strengths in Normal-Weight Uncracked Concrete for Temporary Applications[3,4,6,7,8,9,10]

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Critical Edge Distance c_{ac} (in.)	Design Strength (lb.)								
			f'c = 2,500 psi			f'c = 4,000 psi			f'c = 6,000 psi		
			Tension ϕN_n	Shear ϕV_n	60-degree[5]	Tension ϕN_n	Shear ϕV_n	60-degree[5]	Tension ϕN_n	Shear ϕV_n	60-degree[5]
Single-use[1] **IMPORTANT: these values are higher as compared to a reused anchor**											
⅝	4	4½	3,990	3,335	3,270	5,050	4,215	4,135	6,185	5,165	5,065
	5½	6⅜	6,375	6,000	5,475	8,065	6,000	6,290	9,880	6,000	7,020
¾	4	6	4,425	4,685	3,970	5,595	5,925	5,015	6,855	7,255	6,145
	6¼	7 5/16	8,355	8,145	7,270	10,565	10,105	9,130	12,940	10,105	10,310
Reused after passing a check with the Simpson Strong-Tie® Titen HD Thread Gauge[2] **IMPORTANT: these values are reduced as compared to a single-use anchor**											
⅝	4	4½	3,080	3,335	2,785	3,895	4,215	3,520	4,775	5,165	4,315
	5½	6⅜	5,855	6,000	5,190	7,410	6,000	5,995	9,070	6,000	6,710
¾	4	6	3,570	4,685	3,435	4,520	5,925	4,350	5,535	7,255	5,325
	6¼	7 5/16	6,110	7,890	5,850	7,725	7,890	6,840	9,465	7,890	7,750

1. Tabulated values are based on the characteristic ultimate values obtained from testing a Simpson Strong-Tie® Titen HD anchor installed for the first time in concrete.
2. Tabulated values are based on the characteristic ultimate values obtained from testing a Simpson Strong-Tie® Titen HD anchor meeting the minimum thread outside diameter requirement as checked with the Simpson Strong-Tie® Titen HD Thread Gauge.
3. For lightweight concrete, multiply design strength by λ_a as follows: for sand-lightweight, $\lambda_a = 0.68$; for all-lightweight, $\lambda_a = 0.60$.
4. Design strength in 2,500 psi, 4,000 psi and 6,000 psi concrete are based on test data and calculations according to ACI 318-19 Chapter 17.
5. 60-degree loads are calculated for a pinned connection where the load acts 60 degrees from a line parallel to the concrete surface using the interaction equation between tension and shear failure with the tabulated tension and shear design strength.
6. Tabulated values are for single anchor with no influence of another anchor.
7. Tabulated values are based on an anchor placed at critical edge distance from one concrete edge. See Figure 1 below.
8. Interpolation between embedment depth is not permitted.
9. The Designer of Record is responsible for the foundation design.
10. For anchor subjected to both tension and shear loads, it shall be designed to satisfy following:
   - For $N_a/\phi N_n \leq 0.2$, the full design strength in shear is permitted.
   - For $V_a/\phi V_n \leq 0.2$, the full design strength in tension is permitted.
   - For all other cases: $N_a/\phi N_n + V_a/\phi V_n \leq 1.2$.

   where:
   N_a = Applied tension load
   ϕN_n = Tension design strength from table
   V_a = Applied shear load
   ϕV_n = Shear design strength from table

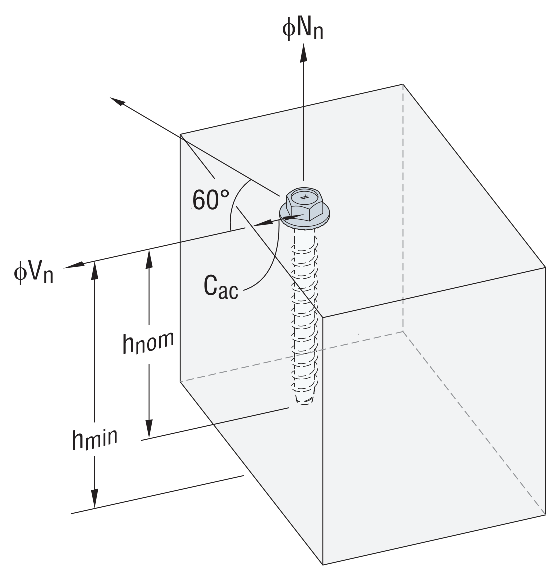


Figure 1

* See page 3 for an explanation of the load table icons.

Reused Titen HD® Technical Information

SIMPSON Strong-Tie®

Reused Titen HD® Carbon Steel Allowable Loads in Normal-Weight Uncracked Concrete for Temporary Applications - Dead Load[3,4,6,7,8,9,10,11]

*

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Critical Edge Distance c_{ac} (in.)	Allowable Loads (lb.)								
			f'_c = 2,500 psi			f'_c = 4,000 psi			f'_c = 6,000 psi		
			Tension N_{al}	Shear V_{al}	60-degree[5]	Tension N_{al}	Shear V_{al}	60-degree[5]	Tension N_{al}	Shear V_{al}	60-degree[5]
Single-use[1] **IMPORTANT: these values are higher as compared to a reused anchor**											
5⁄8	4	4½	3,325	2,780	2,725	4,210	3,515	3,445	5,155	4,305	4,220
	5½	6⅜	5,315	5,000	4,565	6,720	5,000	5,240	8,235	5,000	5,850
¾	4	6	3,690	3,905	3,310	4,665	4,940	4,180	5,715	6,045	5,120
	6¼	7 5⁄16	6,965	6,790	6,060	8,805	8,420	7,610	10,785	8,420	8,590
Reused after passing a check with the Simpson Strong-Tie® Titen HD Thread Gauge[2] **IMPORTANT: these values are reduced as compared to a single-use anchor**											
5⁄8	4	4½	2,565	2,780	2,320	3,245	3,515	2,935	3,980	4,305	3,595
	5½	6⅜	4,880	5,000	4,325	6,175	5,000	4,995	7,560	5,000	5,590
¾	4	6	2,975	3,905	2,865	3,765	4,940	3,625	4,615	6,045	4,440
	6¼	7 5⁄16	5,090	6,575	4,875	6,440	6,575	5,700	7,890	6,575	6,460

See footnotes on page 23.

Reused Titen HD® Carbon Steel Allowable Loads in Normal-Weight Uncracked Concrete for Temporary Applications - Wind Load[3,4,6,7,8,9,10,11]

*

Anchor Dia. (in.)	Nominal Embed. Depth (in.)	Critical Edge Distance c_{ac} (in.)	Allowable Loads (lb.)								
			f'_c = 2,500 psi			f'_c = 4,000 psi			f'_c = 6,000 psi		
			Tension N_{al}	Shear V_{al}	60-degree[5]	Tension N_{al}	Shear V_{al}	60-degree[5]	Tension N_{al}	Shear V_{al}	60-degree[5]
Single-use[1] **IMPORTANT: these values are higher as compared to a reused anchor**											
5⁄8	4	4½	2,495	2,085	2,045	3,155	2,635	2,585	3,865	3,230	3,165
	5½	6⅜	3,985	3,750	3,420	5,040	3,750	3,930	6,175	3,750	4,390
¾	4	6	2,765	2,930	2,480	3,495	3,705	3,135	4,285	4,535	3,840
	6¼	7 5⁄16	5,220	5,090	4,545	6,605	6,315	5,705	8,090	6,315	6,445
Reused after passing a check with the Simpson Strong-Tie® Titen HD Thread Gauge[2] **IMPORTANT: these values are reduced as compared to a single-use anchor**											
5⁄8	4	4½	1,925	2,085	1,740	2,435	2,635	2,200	2,985	3,230	2,695
	5½	6⅜	3,660	3,750	3,245	4,630	3,750	3,745	5,670	3,750	4,195
¾	4	6	2,230	2,930	2,145	2,825	3,705	2,720	3,460	4,535	3,330
	6¼	7 5⁄16	3,820	4,930	3,655	4,830	4,930	4,275	5,915	4,930	4,845

See footnotes on page 23.

* See page 3 for an explanation of the load table icons.

Reused Titen HD® Technical Information

SIMPSON Strong-Tie

1. Tabulated allowable loads are for a Simpson Strong-Tie® Titen HD anchor installed for the first time in concrete.
2. Tabulated allowable loads are for a Simpson Strong-Tie® Titen HD anchor meeting the minimum thread outside diameter requirement as checked with the Simpson Strong-Tie® Thread Gauge.
3. For lightweight concrete, multiply allowable loads by λ_a as follows: for sand-lightweight, $\lambda_a = 0.68$; for all-lightweight, $\lambda_a = 0.60$.
4. Allowable loads in 2,500 psi, 4,000 psi and 6,000 psi concrete are based on test data and calculations according to ACI 318-19 Chapter 17.
5. 60-degree loads are calculated for a pinned connection where the load acts 60 degrees from a line parallel to the concrete surface using the interaction equation between tension and shear failure with the tabulated allowable tension and shear loads.
6. Tabulated values are for single anchor with no influence of another anchor.
7. Tabulated values are based on an anchor placed at critical edge distance from one concrete edge. See Figure 2 below.
8. Interpolation between embedment depth is not permitted.
9. The Designer of Record is responsible for the foundation design.
10. Allowable loads are calculated based on design strength values using a conversion factors as follows:

$$T_{al} = \frac{\phi N_n}{\alpha}$$

and

$$V_{al} = \frac{\phi V_n}{\alpha}$$

where:

T_{al} = Allowable tension load

V_{al} = Allowable shear load

α = Conversion factor calculated as a weighted average of the load factors for the controlling load combination

For example:

$\alpha = 1.2$ for load combination of 1.2D assuming 100% dead load

$\alpha = 1.6$ for load combination of 1.6W assuming 100% wind load

11. For anchor subjected to both tension and shear loads, it shall be designed to satisfy following:
- For $N_a/N_{al} \le 0.2$, the full allowable load in shear is permitted.
- For $V_a/V_{al} \le 0.2$, the full allowable load in tension is permitted.
- For all other cases: $N_a/N_{al} + V_a/V_{al} \le 1.2$.

where:

N_a = Applied ASD tension load

N_{al} = Allowable tension load from table

V_a = Applied ASD shear load

V_{al} = Allowable shear load from table

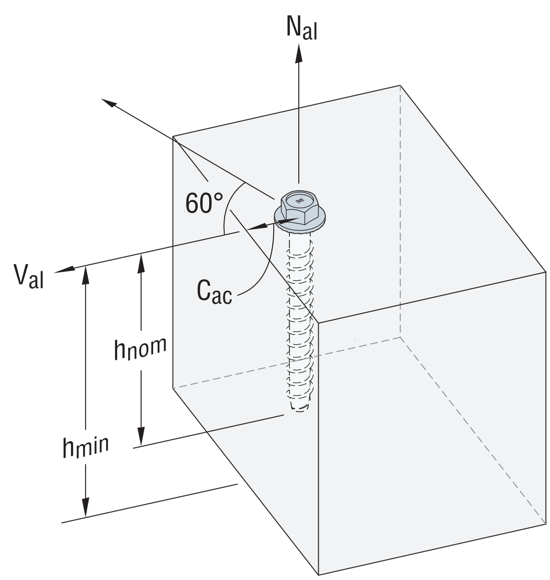


Figure 2