PIONEERING REUSABILITY AND CONVENIENCE IN THE SCREW ANCHOR MARKET

KWIK HUS Reusability System

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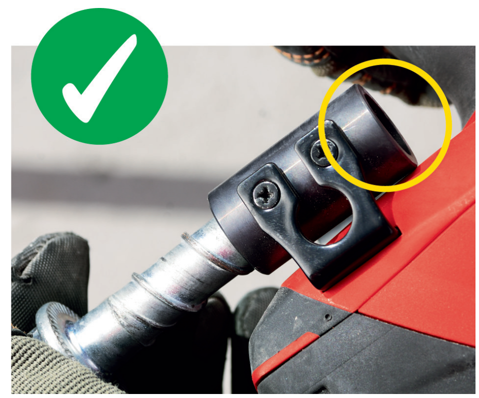
KWIK HUS Reusability System

With the Hilti Reusability Gauge (HRG), Hilti allows and provides guidance for reusing its KWIK HUS screw anchor.

Screw anchor holding values are influenced by the ability of the screw's threads to bear against the concrete. Reusing an anchor will overtime reduce the diameter of it's threads, thereby reducing the anchor's holding values. Hilti publishes load values for both single-use and reused anchors — and has developed a matched-diameter "go/no-go" HRG gauge to verify the anchor is suitable for reuse.

With up to 20 reuses, the cost per fastening point can be significantly reduced, improving profitability and productivity.

This makes the KWIK HUS the first screw anchor that allows the installer to... **Drill. Drive. Done... Reuse.**



Productivity

- Removable and reusable, reducing the amount of anchors needed per project and cost per fastening point
- More than 50% installation time savings over coil and stud anchors
- Higher number of reuses allowed compared to coil anchors
- No additional coil component needed to purchase

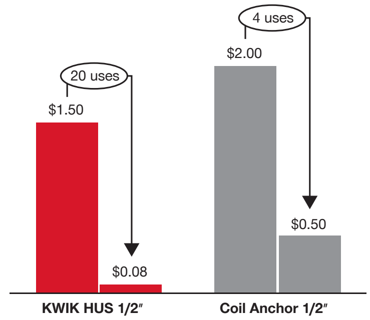
Reliability

- Reusability gauge quickly identifies if the anchor is still within its useful life
- Published load capacity listings for reused anchors provide guidance to installers and engineers

Great for temporary bracing...

... and temporary railings

In the example below, using a 1/2" screw anchor after 20 uses drops the price per fastening point to just $0.08. Coupled with the installation time savings of more than 50% when inserting a screw anchor versus a coil anchor, installing KWIK HUS screws with the HRG can lead to thousands of dollars in savings per project. Note: Number of reuses is dependent upon the anchor diameter and the concrete compressive strength.



SCREW ANCHOR KWIK HUS

Applications and advantages

- Attaching formwork and tilt-up braces, sill plates, perimeter walls
- Racking and shelving
- Attaching ledgers
- For use with standard ANSI-tolerance drill bit; no special tolerance drill bits are required
- Tested and evaluated according to AC193 for uncracked concrete and AC106 for grout-filled CMU blocks

Technical data

Approvals / Test reports	Nuclear (NQA-1)[1]
Environmental conditions	Indoor, dry conditions
Head configuration	Hex head
Installation direction	All
Material, corrosion	Steel, zinc-plated to a min. thickness of 8 μm
Type of fixing	Through-fastening

1 Nuclear approval does not apply to 1/4" KWIK HUS anchor.

Screw anchor KWIK HUS order information

Order Designation	Drill bit diameter	Anchor length	Box only		Master carton 1x	
			Sales pack quantity	Item number	Sales pack quantity	Item number
Screw anchor KH 1/4" x 2-5/8"	1/4 in	2-5/8 in	100 pc	2309298	800 pc	3704533
Screw anchor KH 3/8" x 2-1/8"	3/8 in	2-1/8 in	50 pc	434436	450 pc	3465007
Screw anchor KH 3/8 x 3"	3/8 in	3 in	50 pc	434437	300 pc	3465008
Screw anchor KH 3/8" x 3-1/2"	3/8 in	3-1/2 in	50 pc	434438	300 pc	3465009
Screw anchor KH 3/8" x 4"	3/8 in	4 in	50 pc	434439	300 pc	3465010
Screw anchor KH 3/8" x 5"	3/8 in	5 in	30 pc	434440	270 pc	3465011
Screw anchor KH 1/2" x 3"	1/2 in	3 in	30 pc	434441	180 pc	3465012
Screw anchor KH 1/2" x 3-1/2"	1/2 in	3-1/2 in	25 pc	434442	150 pc	3465013
Screw anchor KH 1/2" x 4"	1/2 in	4 in	25 pc	434443	150 pc	3465014
Screw anchor KH 1/2" x 4-1/2"	1/2 in	4-1/2 in	25 pc	434444	150 pc	3465015
Screw anchor KH 1/2" x 5"	1/2 in	5 in	25 pc	434445	150 pc	3465016
Screw anchor KH 1/2" x 6"	1/2 in	6 in	25 pc	434446	150 pc	3465017
Screw anchor KH 5/8" x 4"	5/8 in	4 in	15 pc	434447	90 pc	3465018
Screw anchor KH 5/8" x 5-1/2"	5/8 in	5-1/2 in	15 pc	434448	90 pc	3465019
Screw anchor KH 5/8" x 6-1/2"	5/8 in	6-1/2 in	15 pc	434449	45 pc	3465020
Screw anchor KH 3/4" x 4-1/2"	3/4 in	4-1/2 in	10 pc	434450	60 pc	3465021
Screw anchor KH 3/4" x 5-1/2"	3/4 in	5-1/2 in	10 pc	434451	30 pc	3465022
Screw anchor KH 3/4" x 7"	3/4 in	7 in	10 pc	434452	40 pc	3465023
Screw anchor KH 3/4" x 9"	3/4 in	9 in	10 pc	434453	40 pc	3465024

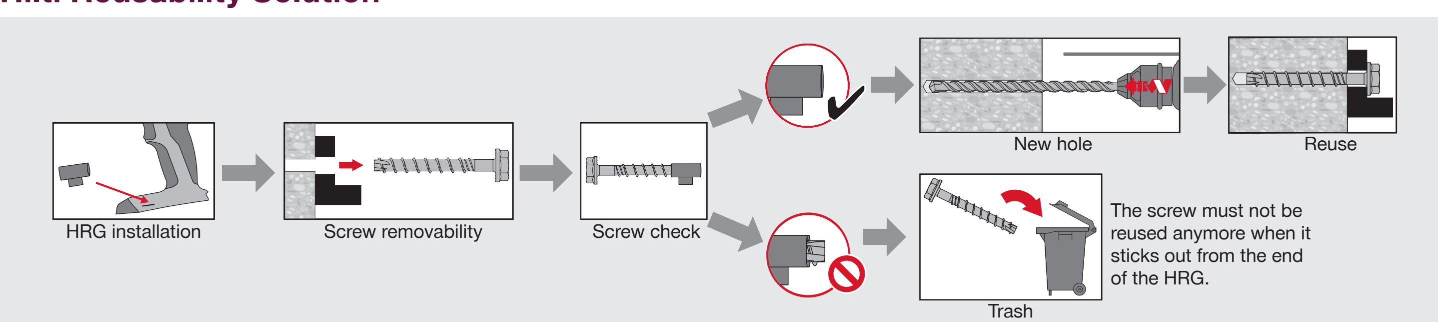
HRG — KWIK HUS anchor reusability gauge

Order Designation	Diameter	Sales pack quantity	Item number
Hilti reusability gauge HRG 1/4''	1/4 in	1 pc[1]	2309298
Hilti reusability gauge HRG 3/8"	3/8 in	1 pc	2122554
Hilti reusability gauge HRG 1/2"	1/2 in	1 pc	2122555
Hilti reusability gauge HRG 5/8"	5/8 in	1 pc	2122556
Hilti reusability gauge HRG 3/4"	3/4 in	1 pc	2122557

1 Included in screw anchor sales pack.

The Hilti Reusability Gauge (HRG) indicates to the installer if the anchor has exceeded its useful life prior to installation.

Hilti Reusability Solution



PRODUCT DESCRIPTION

The Hilti Reusable Gauge (HRG) is a zinc-plated hollow steel tube used with the Hilti KWIK HUS (KH) screw anchor for reuse applications (e.g. concrete formwork, tilt-up bracing, temporary railings and opening coverings). Each KH diameter has a corresponding HRG that can be attached to a Hilti impact wrench. A KH can be installed, used, and removed multiple times until the HRG indicates whether the threads on the anchor have been worn beyond their useful life. The concept is simple: if the KH does not pass through the length of the HRG, it can continue to be used with the “reused” published loads in this document.

DESCRIPTION OF TECHNICAL DATA

Testing and Product Evaluation

Hilti KWIK HUS screw anchors were continually reused in concrete until the screw threads met the lifetime limits as indicated by the HRG. The worn down KH screws were then tested in tension and shear and nominal capacities were determined based on ICC Evaluation Services (ICC-ES) Acceptance Criteria for Post-installed Mechanical Anchors in Concrete Elements (AC193), which incorporates the requirements of ACI 355.2.

Anchor Design Codes

- **United States** — Design strength calculated using ACI 318 Chapter 17.
- **Canada** — Factored resistance calculated using CSA A23.3 Annex D.

Design of KWIK HUS Mechanical Anchor System with Hilti Reusable Gauge

Determination of Nominal Strengths (ACI) and Nominal Resistances (CSA)

The nominal strength (ACI), or nominal resistance (CSA), determined through testing according to AC193 / ACI 355.2 or calculation through ACI 318 Ch. 17 / CSA A23.3 Annex D is multiplied by strength modification factors, resulting in a design strength (ACI), or factored resistance (CSA), for the KH anchor. Design strengths (factored resistances) are provided in Table 3 of this document for KH anchors worn to the limits of the HRG inner diameters.

ACI:

N_n = Nominal strength in tension (lesser of concrete, pullout, or steel strength)

V_n = Nominal strength in shear (lesser of pryout or steel strength)

ϕ = Strength reduction factor

ϕN_n = Design strength in tension

ϕV_n = Design strength in shear

CSA:

N_n = Nominal strength in tension (lesser of concrete, pullout, or steel strength)

V_n = Nominal strength in shear (lesser of pryout or steel strength)

ϕ = Material resistance factor

R = Resistance modification factor

N_r = Factored resistance in tension = $\phi N_n R$

V_r = Factored resistance in shear = $\phi V_n R$

Interaction of Tension and Shear

Where anchors are loaded simultaneously in tension and shear, interaction must be considered. Applicable ACI 318 Ch. 17 and CSA A23.3 Annex D anchorage interaction equations are given below.

ACI: $\frac{N_{ua}}{\phi N_n} + \frac{V_{ua}}{\phi V_n} \leq 1.2$

where:

N_{ua} = Required strength in tension based on factored load combinations of ACI 318-19 Chapter 5

V_{ua} = Required strength in shear based on factored load combinations of ACI 318-19 Chapter 5

CSA: $\frac{N_f}{N_r} + \frac{V_f}{V_r} \leq 1.2$

where:

N_f = Required strength in tension based on factored load combinations of CSA A23.3-19 Chapter 8

V_f = Required strength in shear based on factored load combinations of CSA A23.3-19 Chapter 8

The full tensile strength can be permitted if:

ACI: $\frac{V_{ua}}{\phi V_n} \leq 0.2$ **CSA:** $\frac{V_f}{V_r} \leq 0.2$

The full shear strength can be permitted if:

ACI: $\frac{N_{ua}}{\phi N_n} \leq 0.2$ **CSA:** $\frac{N_f}{N_r} \leq 0.2$

Allowable Stress Design

The design strength (factored resistance) values in Tables 2 and 3 can be converted to an Allowable Stress Design (ASD) value as follows:

$$N_{ASD} = \frac{\phi N_n}{\propto_{ASD}}$$

$$V_{ASD} = \frac{\phi V_n}{\propto_{ASD}}$$

where

$\propto_{ASD}$ = Conversion factor calculated as a weighted average of the LRFD load factors normalized by the ASD load factors for the controlling load combination. Guidance for calculation of $\propto_{ASD}$ is given at: http://www.icc-es.org/News/Notices/ES/SD-ASD_Letter.pdf.

Some examples of $\propto_{ASD}$ for specific cases are provided below:

- **Pure wind load:** $\propto_{ASD,W} = 1.67$
- **Pure live load:** $\propto_{ASD,L} = 1.6$
- **Pure dead load:** $\propto_{ASD,D} = 1.4$
- **50% dead load, 50% live load:** $\propto_{ASD,DL} = 1.4$

Table 1 — Reused KWIK HUS installation parameters for temporary applications with the Hilti HRG[1]

Characteristic	Symbol	Units	Nominal anchor diameter (in.)											
			1/4		3/8			1/2			5/8		3/4	
Nominal bit diameter	d_{bit}	in.	1/4		3/8			1/2			5/8		3/4	
Fixture hole diameter	d_h	in.	3/8		1/2			5/8			3/4		7/8	
		(mm)	(10)		(13)			(16)			(19)		(22)	
Installation torque[2]	T_{inst}	ft-lb	10		40			45			85		95	
		(Nm)	(14)		(54)			(61)			(115)		(129)	
Maximum impact wrench torque rating with f'_c >3,000 psi[3]	T_{impact}	ft-lb	66		122	148		122	148		330		330	
		(Nm)	(89)		(165)	(201)		(165)	(201)		(447)		(447)	
Maximum impact wrench torque rating with f'_c <3,000 psi[3]	T_{impact}	ft-lb	44		44	100		100			148	330	330	
		(Nm)	(60)		(60)	(136)		(136)			(201)	(447)	(447)	
Nominal embedment	h_{nom}	in.	1-1/8	1-5/8	1-5/8	2-1/2	3-1/4	2-1/4	3	4-1/4	3-1/4	5	4	6-1/4
		(mm)	(83)	(127)	(41)	(64)	(83)	(57)	(76)	(108)	(83)	(127)	(102)	(159)
Effective embedment	h_{ef}	in.	0.75	1.18	1.11	1.86	2.20	1.52	2.16	3.22	2.39	3.88	2.92	4.84
		(mm)	(19)	(30)	(28)	(47)	(56)	(39)	(55)	(82)	(61)	(99)	(74)	(123)
Minimum hole depth	h_o	in.	1-3/8	1-7/8	1-5/8	2-3/4	3-1/2	2-5/8	3-3/8	4-5/8	3-5/8	5-3/8	4-3/8	6-5/8
		(mm)	(35)	(48)	(41)	(70)	(89)	(67)	(86)	(117)	(92)	(137)	(111)	(168)
Minimum edge distance in tension and in direction of shear loading	c_{a1}	in.	1-1/2		3-3/8	5-1/4	6	4-1/8	5-5/8	8-3/8	6-3/8	10	10	12-1/8
		(mm)	(38)		(85)	(133)	(154)	(106)	(143)	(214)	(162)	(253)	(253)	(308)
Minimum edge distance parallel to shear load direction	c_{a2}	in.	2		5	7-7/8	9-1/8	6-1/4	8-1/2	12-5/8	9-1/2	15	15	18-1/4
		(mm)	(51)		(128)	(200)	(231)	(159)	(215)	(321)	(243)	(380)	(379)	(463)
Minimum spacing	s_{min}	in.	3		4-7/8	7-1/2	9-3/4	6-3/4	9	12-3/4	9-3/4	15	12	18-3/4
		(mm)	(76)		(124)	(191)	(248)	(171)	(229)	(324)	(248)	(381)	(305)	(476)
Minimum concrete thickness	h_{min}	in.	3-1/4		3-1/4	4	4-7/8	3-3/4	4-3/4	6-3/4	5	7	6	8-1/8
		(mm)	(83)		(83)	(102)	(124)	(95)	(121)	(171)	(127)	(178)	(152)	(206)
Wrench size	-	in.	7/16		9/16			3/4			15/16		1-1/8	
		(mm)	(11)		(14)			(19)			(24)		(29)	

1 See Figure 1 for installation parameters intended for re-used KH measured with HRG.
2 T_{inst} applies to installations using a calibrated torque wrench.
3 Torque ratings of Hilti impact tools. Because of variability in measurement procedures, the published torque of an impact tool may not correlate properly with the above setting torques. Over-torqueing can damage the anchor and/or reduce its holding capacity.

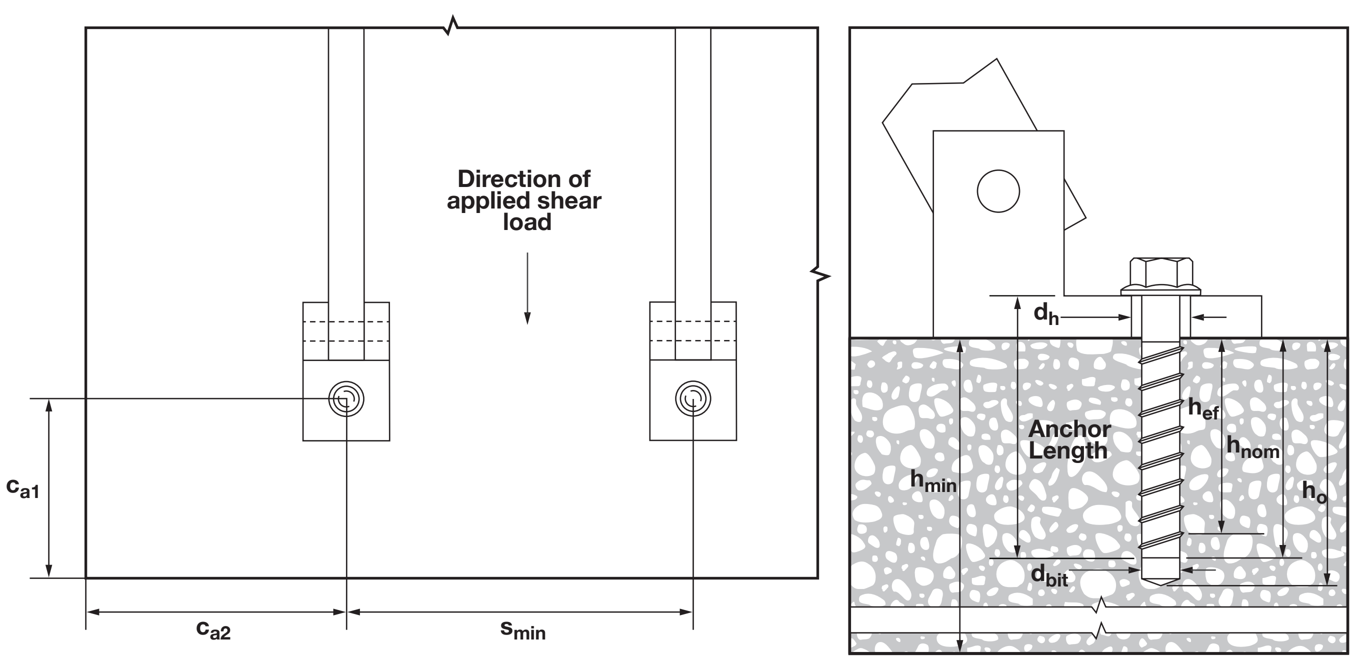


Figure 1 — Illustration of KWIK HUS installation parameters for reuse.

Table 2 — Single-use Hilti KWIK HUS design strength (factored resistance) in uncracked concrete[1,2]
IMPORTANT: these values are higher as compared to a reused anchor

Nominal anchor diameter	Nominal embedment		f'_c = 2000 psi (13.7 MPa)						f'_c = 4000 psi (27.5 MPa)						f'_c = 6000 psi (41.2 MPa)					
			Tension ϕN_n or N_r		Shear ϕV_n or V_r		60-degree[5]		Tension ϕN_n or N_r		Shear ϕV_n or V_r		60-degree[5]		Tension ϕN_n or N_r		Shear ϕV_n or V_r		60-degree[5]	
in.	in.	(mm)	lb	(kN)	lb	(kN)	lb	(kN)	lb	(kN)	lb	(kN)	lb	(kN)	lb	(kN)	lb	(kN)	lb	(kN)
1/4	1-1/8	(29)	110	(0.5)	315	(1.4)	125	(0.6)	165	(0.7)	445	(2.0)	190	(0.8)	165	(0.7)	545	(2.4)	195	(0.9)
	1-5/8	(41)	389	(1.7)	930	(4.1)	435	(1.9)	650	(2.9)	930	(4.1)	640	(2.8)	765	(3.4)	930	(4.1)	720	(3.2)
3/8	1-5/8	(41)	815	(3.6)	880	(3.9)	735	(3.3)	1,155	(5.1)	1,245	(5.5)	1,040	(4.6)	1,415	(6.3)	1,520	(6.8)	1,275	(5.7)
	2-1/2	(64)	1,770	(7.9)	1,905	(8.5)	1,595	(7.1)	2,505	(11.1)	2,695	(12.0)	2,260	(10.1)	3,065	(13.6)	3,095	(13.8)	2,700	(12.0)
	3-1/4	(83)	2,275	(10.1)	2,450	(10.9)	2,050	(9.1)	3,220	(14.3)	3,095	(13.8)	2,785	(12.4)	3,945	(17.6)	3,095	(13.8)	3,150	(14.0)
1/2	2-1/4	(57)	1,305	(5.8)	1,410	(6.3)	1,180	(5.2)	1,850	(8.2)	1,990	(8.9)	1,670	(7.4)	2,265	(10.1)	2,440	(10.9)	2,045	(9.1)
	3	(76)	2,215	(9.9)	2,385	(10.6)	2,000	(8.9)	3,130	(13.9)	3,375	(15.0)	2,825	(12.6)	3,835	(17.1)	4,130	(18.4)	3,460	(15.4)
	4-1/4	(108)	3,375	(15.0)	4,910	(21.8)	3,350	(14.9)	5,700	(25.4)	4,910	(21.8)	4,730	(21.0)	6,980	(31.1)	4,910	(21.8)	5,310	(23.6)
5/8	3-1/4	(83)	2,900	(12.9)	3,120	(13.9)	2,615	(11.6)	4,100	(18.2)	4,415	(19.6)	3,700	(16.5)	5,025	(22.4)	5,410	(24.1)	4,530	(20.2)
	5	(127)	3,960	(17.6)	6,735	(30.0)	4,095	(18.2)	8,485	(37.8)	6,735	(30.0)	6,805	(30.3)	10,390	(46.2)	6,735	(30.0)	7,615	(33.9)
3/4	4	(102)	3,340	(14.9)	8,435	(37.5)	3,765	(16.8)	5,540	(24.7)	9,995	(44.5)	5,815	(25.9)	6,785	(30.2)	9,995	(44.5)	6,755	(30.1)
	6-1/4	(159)	8,355	(37.2)	9,995	(44.5)	7,810	(34.8)	11,820	(52.6)	9,995	(44.5)	9,735	(43.3)	14,475	(64.4)	9,995	(44.5)	10,925	(48.6)

1 Tabulated values are based on the characteristic ultimate values obtained from testing a Hilti KWIK HUS anchor installed for the first time in concrete. See the Description of Technical Data section for an explanation of how values were determined.
2 Tabulated values are for normal-weight concrete only. For lightweight concrete, multiply design strength (factored resistance) by λ_a as follows: for sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60.
3 Since ACI and CSA limit the concrete compressive strength to 2,500 psi (17.2 MPa) for calculation of the design strength (factored resistance), the published results for 2,000 psi (13.7 MPa) concrete are based on testing.
4 Design strength (factored resistance) in 4,000 psi (27.5 MPa) and 6,000 psi (41.2 MPa) concrete are based on test data and calculations according to ACI 318-19 Chapter 17 and CSA A23.3-19 Annex D.
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 in the Description of Technical Data section with the tabulated tension and shear design strengths (factored resistances).

Table 3 — Reused Hilti KWIK HUS design strength (factored resistance) with the Hilti Reusability Gauge in uncracked concrete[1,2]
IMPORTANT: these values are reduced as compared to a single-use anchor

Nominal anchor diameter	Nominal embedment		f'_c = 2000 psi (13.7 MPa)						f'_c = 4000 psi (27.5 MPa)						f'_c = 6000 psi (41.2 MPa)					
			Tension ϕN_n or N_r		Shear ϕV_n or V_r		60-degree[5]		Tension ϕN_n or N_r		Shear ϕV_n or V_r		60-degree[5]		Tension ϕN_n or N_r		Shear ϕV_n or V_r		60-degree[5]	
in.	in.	(mm)	lb	(kN)	lb	(kN)	lb	(kN)	lb	(kN)	lb	(kN)	lb	(kN)	lb	(kN)	lb	(kN)	lb	(kN)
1/4	1-1/8	(29)	106	(0.5)	315	(1.4)	125	(0.6)	155	(0.7)	445	(2.0)	180	(0.8)	155	(0.7)	545	(2.4)	185	(0.8)
	1-5/8	(41)	342	(1.5)	930	(4.1)	390	(1.7)	575	(2.6)	930	(4.1)	585	(2.6)	725	(3.2)	930	(4.1)	695	(3.1)
3/8	1-5/8	(41)	670	(3.0)	880	(3.9)	645	(2.9)	915	(4.1)	1,245	(5.5)	890	(4.0)	1,100	(4.9)	1,520	(6.8)	1,075	(4.8)
	2-1/2	(64)	970	(4.3)	1,905	(8.5)	1,040	(4.6)	1,370	(6.1)	2,695	(12.0)	1,470	(6.5)	2,395	(10.7)	3,095	(13.8)	2,295	(10.2)
	3-1/4	(83)	2,160	(9.6)	2,450	(10.9)	1,985	(8.8)	2,705	(12.0)	3,095	(13.8)	2,490	(11.1)	2,870	(12.8)	3,095	(13.8)	2,590	(11.5)
1/2	2-1/4	(57)	955	(4.2)	1,410	(6.3)	950	(4.2)	1,350	(6.0)	1,990	(8.9)	1,345	(6.0)	1,955	(8.7)	2,440	(10.9)	1,850	(8.2)
	3	(76)	1,555	(6.9)	2,385	(10.6)	1,565	(7.0)	2,195	(9.8)	3,375	(15.0)	2,210	(9.8)	3,380	(15.0)	4,130	(18.4)	3,180	(14.2)
	4-1/4	(108)	3,205	(14.3)	4,910	(21.8)	3,225	(14.4)	5,250	(23.4)	4,910	(21.8)	4,500	(20.0)	5,780	(25.7)	4,910	(21.8)	4,770	(21.2)
5/8	3-1/4	(83)	2,225	(9.9)	3,120	(13.9)	2,185	(9.7)	3,145	(14.0)	4,415	(19.6)	3,090	(13.8)	4,280	(19.0)	5,410	(24.1)	4,070	(18.1)
	5	(127)	3,760	(16.7)	6,735	(30.0)	3,940	(17.5)	7,720	(34.4)	6,735	(30.0)	6,435	(28.6)	6,945	(30.9)	6,735	(30.0)	6,030	(26.8)
3/4	4	(102)	2,195	(9.8)	6,695	(29.8)	2,555	(11.4)	3,100	(13.8)	6,695	(29.8)	3,390	(15.1)	6,445	(28.7)	6,695	(29.8)	5,740	(25.5)
	6-1/4	(159)	7,935	(35.3)	9,995	(44.5)	7,540	(33.6)	11,230	(50.0)	9,995	(44.5)	9,440	(42.0)	12,390	(55.1)	9,995	(44.5)	10,005	(44.5)

1 Tabulated values are based on the characteristic ultimate values obtained from testing a Hilti KWIK HUS anchor meeting the minimum diameter requirements as checked with the Hilti Reusability Gauge. See the Description of Technical Data section for an explanation of how values were determined.
2 Tabulated values are for normal-weight concrete only. For lightweight concrete, multiply design strength (factored resistance) by λ_a as follows: for sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60.
3 Since ACI and CSA limit the concrete compressive strength to 2,500 psi (17.2 MPa) for calculation of the design strength (factored resistance), the published results for 2,000 psi (13.7 MPa) concrete are based on testing.
4 Design strength (factored resistance) in 4,000 psi (27.5 MPa) and 6,000 psi (41.2 MPa) concrete are based on test data and calculations according to ACI 318-19 Chapter 17 and CSA A23.3-19 Annex D.
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 in the Description of Technical Data section with the tabulated tension and shear design strengths (factored resistances).

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