KCC AND KCCM CAST-IN ANCHORS

Technical Supplement

October 2024

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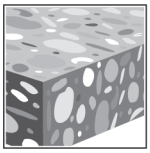
1. KCC-WF, KCC-MD, KCCM-WF, AND KCCM-MD CAST-IN ANCHOR

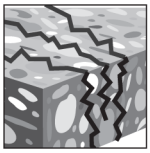
The following document is a supplementary document and provides updates to section 3.3.17 of the Hilti North American Product Technical Guide, Volume 2: Anchor Fastening Technical Guide, Edition 22 (PTG 22). Refer to PTG 22 for additional information not contained in this document.

1.1. PRODUCT DESCRIPTION

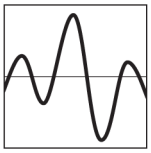
Anchor System		Features and Benefits
	Internally threaded cast-in anchors for wood form construction (KCC-WF and KCCM-WF)	• Quick push-to-connect technology offers ultimate productivity • Ideal for pre-assembled / pre-fabricated hanger assemblies • KCC-WF and KCCM-WF — Color-coded foam covering protects inner threads from concrete intrusion • KCC-WF and KCCM-WF — Nails through the head helps prevent anchor from being knocked over and from head popping off due to rebar hits • KCC-MD and KCCM-MD — Pre-assembled self-tapping screws reduce installation time • KCC-MD and KCCM-MD — Color-coded plastic plugs protect inner threads from concrete, sprayed-on fireproofing, or sprayed-on insulation • KCC-MD L and KCCM-MD L — Pre-assembled spanner plate offers flexibility with installation at any location on the metal deck including the incline • KCC-MD L and KCCM-MD L— Anchor installs to the top of the flutes, so anchoring point is at consistent height throughout, which is ideal for pre-fabricated hangers
	Internally threaded short plate cast-in anchors for lightweight concrete over metal deck construction (KCC-MD S and KCCM-MD S)	
	Internally threaded long plate cast-in anchors for lightweight concrete over metal deck construction (KCC-MD L and KCCM-MD L)	**NOTE** KCCM anchors are designed for permanent applications and single use.



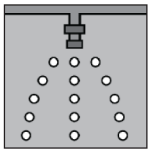
Uncracked concrete



Cracked concrete



Seismic Design Categories A-F



Fire sprinkler listings

Approvals/Listings	
ICC-ES (International Code Council) 2024 International Building Code / International Residential Code (IBC/IRC)	ESR-4145 in concrete per ACI 318 Ch. 17 / ICC-ES AC446
City of Los Angeles	2023 LABC Supplement (within ESR-4145)
Florida Building Code	2023 FBC with HVHZ
UL LLC (Underwriters Laboratory LLC)	Pipe Hanger Equipment for Fire Protection Services for 3/8 through 1/2 (See Table 27) including plenum rated for air handling spaces per UL 2043
FM (Factory Mutual) Pipe	Hanger Components for Automatic Sprinkler Systems for 3/8 through 1/2 (See Table 27) including plenum rated for air handling spaces per UL 2043
ANSI/MSS SP-58-2018	Anchors conform to ANSI/MSSP-58-2018. Contact Hilti for more information.

1.2. MATERIAL SPECIFICATIONS

KCC-WF, KCC-MD, KCCM WF, and KCCM-MD have an insert body made from carbon steel with an engineered plastic flange. The insert body is zinc plated per ASTM B633 Fe/Zn 5 Type III.

1.3. INSTALLATION PARAMETERS

Table 1. Hilti KCC-WF and KCCM-WF cast-in anchor installation information

Setting Information	Symbol	Units	KCC-WF 3/8"	KCC-WF 1/2"	KCCM-WF 1/4"-3/8"		KCCM-WF 3/8"-1/2"	
Insert thread nominal diameter and threads per inch	d	UNC	3/8-16	1/2-13	1/4-20	3/8-16	3/8-16	1/2-13
Effective embedment[2]	h_{ef}	in. (mm)	1.63 (41)	2.04 (52)	2.04 (52)		2.25 (57)	
Nominal embedment[2]	h_{nom}	in. (mm)	1.76 (45)	2.17 (55)	2.17 (55)		2.38 (60)	
Outside diameter of anchor steel body	d_a	in. (mm)	0.67 (17.0)	0.87 (22.1)	0.89 (22.6)		1.05 (26.6)	
Bearing area[2]	A_{brg}	in.^{2} (mm^2)	1.00 (643)	1.23 (792)	0.95 (611)		1.30 (841)	
Steel head thickness	t_{sh}	mm	3.3	3.3	3.3		3.3	
Minimum member thickness	h_{min}	in. (mm)	2-1/2 (64)	3 (76)	2-3/4 (70)		3 (76)	
Minimum edge distance[1]	c_{min}	in. (mm)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)		1-1/2 (38)	
Minimum anchor spacing	s_{min}	in. (mm)	2-5/8 (68)	3-1/2 (88)	3-1/2 (90)		4-1/4 (106)	
Thread engagement length[2]	l_{th}	in. (mm)	1.6 (41)	1.9 (48)	2.0 (52)	1.8 (46)	2.2 (57)	1.9 (48)

[1]Edge distance must satisfy specified cover requirements for reinforcement according to ACI 318 section 20.5.1.3 or CSA A23.3 clause 7.9.

[2]See Figure 1

Figure 1. KCC-WF and KCCM-WF installation information and thread engagement

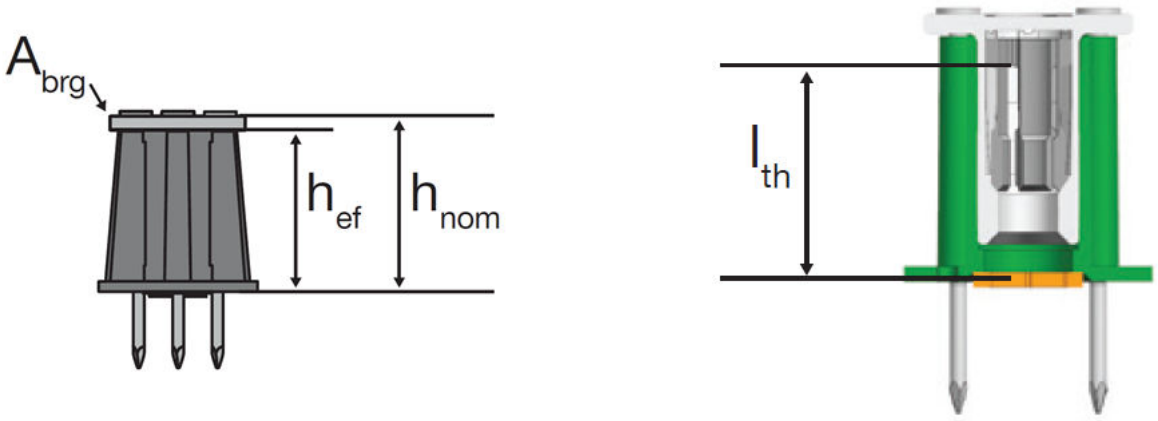


Table 2. Hilti KCC-MD S, KCC-MD L, KCCM-MD S, and KCCM-MD L cast-in anchor installation information

Setting Information	Symbol	Units	KCC-MD S 3/8"	KCC-MD S 1/2"	KCC-MD L 3/8"	KCC-MD L 1/2"	KCCM-MD S 1/4"-3/8"		KCCM-MD S 3/8"-1/2"		KCCM-MD L 1/4"-3/8"		KCCM-MD L 3/8"-1/2"	
Insert thread nominal diameter and threads per inch	d	UNC	3/8-16	1/2-13	3/8-16	1/2-13	1/4-20	3/8-16	3/8-16	1/2-13	1/4-20	3/8-16	3/8-16	1/2-13
Outside diameter of anchor steel body	d_a	in. (mm)	0.67 (17.0)	0.87 (22.1)	0.67 (17.0)	0.87 (22.1)	0.89 (22.6)		1.05 (26.6)		0.89 (22.6)		1.05 (26.6)	
Bearing area	A_{brg}	in.^{2} (mm^2)	1.00 (627)	1.20 (771)	1.00 (627)	1.20 (771)	0.95 (611)		1.30 (841)		0.95 (611)		1.30 (841)	
Effective embedment	h_{ef}	in. (mm)	2.00 (51)	2.50 (64)	2.00 (51)	2.50 (64)	2.32 (59)		2.60 (66)		2.32 (59)		2.60 (66)	
Nominal embedment	h_{nom}	in. (mm)	2.13 (54)	2.63 (67)	2.13 (54)	2.63 (67)	2.45 (62)		2.73 (69)		2.45 (62)		2.73 (69)	
Metal hole saw diameter	d_{bit}	in.	11/16	13/16	5/8	3/4	13/16		15/16		3/4		7/8	
Steel head thickness	t_{sh}	mm	3.3	3.3	3.3	3.3	3.3		3.3		3.3		3.3	
Minimum concrete cover over metal deck - upper flute install	$h_{deck,min}$	in. (mm)	2-1/2 (64)	3-1/4 (83)	2-1/2 (64)	3-1/4 (83)	3 (76)		3-1/4 (83)		3 (76)		3-1/4 (83)	
Minimum concrete cover over metal deck - lower flute install	$h_{deck,min}$	in. (mm)	2-1/2 (64)	3-1/4 (83)	2-1/2 (64)	3-1/4 (83)	2-1/2 (64)		3-1/4 (83)		2-1/2 (64)		3-1/4 (83)	
Min. metal deck gauge	-	-	20	20	20	20	20		20		20		20	
Minimum edge distance	c_{min}	in. (mm)	6 (152)	7-1/2 (191)	6 (152)	7-1/2 (191)	7 (177)		7-3/4 (198)		7 (177)		7-3/4 (198)	
Minimum anchor spacing	s_{min}	in. (mm)	6 (152)	7-1/2 (191)	6 (152)	7-1/2 (191)	7 (177)		7-3/4 (198)		7 (177)		7-3/4 (198)	
Optional minimum anchor spacing, upper flute only[1]	$s_{min,upper}$	in. (mm)	2-5/8 (68)	3-1/2 (88)	2-5/8 (68)	3-1/2 (88)	3-1/2 (90)		4-1/4 (106)		3-1/2 (90)		4-1/4 (106)	
Thread engagement length Plastic on / Metal tube on[2]	l_{th}	in. (mm)	4.3 (109)	4.7 (119)	6.9 (175)	7.3 (185)	4.6 (116)	4.3 (110)	4.8 (122)	4.5 (114)	7.0 (179)	6.8 (173)	7.4 (189)	7.1 (180)
Thread engagement length Plastic off[2]	l_{th}	in. (mm)	2.5 (64)	2.9 (74)	N/A	N/A	2.8 (72)	2.6 (67)	3.1 (78)	2.8 (70)	N/A	N/A	N/A	N/A

[1]In the upper flute installation only, see Figures 5, 6, or 7 (for upper flute conditions), it is permitted to reduce the minimum spacing to the value shown as optional spacing when an ACI 318 Ch. 17 or CSA A23.3 Annex D design is performed to account for the reduced spacing. In tension, in addition to the steel strength in tension for the upper flute in Table 6 and Table 7 (Table 18 and Table 19 for CSA) and the steel strength of the inserted steel rod, the concrete breakout in tension per ACI 318 Ch. 17 needs to be determined in lieu of the upper flute values in Tables 8 to 13 (Tables 20 to 25 CSA). In shear, in addition to the steel strength in shear for the upper flute in Table 6 and Table 7 (Table 18 and Table 19 for CSA) and the steel strength in shear of the inserted steel rod, the concrete breakout and pryout strength in shear per ACI 318 Ch. 17 or CSA A23.3 Annex D needs to be determined.

[2]See Figure 2, Figure 3, and Figure 4

Figure 2. KCC-MD S and KCCM-MD S

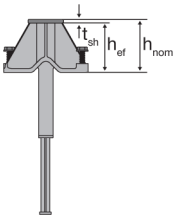


Figure 3. KCC-MD L and KCCM-MD L

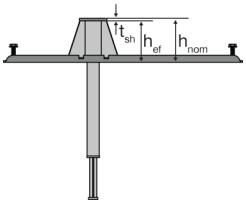
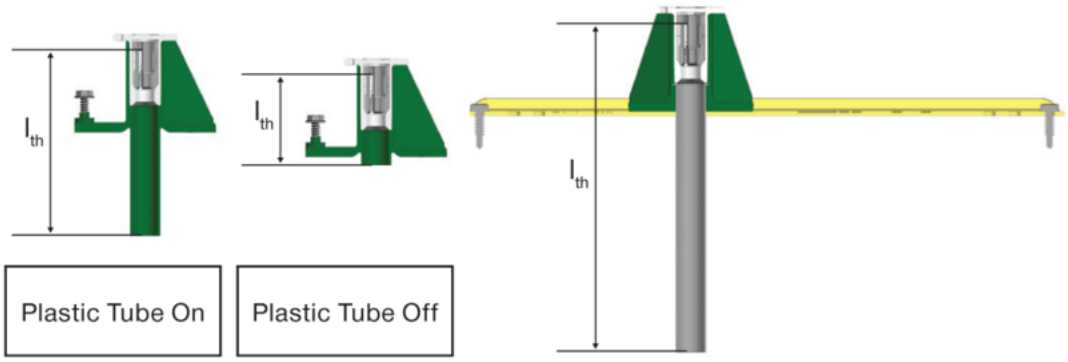


Figure 4. KCC-MD and KCCM-MD thread engagement measurement



(a) KCC-MD S and KCCM-MD S installation information

(b) KCC-MD L and KCCM-MD L installation information (Metal Tube On)

1.4. DESIGN INFORMATION IN CONCRETE PER ACI 318

ACI 318 Chapter 17

The technical data contained in this section are Hilti Simplified Tables. The load values were developed using the Strength Design parameters and variables of ESR-4145 and the equations within ACI 318 Chapter 17. For a detailed explanation of the Hilti Simplified Design Tables, refer to Hilti Product Technical Guide Volume 2 Edition 22 (PTG Ed. 22), Section 3.1.8. Data tables from ESR-4145 are not contained in this section but can be found at www.icc-es.org or at www.hilti.com.

Table 3. Design strength for steel failure of KCC-WF and KCCM-WF inserts [1,2,3]

Design Information	Symbol	Units	Insert Type					
			KCC-WF 3/8"	KCC-WF 12"	KCCM-WF 1/4"-3/8"		KCCM-WF 3/8"-1/2"	
Nominal rod diameter	-	in.	3/8	1/2	1/4	3/8	3/8	1/2
Design steel strength of insert in tension	$\phi N_{sa,insert}$	lb (kN)	2,625 (11.7)	3,515 (15.6)	5,845 (26.0)	5,845 (26.0)	7,305 (32.5)	7,305 (32.5)
Design seismic steel strength of insert in tension	$\phi N_{sa,insert,eq}$	lb (kN)	2,625 (11.7)	3,515 (15.6)	5,845 (26.0)	5,845 (26.0)	7,305 (32.5)	7,305 (32.5)
Design steel strength of insert in shear	$\phi V_{sa,insert}$	lb (kN)	2,970 (13.2)	3,340 (14.9)	N/A	2,875 (12.8)	1,930 (8.6)	5,620 (25.0)
Design seismic steel strength of insert in shear	$\phi V_{sa,insert}$	lb (kN)	2,970 (13.2)	3,340 (14.9)	N/A	2,855 (12.7)	1,205 (5.4)	4,370 (19.4)

[1]See PTG Ed. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Hilti KCC-WF and KCCM-WF Inserts are considered brittle steel elements

[3]Values are for the insert only. The capacity of the threaded rod must also be determined from Table 14. The design strength of the concrete must be in accordance with ACI 318 Chapter 17 and Table 4 and Table 5 as necessary. Compare the values (threaded rod, inserts, and concrete). The lesser of the values is to be used for the design.

Table 4. Hilti KCC-WF and KCCM-WF cast-in insert design strength with concrete / pullout failure in uncracked concrete[1,2,3,4,5]

Insert Type	Effective embedment depth in. (mm)	Tension - ΦN_n				Shear - ΦV_n			
		f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)	f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)
KCC-WF 3/8"	1.63 (41)	2,185 (9.7)	2,390 (10.6)	2,760 (12.3)	3,385 (15.1)	2,185 (9.7)	2,390 (10.6)	2,760 (12.3)	3,385 (15.1)
KCC-WF 1/2"	2.04 (52)	3,055 (13.6)	3,350 (14.9)	3,865 (17.2)	4,735 (21.1)	3,055 (13.6)	3,350 (14.9)	3,865 (17.2)	4,735 (21.1)
KCCM-WF 1/4"-3/8"	2.04 (52)	3,055 (13.6)	3,350 (14.9)	3,865 (17.2)	4,735 (21.1)	3,055 (13.6)	3,350 (14.9)	3,865 (17.2)	4,735 (21.1)
KCCM-WF 3/8"-1/2"	2.25 (57)	3,540 (15.7)	3,880 (17.3)	4,480 (19.9)	5,485 (24.4)	3,540 (15.7)	3,880 (17.3)	4,480 (19.9)	5,485 (24.4)

[1]See PTG Ed. 22 Section 3.1.8.6 to convert design strength value to ASD value

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular values are for single anchors located at edge distance (c) and spacing (s) greater than $3h_{ef}$. For anchors with edge distance or spacing less than $3h_{ef}$ use ACI 318 to calculate load reduction factor. Compare the calculated value to the steel values (threaded rod and inserts) in Table 14 and Table 3. The lesser of the values is to be used for the design.

[4]Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.85. For all-lightweight, λ_a = 0.75.

[5]Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. No reduction needed for seismic shear.

Table 5. Hilti KCC-WF and KCCM-WF cast-in insert design strength with concrete / pullout failure in cracked concrete [1,2,3,4,5]

Insert Type	Effective embedment depth in. (mm)	Tension - ΦN$_n$				Shear - ΦV n			
		f´$_c$ = 2,500 psi (17.2 MPa) lb (kN)	f´$_c$ = 3,000 psi (20.7 MPa) lb (kN)	f´$_c$ = 4,000 psi (27.6 MPa) lb (kN)	f´$_c$ = 6,000 psi (41.1 MPa) lb (kN)	f´$_c$ = 2,500 psi (17.2 MPa) lb (kN)	f´$_c$ = 3,000 psi (20.7 MPa) lb (kN)	f´$_c$ = 4,000 psi (27.6 MPa) lb (kN)	f´$_c$ = 6,000 psi (41.1 MPa) lb (kN)
KCC-WF 3/8"	1.63 (41)	1,745 (7.8)	1,910 (8.5)	2,210 (9.8)	2,705 (12.0)	1,745 (7.8)	1,910 (8.5)	2,210 (9.8)	2,705 (12.0)
KCC-WF 1/2"	2.04 (52)	2,445 (10.9)	2,680 (11.9)	3,095 (13.8)	3,790 (16.9)	2,445 (10.9)	2,680 (11.9)	3,095 (13.8)	3,790 (16.9)
KCCM-WF 1/4"-3/8"	2.04 (52)	2,455 (10.9)	2,680 (11.9)	3,095 (13.8)	3,790 (16.9)	2,445 (10.9)	2,680 (11.9)	3,095 (13.8)	3,790 (16.9)
KCCM-WF 3/8"-1/2"	2.25 (57)	2,835 (12.6)	3,105 (13.8)	3,585 (15.9)	4,390 (19.5)	2,835 (12.6)	3,105 (13.8)	3,585 (15.9)	4,390 (19.5)

[1]See PTG Ed. 22 Section 3.1.8.6 to convert design strength value to ASD value

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular values are for single anchors located at edge distance (c) and spacing (s) greater than 3h$_{ef}$. For anchors with edge distance or spacing less than 3h$_{ef}$ use ACI 318 to calculate load reduction factor. Compare the calculated value to the steel values (threaded rod and inserts) in Table 14 and Table 3. The lesser of the values is to be used for the design.

[4]Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.85. For all-lightweight, λ_a = 0.75.

[5]Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. No reduction needed for seismic shear.

Table 6. Design strength for steel failure of KCC-MD S and L inserts [1,2,3,4]

Design Information	Symbol	Units	Insert Type			
			KCC-MD S 3/8"	KCC-MD S 1/2"	KCC-MD L 3/8"	KCC-MD L 1/2"
Nominal rod diameter		in.	3/8	1/2	3/8	1/2
Design steel strength of insert in tension	ϕN$_{sa,insert}$	lb (kN)	2,625 (11.7)	3,515 (15.6)	2,625 (11.7)	3,515 (15.6)
Design seismic steel strength of insert in tension	ϕN$_{sa,insert,eq}$	lb (kN)	2,625 (11.7)	3,515 (15.6)	2,625 (11.7)	3,515 (15.6)
Installations in upper flute of metal deck (i.e. W-deck and B-deck) according to Figure 5						
Design steel strength of insert in shear	ϕV$_{sa,insert}$	lb (kN)	2,810 (12.5)	3,340 (14.9)	2,810 (12.5)	3,340 (14.9)
Design seismic steel strength of insert in shear	ϕV$_{sa,insert,eq}$	lb (kN)	2,810 (12.5)	3,340 (14.9)	2,810 (12.5)	3,340 (14.9)
Installations in lower flute of metal deck (i.e. W-deck) according to Figure 6						
Design steel strength of insert in shear	ϕV$_{sa,insert}$	lb (kN)	2,060 (9.2)	2,510 (11.2)	2,970 (13.2)	3,340 (14.9)
Design seismic steel strength of insert in shear	ϕV$_{sa,insert,eq}$	lb (kN)	2,060 (9.2)	2,510 (11.2)	2,970 (13.2)	3,340 (14.9)
Installations in lower flute of metal deck (i.e. B-deck) according to Figure 7						
Design steel strength of insert in shear	ϕV$_{sa,insert}$	lb (kN)	1,895 (8.4)	2,380 (10.6)	2,890 (12.9)	3,340 (14.9)
Design seismic steel strength of insert in shear	ϕV$_{sa,insert,eq}$	lb (kN)	1,895 (8.4)	2,380 (10.6)	2,890 (12.9)	3,340 (14.9)
Installations over flute incline of metal deck (i.e. W-deck) according to Figure 8						
Design steel strength of insert in shear	ϕV$_{sa,insert}$	lb (kN)	N/A		1,030 (4.6)	2,665 (11.9)
Design seismic steel strength of insert in shear	ϕV$_{sa,insert,eq}$	lb (kN)			1,030 (4.6)	2,135 (9.5)

[1]See PTG ED. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Hilti KCC-MD Inserts are considered as brittle steel elements.

[3]Tension values are for the inserts only. The capacity of the threaded rods must be also determined from Table 14 . The design strength of concrete must be obtained from Tables 8 to 13. Compare the tension values of threaded rod, inserts, and concrete. The lesser of the values is to be used for the design.

[4]Shear values are for the inserts only. The capacity of the threaded rods must be also determined from Table 14. The calculation of concrete shear strength is not required. Compare the shear values of threaded rod and inserts. The lesser of the values is to be used for the design strength of the anchor in shear.

Table 7. Design strength for steel failure of KCCM-MD S and L inserts [1,2,3,4]

Design Information	Symbol	Units	Insert Type							
			KCCM-MD S 1/4"-3/8"		KCCM-MD S 3/8"-1/2"		KCCM-MD L 1/4"-3/8"		KCCM-MD L 3/8"-1/2"	
Nominal rod diameter		in.	1/4	3/8	3/8	1/2	1/4	3/8	3/8	1/2
Design steel strength of insert in tension	$\phi N_{sa,insert}$	lb (kN)	5,845 (26.0)		7,305 (32.5)		5,845 (26.0)		7,305 (32.5)	
Design seismic steel strength of insert in tension	$\phi N_{sa,insert,eq}$	lb (kN)	N/A	5,845 (26.0)	7,305 (32.5)		N/A	5,845 (26.0)	7,305 (32.5)	
Installations in upper flute of metal deck (i.e. W-deck and B-deck) according to Figure 5										
Design steel strength of insert in shear	$\phi V_{sa,insert}$	lb (kN)	N/A	2,810 (12.5)	1,930 (8.6)	3,340 (14.9)	N/A	2,810 (12.5)	1,930 (8.6)	3,340 (14.9)
Design seismic steel strength of insert in shear	$\phi V_{sa,insert,eq}$	lb (kN)	N/A	2,810 (12.5)	1,205 (5.4)	3,340 (14.9)	N/A	2,810 (12.5)	1,205 (5.4)	3,340 (14.9)
Installations in lower flute of metal deck (i.e. W-deck) according to Figure 6										
Design steel strength of insert in shear	$\phi V_{sa,insert}$	lb (kN)	N/A	2,060 (9.2)	1,930 (8.6)	2,510 (11.2)	N/A	2,875 (12.8)	1,930 (8.6)	3,340 (14.9)
Design seismic steel strength of insert in shear	$\phi V_{sa,insert,eq}$	lb (kN)	N/A	2,060 (9.2)	1,205 (5.4)	2,510 (11.2)	N/A	2,855 (12.7)	1,205 (5.4)	3,340 (14.9)
Installations in lower flute of metal deck (i.e. B-deck) according to Figure 7										
Design steel strength of insert in shear	$\phi V_{sa,insert}$	lb (kN)	N/A	1,895 (8.4)	1,895 (8.4)	2,380 (10.6)	N/A	2,875 (12.8)	1,930 (8.6)	3,340 (14.9)
Design seismic steel strength of insert in shear	$\phi V_{sa,insert,eq}$	lb (kN)	N/A	1,895 (8.4)	1,205 (5.4)	2,380 (10.6)	N/A	2,855 (12.7)	1,205 (5.4)	3,340 (14.9)
Installations over flute incline of metal deck (i.e. W-deck) according to Figure 8										
Design steel strength of insert in shear	$\phi V_{sa,insert}$	lb (kN)	N/A					1,030 (4.6)	1,030 (4.6)	2,665 (11.9)
Design seismic steel strength of insert in shear	$\phi V_{sa,insert,eq}$	lb (kN)						1,030 (4.6)	1,030 (4.6)	2,135 (9.5)

[1]See PTG ED. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Hilti KCCM-MD Inserts are considered as brittle steel elements.

[3]Tension values are for the inserts only. The capacity of the threaded rods must be also determined from Table 14 . The design strength of concrete must be obtained from Tables 8 to 13. Compare the tension values of threaded rod, inserts, and concrete. The lesser of the values is to be used for the design.

[4]Shear values are for the inserts only. The capacity of the threaded rods must be also determined from Table 14. The calculation of concrete shear strength is not required. Compare the shear values of threaded rod and inserts. The lesser of the values is to be used for the design strength of the anchor in shear.

Table 8. Hilti KCC-MD S/L and KCCM-MD S/L tension design strength in the soffit of uncracked sand-lightweight concrete over metal deck (B profile)[1,2,3,4,5,6,7,8]

Insert Type	Nominal Embed. Depth in. (mm)	Upper flute per Figure 5		Lower flute per Figure 7	
		Tension - ΦN_n		Tension - ΦN_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
KCC-MD S 3/8”	2.13 (54)	3,610 (16.1)	4,170 (18.5)	635 (2.8)	735 (3.3)
KCC-MD S 1/2”	2.63 (67)	4,580 (20.4)	5,290 (23.5)	695 (3.1)	805 (3.6)
KCC-MD L 3/8”	2.13 (54)	3,610 (16.1)	4,170 (18.5)	3,610 (16.1)	4,170 (18.5)
KCC-MD L 1/2”	2.63 (67)	4,580 (20.4)	5,290 (23.5)	4,580 (20.4)	5,290 (23.5)
KCCM-MD S 1/4"-3/8"	2.46 (62)	3,610 (16.1)	4,170 (18.5)	635 (2.8)	735 (3.3)
KCCM-MD S 3/8"-1/2"	2.71 (69)	4,580 (20.4)	5,290 (23.5)	695 (3.1)	805 (3.6)
KCCM-MD L 1/4"-3/8"	2.46 (62)	3,610 (16.1)	4,170 (18.5)	3,610 (16.1)	4,170 (18.5)
KCCM-MD L 3/8"-1/2"	2.71 (69)	4,580 (20.4)	5,290 (23.5)	4,580 (20.4)	5,290 (23.5)

[1]See PTG ED. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).

[4]Tabular values are for normal weight or sand-lightweight concrete.

[5]No additional reduction factors for spacing or edge distance need to be applied.

[6]Compare tabular value to the insert steel strength values in Table 6 for KCC-MD or Table 7 for KCCM-MD and threaded rod steel strength values in Table 14. The lesser of the values is to be used for the design.

[7]Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.22, Section 3.1.8.7 for additional information on seismic applications.

[8]For Hilti KCC-MD and KCCM-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Table 6 for KCC-MD or Table 7 for KCCM-MD for shear calculations.

Table 9. Hilti KCC-MD S/L and KCCM-MD S/L tension design strength in the soffit of cracked sand-lightweight concrete over metal deck (B profile) [1,2,3,4,5,6,7,8]

Insert Type	Nominal Embed. Depth in. (mm)	Upper flute per Figure 5		Lower flute per Figure 7	
		Tension - ΦN_n		Tension - ΦN_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
KCC-MD S 3/8”	2.13 (54)	2,890 (12.9)	3,335 (14.8)	505 (2.2)	585 (2.6)
KCC-MD S 1/2”	2.63 (67)	3,660 (16.3)	4,225 (18.8)	555 (2.5)	640 (2.8)
KCC-MD L 3/8”	2.13 (54)	2,890 (12.9)	3,335 (14.8)	2,890 (12.9)	3,335 (14.8)
KCC-MD L 1/2”	2.63 (67)	3,660 (16.3)	4,225 (18.8)	3,660 (16.3)	4,225 (18.8)
KCCM-MD S 1/4"-3/8"	2.46 (62)	2,890 (12.9)	3,335 (14.8)	505 (2.2)	585 (2.6)
KCCM-MD S 3/8"-1/2"	2.71 (69)	3,660 (16.3)	4,225 (18.8)	555 (2.5)	640 (2.8)
KCCM-MD L 1/4"-3/8"	2.46 (62)	2,890 (12.9)	3,335 (14.8)	2,890 (12.9)	3,335 (14.8)
KCCM-MD L 3/8"-1/2"	2.71 (69)	3,660 (16.3)	4,225 (18.8)	3,660 (16.3)	4,225 (18.8)

[1]See PTG ED. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).

[4]Tabular values are for normal weight or sand-lightweight concrete.

[5]No additional reduction factors for spacing or edge distance need to be applied.

[6]Compare tabular value to the insert steel strength values in Table 6 for KCC-MD or Table 7 for KCCM-MD and threaded rod steel strength values in Table 14. The lesser of the values is to be used for the design.

[7]Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.22, Section 3.1.8.7 for additional information on seismic applications.

[8]For Hilti KCC-MD and KCCM-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Table 6 for KCC-MD or Table 7 for KCCM-MD for shear calculations.

Table 10. Hilti KCC-MD S/L and KCCM-MD S/L tension design strength in the soffit of uncracked sand-lightweight concrete over metal deck (W profile with 3-7/8” width) [1,2,3,4,5,6,7,8]

Insert Type	Nominal Embed. Depth in. (mm)	Upper flute per Figure 5		Lower flute per Figure 6		Inclined per Figure 8	
		Tension - ΦN_n		Tension - ΦN_n		Tension - ΦN_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f' = 4,000 psi c (27.6 MPa) lb (kN)
KCC-MD S 3/8”	2.13 (54)	3,610 (16.1)	4,170 (18.5)	1,850 (8.2)	2,135 (9.5)	N/A	N/A
KCC-MD S 1/2”	2.63 (67)	4,580 (20.4)	5,290 (23.5)	2,120 (9.4)	2,450 (10.9)	N/A	N/A
KCC-MD L 3/8”	2.13 (54)	3,610 (16.1)	4,170 (18.5)	4,895 (21.8)	5,650 (25.1)	3,610 (16.1)	4,170 (18.5)
KCC-MD L 1/2”	2.63 (67)	4,580 (20.4)	5,290 (23.5)	6,565 (29.2)	7,580 (33.7)	4,580 (20.4)	5,290 (23.5)
KCCM-MD S 1/4"-3/8"	2.46 (62)	3,610 (16.1)	4,170 (18.5)	1,850 (8.2)	2,135 (9.5)	N/A	N/A
KCCM-MD S 3/8"-1/2"	2.71 (69)	4,580 (20.4)	5,290 (23.5)	2,120 (9.4)	2,450 (10.9)	N/A	N/A
KCCM-MD L 1/4"-3/8"	2.46 (62)	3,610 (16.1)	4,170 (18.5)	4,895 (21.8)	5,650 (25.1)	3,610 (16.1)	4,170 (18.5)
KCCM-MD L 3/8"-1/2"	2.71 (69)	4,580 (20.4)	5,290 (23.5)	6,565 (29.2)	7,580 (33.7)	4,580 (20.4)	5,290 (23.5)

[1]See PTG ED. 22 Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment)

[4]Tabular values are for normal weight or sand-lightweight concrete.

[5]No additional reduction factors for spacing or edge distance need to be applied.

[6]Compare tabular value to the insert steel strength values in Table 6 for KCC-MD or Table 7 for KCCM-MD and threaded rod steel strength values in Table 14. The lesser of the values is to be used for the design.

[7]Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.22, Section 3.1.8.7 for additional information on seismic applications.

[8]For Hilti KCC-MD and KCCM-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Table 6 for KCC-MD or Table 7 for KCCM-MD for shear calculations.

Table 11. Hilti KCC-MD S/L and KCCM-MD S/L tension design strength in the soffit of cracked sand-lightweight concrete over metal deck (W profile with 3-7/8" width) [1,2,3,4,5,6,7,8]

Insert Type	Nominal Embed. Depth in. (mm)	Upper flute per Figure 5		Lower flute per Figure 6		Inclined per Figure 8	
		Tension - ΦN_n		Tension - ΦN_n		Tension - ΦN_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f' = 4,000 psi c (27.6 MPa) lb (kN)
KCC-MD S 3/8"	2.13 (54)	2,890 (12.9)	3,335 (14.8)	1,480 (6.6)	1,710 (7.6)	N/A	N/A
KCC-MD S 1/2"	2.63 (67)	3,660 (16.3)	4,225 (18.8)	1,695 (7.5)	1,955 (8.7)	N/A	N/A
KCC-MD L 3/8"	2.13 (54)	2,890 (12.9)	3,335 (14.8)	3,915 (17.4)	4,520 (20.1)	2,890 (12.9)	3,335 (14.8)
KCC-MD L 1/2"	2.63 (67)	3,660 (16.3)	4,225 (18.8)	5,250 (23.4)	6,060 (27.0)	3,660 (16.3)	4,225 (18.8)
KCCM-MD S 1/4"-3/8"	2.46 (62)	2,890 (12.9)	3,335 (14.8)	1,489 (6.6)	1,710 (7.6)	N/A	N/A
KCCM-MD S 3/8"-1/2"	2.71 (69)	3,660 (16.3)	4,225 (18.8)	1,695 (7.5)	1,955 (8.7)	N/A	N/A
KCCM-MD L 1/4"-3/8"	2.46 (62)	2,890 (12.9)	3,335 (14.8)	3,915 (17.4)	4,520 (20.1)	2,890 (12.9)	3,335 (14.8)
KCCM-MD L 3/8"-1/2"	2.71 (69)	3,660 (16.3)	4,225 (18.8)	5,250 (23.4)	6,060 (27.0)	3,660 (16.3)	4,225 (18.8)

[1]See PTG ED. 22 Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment)

[4]Tabular values are for normal weight or sand-lightweight concrete.

[5]No additional reduction factors for spacing or edge distance need to be applied.

[6]Compare tabular value to the insert steel strength values in Table 6 for KCC-MD or Table 7 for KCCM-MD and threaded rod steel strength values in Table 14. The lesser of the values is to be used for the design.

[7]Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.22, Section 3.1.8.7 for additional information on seismic applications.

[8]For Hilti KCC-MD and KCCM-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Table 6 for KCC-MD or Table 7 for KCCM-MD for shear calculations.

Table 12. Hilti KCC-MD S/L and KCCM-MD S/L tension design strength in the soffit of uncracked sand-lightweight concrete over metal deck (W profile with 4-1/2" width) [1,2,3,4,5,6,7,8]

Insert Type	Nominal Embed. Depth in. (mm)	Upper flute per Figure 5		Lower flute per Figure 6		Inclined per Figure 8	
		Tension - ΦN_n		Tension - ΦN_n		Tension - ΦN_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
KCC-MD S 3/8"	2.13 (54)	3,610 (16.1)	4,170 (18.5)	1,850 (8.2)	2,135 (9.5)	N/A	N/A
KCC-MD S 1/2"	2.63 (67)	4,580 (20.4)	5,290 (23.5)	2,120 (9.4)	2,450 (10.9)	N/A	N/A
KCC-MD L 3/8"	2.13 (54)	3,610 (16.1)	4,170 (18.5)	4,895 (21.8)	5,650 (25.1)	3,610 (16.1)	4,170 (18.5)
KCC-MD L 1/2"	2.63 (67)	4,580 (20.4)	5,290 (23.5)	6,565 (29.2)	7,580 (33.7)	4,580 (20.4)	5,290 (23.5)
KCCM-MD S 1/4"-3/8"	2.46 (62)	3,610 (16.1)	4,170 (18.5)	1,850 (8.2)	2,135 (9.5)	N/A	N/A
KCCM-MD S 3/8"-1/2"	2.71 (69)	4,580 (20.4)	5,290 (23.5)	2,120 (9.4)	2,450 (10.9)	N/A	N/A
KCCM-MD L 1/4"-3/8"	2.46 (62)	3,610 (16.1)	4,170 (18.5)	4,895 (21.8)	5,650 (25.1)	3,610 (16.1)	4,170 (18.5)
KCCM-MD L 3/8"-1/2"	2.71 (69)	4,580 (20.4)	5,290 (23.5)	6,565 (29.2)	7,580 (33.7)	4,580 (20.4)	5,290 (23.5)

[1]See PTG ED. 22 Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment)

[4]Tabular values are for normal weight or sand-lightweight concrete.

[5]No additional reduction factors for spacing or edge distance need to be applied.

[6]Compare tabular value to the insert steel strength values in Table 6 for KCC-MD or Table 7 for KCCM-MD and threaded rod steel strength values in Table 14. The lesser of the values is to be used for the design.

[7]Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.22, Section 3.1.8.7 for additional information on seismic applications.

[8]For Hilti KCC-MD and KCCM-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Table 6 for KCC-MD or Table 7 for KCCM-MD for shear calculations.

Table 13. Hilti KCC-MD S/L and KCCM-MD S/L tension design strength in the soffit of cracked sand-lightweight concrete over metal deck (W profile with 4-1/2” width) [1,2,3,4,5,6,7,8]

Insert Type	Nominal Embed. Depth in. (mm)	Upper flute per Figure 5 Tension - ΦN_n		Lower flute per Figure 6 Tension - ΦN_n		Inclined per Figure 8 Tension - ΦN_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
KCC-MD S 3/8”	2.13 (54)	2,890 (12.9)	3,335 (14.8)	1,480 (6.6)	1,710 (7.6)	N/A	N/A
KCC-MD S 1/2”	2.63 (67)	3,660 (16.3)	4,225 (18.8)	1,695 (7.5)	1,955 (8.7)	N/A	N/A
KCC-MD L 3/8”	2.13 (54)	2,890 (12.9)	3,335 (14.8)	3,915 (17.4)	4,520 (20.1)	2,890 (12.9)	3,335 (14.8)
KCC-MD L 1/2”	2.63 (67)	3,660 (16.3)	4,225 (18.8)	5,250 (23.4)	6,060 (27.0)	3,660 (16.3)	4,225 (18.8)
KCCM-MD S 1/4"-3/8"	2.46 (62)	2,890 (12.9)	3,335 (14.8)	1,480 (6.6)	1,710 (7.6)	N/A	N/A
KCCM-MD S 3/8"-1/2"	2.71 (69)	3,660 (16.3)	4,225 (18.8)	1,695 (7.5)	1,955 (8.7)	N/A	N/A
KCCM-MD L 1/4"-3/8"	2.46 (62)	2,890 (12.9)	3,335 (14.8)	3,915 (17.4)	4,520 (20.1)	2,890 (12.9)	3,335 (14.8)
KCCM-MD L 3/8"-1/2"	2.71 (69)	3,660 (16.3)	4,225 (18.8)	5,250 (23.4)	6,060 (27.0)	3,660 (16.3)	4,225 (18.8)

[1]See PTG ED. 22 Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment)

[4]Tabular values are for normal weight or sand-lightweight concrete.

[5]No additional reduction factors for spacing or edge distance need to be applied.

[6]Compare tabular value to the insert steel strength values in Table 6 for KCC-MD or Table 7 for KCCM-MD and threaded rod steel strength values in Table 14. The lesser of the values is to be used for the design.

[7]Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.22, Section 3.1.8.7 for additional information on seismic applications.

[8]For Hilti KCC-MD and KCCM-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Table 6 for KCC-MD or Table 7 for KCCM-MD for shear calculations.

Table 14. Design strength for steel failure of common threaded rods [1,2]

Nominal Anchor Diameter	Grade A36 threaded rod			ASTM A 193 B7 or ASTM F1554 Gr. 105 threaded rod			ASTM A 307, Grade A threaded rod		
	Tensile[3] $\phi N_{sar,rod}$ or $\phi N_{sar,eq,rod}$ lb (kN)	Shear[4] $\phi V_{sar,rod}$ lb (kN)	Seismic Shear[5] $\phi V_{sar,eq,rod}$ lb (kN)	Tensile[3] $\phi N_{sar,rod}$ or $\phi N_{sar,eq,rod}$ lb (kN)	Shear[4] $\phi V_{sar,rod}$ lb (kN)	Seismic Shear[5] $\phi V_{sar,eq,rod}$ lb (kN)	Tensile[3] $\phi N_{sar,rod}$ or $\phi N_{sar,eq,rod}$ lb (kN)	Shear[4] $\phi V_{sar,rod}$ lb (kN)	Seismic Shear[5] $\phi V_{sar,eq,rod}$ lb (kN)
1/4	1,390 (6.2)	720 (3.2)	505 (2.2)	3,000 (13.3)	1,550 (6.9)	1,085 (4.8)	1,425 (6.3)	740 (3.3)	520 (2.3)
3/8	3,395 (15.1)	1,750 (7.8)	1,225 (5.4)	7,315 (32.5)	3,780 (16.8)	2,646 (11.8)	3,490 (15.5)	1,815 (8.1)	1,270 (5.6)
1/2	6,175 (27.5)	3,210 (14.3)	2,245 (10.0)	13,315 (59.2)	6,915 (30.8)	4,841 (21.5)	6,375 (28.4)	3,315 (14.7)	2,320 (10.3)

[1]See PTG Ed. 22, Section 3.1.8.7 for additional information on seismic applications.

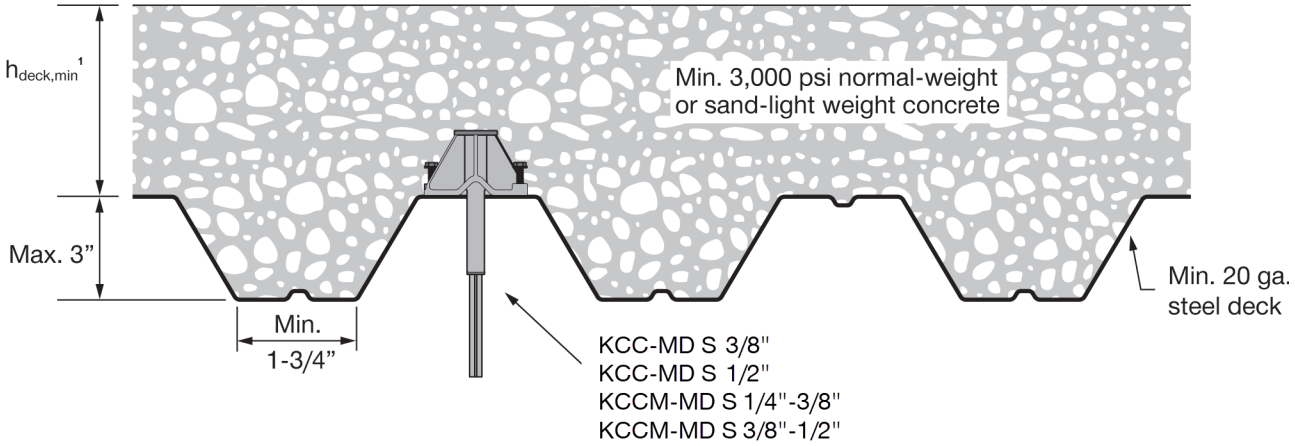
[2]Values are for the threaded rod only. The capacity of the insert must also be determined from Tables 3, 6, and 7. The design strength of concrete must be in accordance with ACI 318 Chapter 17 and Tables 4,5, and 8 to 13 as necessary. Compare the values (threaded rod, inserts, and concrete). The lesser of the values is to be used for the design.

[3]Tensile values determined by static tension tests with $\phi N_{sa} = \phi A_{se,N} f_{uta}$ as noted in ACI 318 Chapter 17.

[4]Shear values determined by static shear tests with $\phi V_{sa} = \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Chapter 17.

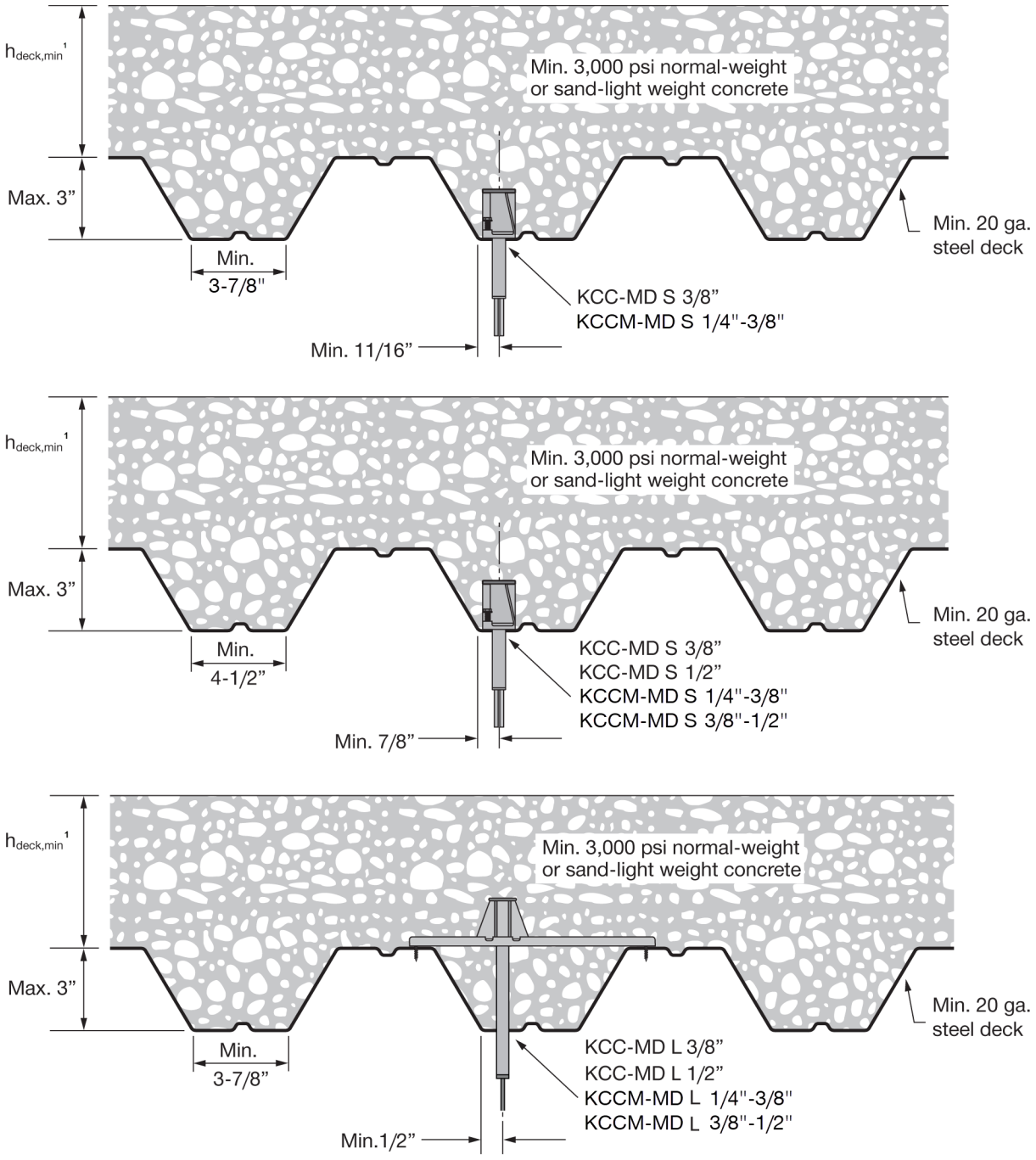
[5]Seismic shear values determined by seismic shear tests with $\phi V_{sa} \leq \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Chapter 17.

Figure 5. Installation of KCC-MD and KCCM-MD inserts in the soffit of concrete filled metal deck floor and roof assemblies-over upper flute (B-deck and W-deck)



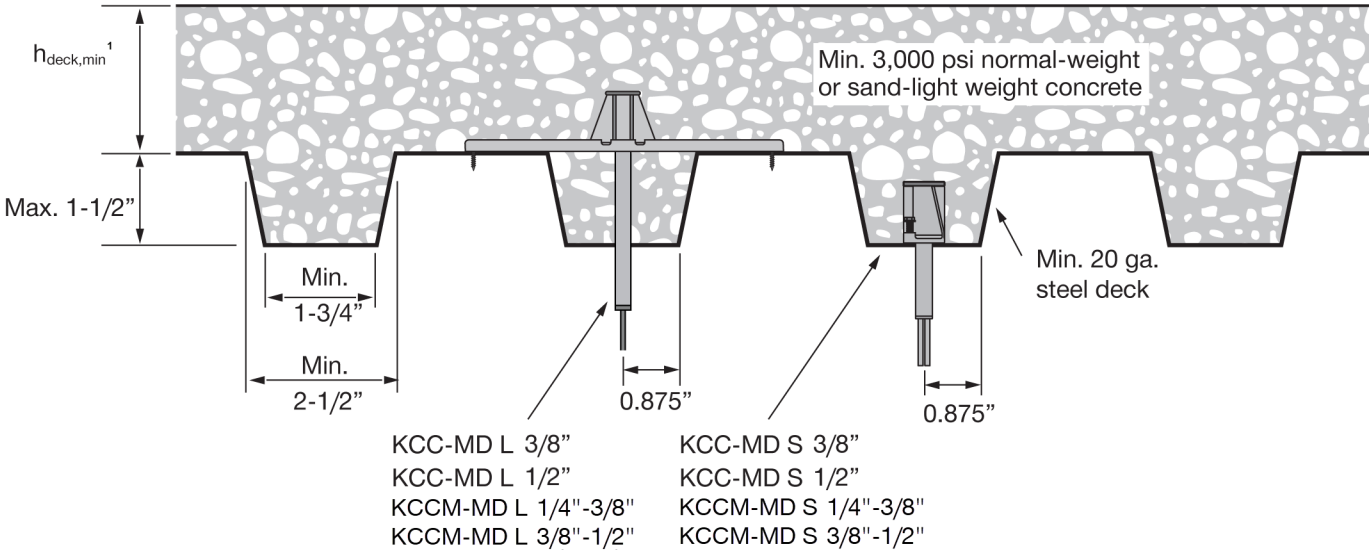
[1] See Table 2

Figure 6. Installation of KCC-MD and KCCM-MD inserts in the soffit of concrete filled metal deck floor and roof assemblies-over lower flute (W-deck)



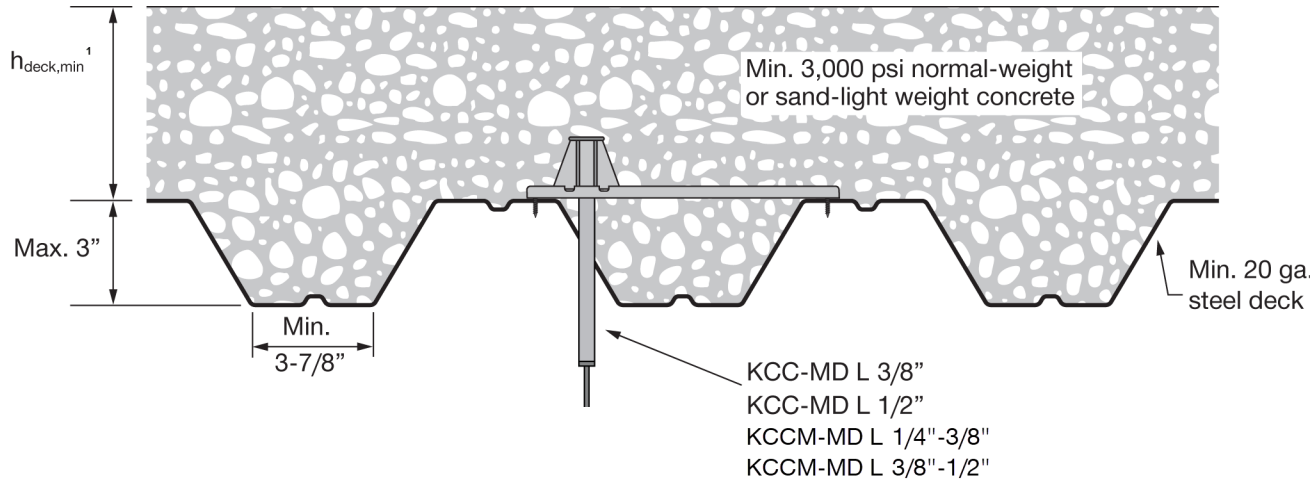
[1] See Table 2

Figure 7. Installation of KCC-MD and KCCM-MD inserts in the soffit of concrete filled metal deck floor and roof assemblies-over lower flute (B-deck)



[1]See Table 2

Figure 8. Installation of KCC-MD and KCCM-MD inserts in the soffit of concrete filled metal deck floor and roof assemblies-over flute incline (W-deck)



[1]See Table 2

1.5. DESIGN DATA IN CONCRETE PER CSA A23.3

CSA A23.3 Annex D Design

Limit State Design of anchors is described in the provisions of CSA A23.3 Annex D for post-installed anchors tested and assessed in accordance with ACI 355.2 for mechanical anchors and ACI 355.4 for adhesive anchors. This section contains the Limit State Design tables with unfactored characteristic loads that are based on the published loads in ICC Evaluation Services ESR-4145. These tables are followed by factored resistance tables. The factored resistance tables

have characteristic design loads that are prefactored by the applicable reduction factors for a single anchor with no anchor-to-anchor spacing of edge distance adjustments for the convenience of the user of this document. All the figures in the previous ACI 318 Chapter 17 design section are applicable to Limit State Design and the tables will reference these figures.

For a detailed explanation of the tables developed in accordance with CSA A23.3 Annex D, refer to PTG ED. 22, Section 3.1.8. Technical assistance is available by contacting Hilti Canada at (800) 363-4458 or at www.hilti.ca.

Table 15. Hilti KCC-WF and KCCM-WF insert design information in accordance with CSA A23.3 Annex D[1,2]

Design Information	Symbol	Units	KCC-WF 3/8"	KCC-WF 1/2"	KCCM-WF 1/4"-3/8"		KCCM-WF 3/8"-1/2"		Ref A23.3-14
Insert thread nominal diameter	d	in.	3/8	1/2	1/4	3/8	3/8	1/2	
Outside diameter of anchor steel body	d_a	in. (mm)	0.67 (17.0)	0.87 (22.1)	0.89 (22.6)		1.05 (26.6)		
Effective embedment	h_{ref}	in. (mm)	1.63 (41)	2.04 (52)	2.04 (52)		2.25 (57)		
Minimum member thickness	h_{min}	-	See Table 1						
Minimum edge distance	c_{min}	-	See Table 1						
Minimum anchor spacing	s_{min}	-	See Table 1						
Steel embed. material resistance factor for reinforcement	ϕ_s	-	0.85						8.4.3
Resistance modification factor for tension, steel failure modes[3]	R	-	0.70						D.5.3
Resistance modification factor for shear, steel failure modes[3]	R	-	0.65						D.5.3
Factored steel resistance in tension	N_{sar}	lb (kN)	2,404 (10.7)	3,219 (14.3)	5,349 (23.8)		6,688 (29.7)		D.6.1.2
Factored steel resistance in tension, seismic	$N_{sar,eq}$	lb (kN)	2,404 (10.7)	3,219 (14.3)	5,349 (23.8)		6,688 (29.7)		D.6.1.2
Factored steel resistance in shear	V_{sar}	lb (kN)	2,735 (12.2)	3,075 (13.7)	N/A	2,646 (11.8)	1,779 (7.9)	5,177 (23.0)	D.7.1.2
Factored steel resistance in shear, seismic	$V_{sar,eq}$	lb (kN)	2,735 (12.2)	3,075 (13.7)	N/A	2,630 (11.7)	1,108 (4.9)	4,022 (17.9)	D.7.1.2
Coeff. for factored conc. breakout resistance, uncracked concrete	$k_{c,uncr}$	-	10						D.6.2.2
Coeff. for factored conc. breakout resistance, cracked concrete	$k_{c,cr}$	-	10						D.6.2.2
Modification factor for anchor resistance, tension, uncracked conc.	$\psi_{c,N}$	-	1.25						D.6.2.6
Modification factor for anchor resistance, tension, cracked conc.	$\psi_{c,N}$	-	1.0						D.6.2.6
Anchor category	-	-	Cast-in						D.5.3 (c)
Concrete material resistance factor	ϕ_c	-	0.65						8.4.2
Resistance modification factor for tension and shear, concrete failure modes, Condition B[4]	R	-	1.00						D.5.3 (c)

[1]Design information in this table is taken from ICC-ES ESR-4145 and converted for use with CSA A23.3 Annex D.

[2]Values are for the insert only. The capacity of the threaded rod must also be determined from Table 26. The design strength of concrete must be in accordance with CSA A23.3 and Tables 16 to 17 as necessary. Compare the values (threaded rod, inserts, and concrete). The lesser of the values is to be used for the design.

[3]The carbon steel KCC-WF and KCCM-WF inserts are considered a brittle steel element as defined by CSA A23.3 Annex D section D.2.

[4]For use with the load combinations of CSA A23.3 chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3 section D.5.3 is not provided, or where pullout or pry out strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.

Table 16. Hilti KCC-WF and KCCM-WF cast-in insert factored resistance based on concrete failure modes in uncracked concrete[1,2,3,4,5]

Insert Type	Effective embedment depth in. (mm)	Tension - N_r				Shear - V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
KCC-WF 3/8"	1.63 (41)	2,185 (9.7)	2,440 (10.9)	2,675 (11.9)	3,090 (13.7)	2,185 (9.7)	2,440 (10.9)	2,675 (11.9)	3,090 (13.7)
KCC-WF 1/2"	2.04 (52)	3,055 (13.6)	3,420 (15.2)	3,745 (16.7)	4,325 (19.2)	3,055 (13.6)	3,420 (15.2)	3,745 (16.7)	4,325 (19.2)
KCCM-WF 1/4"-3/8"	2.04 (52)	3,055 (13.6)	3,420 (15.2)	3,745 (16.7)	4,325 (19.2)	3,055 (13.6)	3,420 (15.2)	3,745 (16.7)	4,325 (19.2)
KCCM-WF 3/8"-1/2"	2.25 (57)	3,540 (15.7)	3,960 (17.6)	4,340 (19.3)	5,010 (22.3)	3,540 (15.7)	3,960 (17.6)	4,340 (19.3)	5,010 (22.3)

[1]See PTG Ed. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular values are for single anchors located at edge distance (c) and spacing (s) greater than $3h_{ef}$ For anchors with edge distance or spacing less than $3h_{ef}$ use CSA A23.3 to calculate load reduction factor. Compare the calculated value to the steel values (threaded rod and inserts) in Tables 15 and 26. The lesser of the values is to be used for the design.

[4]Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.85. For all-lightweight, λ_a = 0.75.

[5]Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. No reduction needed for seismic shear.

Table 17. Hilti KCC-WF and KCCM-WF cast-in insert factored resistance based on concrete failure in cracked concrete[1,2,3,4,5]

Insert Type	Effective embedment depth in. (mm)	Tension - N_r				Shear - V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
KCC-WF 3/8"	1.63 (41)	1,745 (7.8)	1,950 (8.7)	2,140 (9.5)	2,470 (11.0)	1,745 (7.8)	1,950 (8.7)	2,140 (9.5)	2,470 (11.0)
KCC-WF 1/2"	2.04 (52)	2,445 (10.9)	2,735 (12.2)	2,995 (13.3)	3,460 (15.4)	2,445 (10.9)	2,735 (12.2)	2,995 (13.3)	3,460 (15.4)
KCCM-WF 1/4"-3/8"	2.04 (52)	2,445 (10.9)	2,735 (12.2)	2,995 (13.3)	3,460 (15.4)	2,445 (10.9)	2,735 (12.2)	2,995 (13.3)	3,460 (15.4)
KCCM-WF 3/8"-1/2"	2.25 (57)	2,835 (12.6)	3,165 (14.1)	3,470 (15.4)	4,005 (17.8)	2,835 (12.6)	3,165 (14.1)	3,470 (15.4)	4,005 (17.8)

[1]See PTG Ed. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular values are for single anchors located at edge distance (c) and spacing (s) greater than $3h_{ef}$ For anchors with edge distance or spacing less than $3h_{ef}$ use CSA A23.3 to calculate load reduction factor. Compare the calculated value to the steel values (threaded rod and inserts) in Tables 15 and 26. The lesser of the values is to be used for the design.

[4]Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.85. For all-lightweight, λ_a = 0.75.

[5]Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. No reduction needed for seismic shear.

Table 18. Factored resistance for steel failure of KCC-MD S and L inserts[1,2,3,4]

Design Information	Symbol	Units	Insert Type			
			KCC-MD S 3/8"	KCC-MD S 1/2"	KCC-MD L 3/8"	KCC-MD L 1/2"
Insert thread nominal diameter	-	in.	3/8	1/2	3/8	1/2
Anchor O.D.	d_a	in. (mm)	0.67 (17.0)	0.87 (22.1)	0.67 (17.0)	0.87 (22.1)
Effective embedment	h_{ef}	in. (mm)	2.00 (51)	2.50 (64)	2.00 (51)	2.50 (64)
Minimum anchor spacing	s_{min}	-	See Table 2			
Minimum edge distance	c_{min}	-	See Table 2			
Steel embed. material resistance factor for reinforcement	ϕ_s	-	0.85			
Resistance modification factor for tension, steel failure modes	R	-	0.70			
Resistance modification factor for shear, steel failure modes	R	-	0.65			
Factored steel strength of insert in tension	$N_{sar,insert}$	lb (kN)	2,405 (10.7)	3,220 (14.3)	2,405 (10.7)	3,220 (14.3)
Factored seismic steel strength of insert in tension	$N_{sar,insert,eq}$	lb (kN)	2,405 (10.7)	3,220 (14.3)	2,405 (10.7)	3,220 (14.3)
Installations in upper flute of metal deck (i.e. W-deck and B-deck) according to Figure 5						
Factored steel strength of insert in shear	$V_{sar,insert}$	lb (kN)	2,590 (11.5)	3,075 (13.7)	2,590 (11.5)	3,075 (13.7)
Factored seismic steel strength of insert in shear	$V_{sar,insert,eq}$	lb (kN)	2,590 (11.5)	3,075 (13.7)	2,590 (11.5)	3,075 (13.7)
Installations in lower flute of metal deck (i.e. W-deck) according to Figure 6						
Factored steel strength of insert in shear	$V_{sar,insert}$	lb (kN)	1,900 (8.5)	2,310 (10.3)	2,735 (12.2)	3,075 (13.7)
Factored seismic steel strength of insert in shear	$V_{sar,insert,eq}$	lb (kN)	1,900 (8.5)	2,310 (10.3)	2,735 (12.2)	3,075 (13.7)
Installations in lower flute of metal deck (i.e. B-deck) according to Figure 7						
Factored steel strength of insert in shear	$V_{sar,insert}$	lb (kN)	1,745 (7.8)	2,190 (9.7)	2,660 (11.8)	3,075 (13.7)
Factored seismic steel strength of insert in shear	$V_{sar,insert,eq}$	lb (kN)	1,745 (7.8)	2,190 (9.7)	2,660 (11.8)	3,075 (13.7)
Installations over flute incline of metal deck (i.e. W-deck) according to Figure 8						
Factored steel strength of insert in shear	$V_{sar,insert}$	lb (kN)	N/A		950 (4.2)	2,455 (10.9)
Factored seismic steel strength of insert in shear	$V_{sar,insert,eq}$	lb (kN)			950 (4.2)	1,965 (8.7)

[1]Design information in this table is taken from ICC-ES ESR-4145, Table 4, and converted for use with CSA A23.3 Annex D.

[2]The carbon steel KCC-MD is considered a brittle steel element as defined by CSA A23 Annex D section D.2.

[3]Tension values are for the inserts only. The capacity of the threaded rods must be also determined from Table 26 The factored resistance of concrete must be obtained from Tables 20 to 25. Compare the tension values of threaded rod, inserts, and concrete. The lesser of the values is to be used for the design.

[4]Shear values are for the inserts only. The capacity of the threaded rods must be also determined from Table 26. The calculation of concrete shear strength is not required. Compare the shear values of threaded rod and inserts. The lesser of the values is to be used for the design strength of the anchor in shear.

Table 19. Factored resistance for steel failure of KCCM-MD S and L inserts[1,2,3,4]

Design Information	Symbol	Units	Insert Type							
			KCCM-MD S 1/4"-3/8"		KCCM-MD S 3/8"-1/2"		KCCM-MD L 1/4"-3/8"		KCCM-MD L 3/8"-1/2"	
Insert thread nominal diameter	-	in.	1/4	3/8	3/8	1/2	1/4	3/8	3/8	1/2
Anchor O.D.	d_a	in. (mm)	0.87 (22.0)		1.00 (25.4)		0.87 (22.0)		1.00 (25.4)	
Effective embedment	h_{ef}	in. (mm)	2.32 (59)		2.60 (66)		2.32 (59)		2.60 (66)	
Minimum anchor spacing	s_{min}	-	See Table 2							
Minimum edge distance	c_{min}	-	See Table 2							
Steel embed. material resistance factor for reinforcement	ϕ_s	-	0.85							
Resistance modification factor for tension, steel failure modes	R	-	0.70							
Resistance modification factor for shear, steel failure modes	R	-	0.65							
Factored steel strength of insert in tension	$N_{sar,insert}$	lb (kN)	5,350 (23.8)		6,690 (29.8)		5,350 (23.8)		6,690 (29.8)	
Factored seismic steel strength of insert in tension	$N_{sar,insert,eq}$	lb (kN)	N/A	5,350 (23.8)	6,690 (29.8)		N/A	5,350 (23.8)	6,690 (29.8)	
Installations in upper flute of metal deck (i.e. W-deck and B-deck) according to Figure 5										
Factored steel strength of insert in shear	$V_{sar,insert}$	lb (kN)	N/A	2,590 (11.5)	1,780 (7.9)	3,075 (13.7)	N/A	2,590 (11.5)	1,780 (7.9)	3,075 (13.7)
Factored seismic steel strength of insert in shear	$V_{sar,insert,eq}$	lb (kN)	N/A	2,590 (11.5)	1,110 (4.9)	3,075 (13.7)	N/A	2,590 (11.5)	1,110 (4.9)	3,075 (13.7)
Installations in lower flute of metal deck (i.e. W-deck) according to Figure 6										
Factored steel strength of insert in shear	$V_{sar,insert}$	lb (kN)	N/A	1,900 (8.5)	1,780 (7.9)	2,310 (10.3)	N/A	2,645 (11.8)	1,780 (7.9)	3,075 (13.7)
Factored seismic steel strength of insert in shear	$V_{sar,insert,eq}$	lb (kN)	N/A	1,900 (8.5)	1,110 (4.9)	2,310 (10.3)	N/A	2,630 (11.7)	1,110 (4.9)	3,075 (13.7)
Installations in lower flute of metal deck (i.e. B-deck) according to Figure 7										
Factored steel strength of insert in shear	$V_{sar,insert}$	lb (kN)	N/A	1,745 (7.8)	1,745 (7.8)	2,190 (9.7)	N/A	2,645 (11.8)	1,780 (7.9)	3,075 (13.7)
Factored seismic steel strength of insert in shear	$V_{sar,insert,eq}$	lb (kN)	N/A	1,745 (7.8)	1,110 (4.9)	2,190 (9.7)	N/A	2,630 (11.7)	1,110 (4.9)	3,075 (13.7)
Installations over flute incline of metal deck (i.e. W-deck) according to Figure 8										
Factored steel strength of insert in shear	$V_{sar,insert}$	lb (kN)	N/A					950 (4.2)	950 (4.2)	2,455 (10.9)
Factored seismic steel strength of insert in shear	$V_{sar,insert,eq}$	lb (kN)						950 (4.2)	950 (4.2)	1,965 (8.7)

[1]Design information in this table is taken from ICC-ES ESR-4145, Table 4, and converted for use with CSA A23.3 Annex D.

[2]The carbon steel KCCM-MD is considered a brittle steel element as defined by CSA A23 Annex D section D.2.

[3]Tension values are for the inserts only. The capacity of the threaded rods must be also determined from Table 26 The factored resistance of concrete must be obtained from Tables 20 to 25. Compare the tension values of threaded rod, inserts, and concrete. The lesser of the values is to be used for the design.

[4]Shear values are for the inserts only. The capacity of the threaded rods must be also determined from Table 26. The calculation of concrete shear strength is not required. Compare the shear values of threaded rod and inserts. The lesser of the values is to be used for the design strength of the anchor in shear.

Table 20. Hilti KCC-MD S/L and KCCM-MD S/L factored tension resistance in the soffit of uncracked sand-lightweight concrete over metal deck (B profile)[1,2,3,4,5,6,7,8]

Insert Type	Nominal embed. in. (mm)	Upper flute per Figure 5		Lower flute per Figure 7	
		Tension - N_r		Tension - N_r	
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
KCC-MD S 3/8”	2.13 (54)	3,300 (14.7)	4,040 (18.0)	580 (2.6)	710 (3.2)
KCC-MD S 1/2”	2.63 (67)	4,180 (18.6)	5,120 (22.8)	635 (2.8)	775 (3.4)
KCC-MD L 3/8”	2.13 (54)	3,300 (14.7)	4,040 (18.0)	3,300 (14.7)	4,040 (18.0)
KCC-MD L 1/2”	2.63 (67)	4,180 (18.6)	5,120 (22.8)	4,180 (18.6)	5,120 (22.8)
KCCM-MD S 1/4"-3/8"	2.46 (62)	3,300 (14.7)	4,040 (18.0)	580 (2.6)	710 (3.2)
KCCM-MD S 3/8"-1/2"	2.71 (69)	4,180 (18.6)	5,120 (22.8)	635 (2.8)	775 (3.4)
KCCM-MD L 1/4"-3/8"	2.46 (62)	3,300 (14.7)	4,040 (18.0)	3,300 (14.7)	4,040 (18.0)
KCCM-MD L 3/8"-1/2"	2.71 (69)	4,180 (18.6)	5,120 (22.8)	4,180 (18.6)	5,120 (22.8)

[1]See PTG Ed. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).

[4]Tabular values are for normal weight or sand-lightweight concrete.

[5]No additional reduction factors for spacing or edge distance need to be applied.

[6]Compare tabular value to the insert steel strength values in Tables 18 and 19 and threaded rod steel strength values in Table 26. The lesser of the values is to be used for the design.

[7]Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.22, Section 3.1.8.7 for additional information on seismic applications.

[8]For Hilti KCC-MD and KCCM-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Tables 18 and 19 for shear calculations.

Table 21. Hilti KCC-MD S/L and KCCM-MD S/L factored tension resistance in the soffit of cracked sand-lightweight concrete over metal deck (B profile)[1,2,3,4,5,6,7,8]

Insert Type	Nominal embed. in. (mm)	Upper flute per Figure 5		Lower flute per Figure 7	
		Tension - N_r		Tension - N_r	
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
KCC-MD S 3/8”	2.13 (54)	2,640 (11.7)	3,230 (14.4)	465 (2.1)	565 (2.5)
KCC-MD S 1/2”	2.63 (67)	3,345 (14.9)	4,095 (18.2)	505 (2.2)	620 (2.8)
KCC-MD L 3/8”	2.13 (54)	2,640 (11.7)	3,230 (14.4)	2,640 (11.7)	3,230 (14.4)
KCC-MD L 1/2”	2.63 (67)	3,345 (14.9)	4,095 (18.2)	3,345 (14.9)	4,095 (18.2)
KCCM-MD S 1/4"-3/8"	2.46 (62)	2,640 (11.7)	3,230 (14.4)	465 (2.1)	565 (2.5)
KCCM-MD S 3/8"-1/2"	2.71 (69)	3,345 (14.9)	4,095 (18.2)	505 (2.2)	620 (2.8)
KCCM-MD L 1/4"-3/8"	2.46 (62)	2,640 (11.7)	3,230 (14.4)	2,640 (11.7)	3,230 (14.4)
KCCM-MD L 3/8"-1/2"	2.71 (69)	3,335 (14.9)	4,095 (18.2)	3,345 (14.9)	4,095 (18.2)

[1]See PTG Ed. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).

[4]Tabular values are for normal weight or sand-lightweight concrete.

[5]No additional reduction factors for spacing or edge distance need to be applied.

[6]Compare tabular value to the insert steel strength values in Tables 18 and 19 and threaded rod steel strength values in Table 26. The lesser of the values is to be used for the design.

[7]Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.22, Section 3.1.8.7 for additional information on seismic applications.

[8]For Hilti KCC-MD and KCCM-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Tables 18 and 19 for shear calculations.

Table 22. Hilti KCC-MD S/L and KCCM-MD S/L factored tension resistance in the soffit of uncracked sand-lightweight concrete over metal deck (W profile with 3-7/8" width)[1,2,3,4,5,6,7,8]

Insert Type	Nominal embed. in. (mm)	Upper flute per Figure 5		Lower flute per Figure 6		Inclined per Figure 8	
		Tension - N_r		Tension - N_r		Tension - N_r	
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
KCC-MD S 3/8"	2.13 (54)	3,300 (14.7)	4,040 (18.0)	1,685 (7.5)	2,065 (9.2)	N/A	N/A
KCC-MD S 1/2"	2.63 (67)	4,180 (18.6)	5,120 (22.8)	1,935 (8.6)	2,370 (10.5)	N/A	N/A
KCC-MD L 3/8"	2.13 (54)	3,300 (14.7)	4,040 (18.0)	4,470 (19.9)	5,475 (24.4)	3,300 (14.7)	4,040 (18.0)
KCC-MD L 1/2"	2.63 (67)	4,180 (18.6)	5,120 (22.8)	5,990 (26.6)	7,340 (32.6)	4,180 (18.6)	5,120 (22.8)
KCCM-MD S 1/4"-3/8"	2.46 (62)	3,300 (14.7)	4,040 (18.0)	1,685 (7.5)	2,065 (9.2)	N/A	N/A
KCCM-MD S 3/8"-1/2"	2.71 (69)	4,180 (18.6)	5,120 (22.8)	1,935 (8.6)	2,370 (10.5)	N/A	N/A
KCCM-MD L 1/4"-3/8"	2.46 (62)	3,300 (14.7)	4,040 (18.0)	4,470 (19.9)	5,475 (24.4)	3,300 (14.7)	4,040 (18.0)
KCCM-MD L 3/8"-1/2"	2.71 (69)	4,180 (18.6)	5,120 (22.8)	5,990 (26.6)	7,340 (32.6)	4,180 (18.6)	5,120 (22.8)

[1]See PTG Ed. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).

[4]Tabular values are for normal weight or sand-lightweight concrete.

[5]No additional reduction factors for spacing or edge distance need to be applied.

[6]Compare tabular value to the insert steel strength values in Tables 18 and 19 and threaded rod steel strength values in Table 26. The lesser of the values is to be used for the design.

[7]Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.22, Section 3.1.8.7 for additional information on seismic applications.

[8]For Hilti KCC-MD and KCCM-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Tables 18 and 19 for shear calculations.

Table 23. Hilti KCC-MD S/L and KCCM-MD S/L factored tension resistance in the soffit of cracked sand-lightweight concrete over metal deck (W profile with 3-7/8" width)[1,2,3,4,5,6,7,8]

Insert Type	Nominal embed. in. (mm)	Upper flute per Figure 5		Lower flute per Figure 6		Inclined per Figure 8	
		Tension - N_r		Tension - N_r		Tension - N_r	
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
KCC-MD S 3/8"	2.13 (54)	2,640 (11.7)	3,230 (14.4)	1,350 (6.0)	1,655 (7.4)	N/A	N/A
KCC-MD S 1/2"	2.63 (67)	3,345 (14.9)	4,095 (18.2)	1,550 (6.9)	1,895 (8.4)	N/A	N/A
KCC-MD L 3/8"	2.13 (54)	2,640 (11.7)	3,230 (14.4)	3,575 (15.9)	4,380 (19.5)	2,640 (11.7)	3,230 (14.4)
KCC-MD L 1/2"	2.63 (67)	3,345 (14.9)	4,095 (18.2)	4,795 (21.3)	5,870 (26.1)	3,345 (14.9)	4,095 (18.2)
KCCM-MD S 1/4"-3/8"	2.46 (62)	2,640 (11.7)	3,230 (14.4)	1,350 (6.0)	1,655 (7.4)	N/A	N/A
KCCM-MD S 3/8"-1/2"	2.71 (69)	3,345 (14.9)	4,095 (18.2)	1,550 (6.9)	1,895 (8.4)	N/A	N/A
KCCM-MD L 1/4"-3/8"	2.46 (62)	2,640 (11.7)	3,230 (14.4)	3,575 (15.9)	4,380 (19.5)	2,640 (11.7)	3,230 (14.4)
KCCM-MD L 3/8"-1/2"	2.71 (69)	3,345 (14.9)	4,095 (18.2)	4,795 (21.3)	5,870 (26.1)	3,345 (14.9)	4,095 (18.2)

[1]See PTG Ed. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).

[4]Tabular values are for normal weight or sand-lightweight concrete.

[5]No additional reduction factors for spacing or edge distance need to be applied.

[6]Compare tabular value to the insert steel strength values in Tables 18 and 19 and threaded rod steel strength values in Table 26. The lesser of the values is to be used for the design.

[7]Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.22, Section 3.1.8.7 for additional information on seismic applications.

[8]For Hilti KCC-MD and KCCM-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Tables 18 and 19 for shear calculations.

Table 24. Hilti KCC-MD S/L and KCCM-MD S/L factored tension resistance in the soffit of uncracked sand-lightweight concrete over metal deck (W profile with 4-1/2" width)[1,2,3,4,5,6,7,8]

Insert Type	Nominal embed. in. (mm)	Upper flute per Figure 5		Lower flute per Figure 6		Inclined per Figure 8	
		Tension - N_r		Tension - N_r		Tension - N_r	
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
KCC-MD S 3/8"	2.13 (54)	3,300 (14.7)	4,040 (18.0)	1,685 (7.5)	2,065 (9.2)	N/A	N/A
KCC-MD S 1/2"	2.63 (67)	4,180 (18.6)	5,120 (22.8)	1,935 (8.6)	2,370 (10.5)	N/A	N/A
KCC-MD L 3/8"	2.13 (54)	3,300 (14.7)	4,040 (18.0)	4,470 (19.9)	5,475 (24.4)	3,300 (14.7)	4,040 (18.0)
KCC-MD L 1/2"	2.63 (67)	4,180 (18.6)	5,120 (22.8)	5,990 (26.6)	7,340 (32.6)	4,180 (18.6)	5,120 (22.8)
KCCM-MD S 1/4"-3/8"	2.46 (62)	3,300 (14.7)	4,040 (18.0)	1,685 (7.5)	2,065 (9.2)	N/A	N/A
KCCM-MD S 3/8"-1/2"	2.71 (69)	4,180 (18.6)	5,120 (22.8)	1,935 (8.6)	2,370 (10.5)	N/A	N/A
KCCM-MD L 1/4"-3/8"	2.46 (62)	3,300 (14.7)	4,040 (18.0)	4,470 (19.9)	5,475 (24.4)	3,300 (14.7)	4,040 (18.0)
KCCM-MD L 3/8"-1/2"	2.71 (69)	4,180 (18.6)	5,120 (22.8)	5,990 (26.6)	7,340 (32.6)	4,180 (18.6)	5,120 (22.8)

[1]See PTG Ed. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).

[4]Tabular values are for normal weight or sand-lightweight concrete.

[5]No additional reduction factors for spacing or edge distance need to be applied.

[6]Compare tabular value to the insert steel strength values in Tables 18 and 19 and threaded rod steel strength values in Table 26. The lesser of the values is to be used for the design.

[7]Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.22, Section 3.1.8.7 for additional information on seismic applications.

[8]For Hilti KCC-MD and KCCM-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Tables 18 and 19 for shear calculations.

Table 25. Hilti KCC-MD S/L and KCCM-MD S/L factored tension resistance in the soffit of cracked sand-lightweight concrete over metal deck (W profile with 4-1/2" width)[1,2,3,4,5,6,7,8]

Insert Type	Nominal embed. in. (mm)	Upper flute per Figure 5		Lower flute per Figure 6		Inclined per Figure 8	
		Tension - N_r		Tension - N_r		Tension - N_r	
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
KCC-MD S 3/8"	2.13 (54)	2,640 (11.7)	3,230 (14.4)	1,350 (6.0)	1,655 (7.4)	N/A	N/A
KCC-MD S 1/2"	2.63 (67)	3,345 (14.9)	4,095 (18.2)	1,550 (6.9)	1,895 (8.4)	N/A	N/A
KCC-MD L 3/8"	2.13 (54)	2,640 (11.7)	3,230 (14.4)	3,575 (15.9)	4,380 (19.5)	2,640 (11.7)	3,230 (14.4)
KCC-MD L 1/2"	2.63 (67)	3,345 (14.9)	4,095 (18.2)	4,795 (21.3)	5,870 (26.1)	3,345 (14.9)	4,095 (18.2)
KCCM-MD S 1/4"-3/8"	2.46 (62)	2,640 (11.7)	3,230 (14.4)	1,350 (6.0)	1,655 (7.4)	N/A	N/A
KCCM-MD S 3/8"-1/2"	2.71 (69)	3,345 (14.9)	4,095 (18.2)	1,550 (6.9)	1,895 (8.4)	N/A	N/A
KCCM-MD L 1/4"-3/8"	2.46 (62)	2,640 (11.7)	3,230 (14.4)	3,575 (15.9)	4,380 (19.5)	2,640 (11.7)	3,230 (14.4)
KCCM-MD L 3/8"-1/2"	2.71 (69)	3,345 (14.9)	4,095 (18.2)	4,795 (21.3)	5,870 (26.1)	3,345 (14.9)	4,095 (18.2)

[1]See PTG Ed. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Linear interpolation between concrete compressive strengths is not permitted.

[3]Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).

[4]Tabular values are for normal weight or sand-lightweight concrete.

[5]No additional reduction factors for spacing or edge distance need to be applied.

[6]Compare tabular value to the insert steel strength values in Tables 18 and 19 and threaded rod steel strength values in Table 26. The lesser of the values is to be used for the design.

[7]Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.22, Section 3.1.8.7 for additional information on seismic applications.

[8]For Hilti KCC-MD and KCCM-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Tables 18 and 19 for shear calculations.

Table 26. Factored resistance for steel failure of common threaded rods[1,2]

Nominal Anchor Diameter	Grade A36 threaded rod			ASTM A 193 B7 or ASTM F1554 Gr. 105 threaded rod			ASTM A 307, Grade A threaded rod		
	Tensile[3] $\phi N_{sar,rod}$ or $\phi N_{sar,eq,rod}$ lb (kN)	Shear[4] $\phi V_{sar,rod}$ lb (kN)	Seismic Shear[5] $\phi V_{sar,eq,rod}$ lb (kN)	Tensile[3] $\phi N_{sar,rod}$ or $\phi N_{sar,eq,rod}$ lb (kN)	Shear[4] $\phi V_{sar,rod}$ lb (kN)	Seismic Shear[5] $\phi V_{sar,eq,rod}$ lb (kN)	Tensile[4] $\phi N_{sar,rod}$ or $\phi N_{sar,eq,rod}$ lb (kN)	Shear[5] $\phi V_{sar,rod}$ lb (kN)	Seismic Shear[5] $\phi V_{sar,eq,rod}$ lb (kN)
1/4	1,260 (5.6)	705 (3.1)	495 (2.2)	2,720 (12.1)	1,520 (6.8)	1,064 (4.7)	1,290 (5.7)	725 (3.2)	505 (2.2)
3/8	3,075 (13.7)	1,720 (7.7)	1,205 (5.4)	6,630 (29.5)	3,705 (16.5)	2,594 (11.5)	3,160 (14.1)	1,780 (7.9)	1,245 (5.5)
1/2	5,600 (24.9)	3,150 (14.0)	2,205 (9.8)	12,070 (53.7)	6,785 (30.2)	4,750 (21.1)	5,780 (25.7)	3,250 (14.5)	2,275 (10.1)

[1]See PTG Ed. 22, Section 3.1.8.6 to convert design strength value to ASD value.

[2]Values are for the threaded rod only. The capacity of the insert must also be determined from Tables 15, 18, and 19. The design strength of concrete must be in accordance with CSA A23.3 Annex D and Tables 16, 17, and 20 to 25 as necessary. Compare the values (threaded rod, inserts, and concrete). The lesser of the values is to be used for the design.

[3]Tensile $N_{sar} = \phi_s A_{se,N} R f_{ut}$ as noted in CSA A23.3 Annex D.

[4]Shear values determined by static shear tests with $V_{sar} < \phi_s 0.60 A_{se,V} f_{ut} R$. as noted in CSA A23.3 Annex D.

[5]Seismic shear values determined by seismic shear tests with $V_{sar,eq} < \phi_s 0.60 A_{se,V\,fut} R$. as noted in CSA A23.3 Annex D.

Table 27. UL cUL LLC and FM certification for KCC-WF, KCC-MD S/L, KCCM-WF, and KCCM-MD S/L Anchors[1,2]

Design Information		KCC-WF 3/8" KCC-MD S/L 3/8"			KCC-WF 1/2" KCC-MD S/L 1/2"			KCCM-WF 1/4"-3/8" KCCM-MD S/L 1/4"-3/8"			KCCM-WF 3/8"-1/2" KCCM-MD S/L 3/8"-1/2"		
Nominal rod diameter (in.)	Metal deck soffit or Wood Form	UL max pipe size (in.)	Test load (lb)	FM max pipe size (in.)	UL max pipe size (in.)	Test load (lb)	FM max pipe size (in.)	UL max pipe size (in.)	Test load (lb)	FM max pipe size (in.)	UL max pipe size (in.)	Test load (lb)	FM max pipe size (in.)
3/8	Wood Form	4	1,500	4	-	-	-	4	1,500	-	4	1,500	4
	Upper flute	4	1,500	4	-	-	-	4	1,500	-	4	1,500	4
	Lower flute	4	1,500	4	-	-	-	4	1,500	-	4	1,500	4
1/2	Wood Form	-	-	-	8	4,050	8	-	-	-	8	4,050	8
	Upper flute	-	-	-	8	4,050	8	-	-	-	8	4,050	8
	Lower flute	-	-	-	8	4,050	8	-	-	-	8	4,050	8

[1]UL LLC Listing based on successful completion of testing in accordance with UL 203.

[2]FM Approval based on successful completion of testing in accordance with FM 1951.

1.6. INSTALLATION INSTRUCTIONS

Installation Instructions For Use (IFU) are included with each product package. They can also be viewed of downloaded online at www.hilti.com and www.hilti.ca. Because of the possibility of changes, always verify that downloaded IFU are current when used. Proper installation is critical to achieve full performance. Training is available on request. Contact Hilti Technical Services for applications and conditions not addressed in the IFU.

1.7. PRODUCT PORTFOLIO

Table 28. Product Portfolio[1]

Description	Sleeve color[2]	Qty / box	Hole saw diameter
KCC-WF 3/8"	Dark Green	150	N/A
KCC-WF 1/2"	Dark Orange	100	N/A
KCC-MD S 3/8"	Dark Green	75	11/16"
KCC-MD S 1/2"	Dark Orange	45	13/16"
KCC-MD L 3/8"	Dark Green	20	5/8"
KCC-MD L 1/2"	Dark Orange	15	3/4"
KCCM-WF 1/4"-3/8"	Dark Green	100	N/A
KCCM-WF 3/8"-1/2"	Dark Orange	75	N/A
KCCM-MD S 1/4"-3/8"	Dark Green	45	13/16"
KCCM-MD S 3/8"-1/2"	Dark Orange	40	15/16"
KCCM-MD L 1/4"-3/8"	Dark Green	25	3/4"
KCCM-MD L 3/8"-1/2"	Dark Orange	20	7/8"

[1]All dimensions in inches.

[2]Identifies anchor size.

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The data contained in this literature was current as of the date of publication. Updates and changes may be made based on later testing. If verification is needed that the data is still current, please contact the Hilti Technical Support Specialists at 1-800-879-8000. All published load values contained in this literature represent the results of testing by Hilti or test organizations. Local base materials were used. Because of variations in materials, on-site testing is necessary to determine performance at any specific site. Printed in the United States.