The following excerpt are pages from the North American Product Technical Guide, Volume 2: Anchor Fastening, Edition 21.

Please refer to the publication in its entirety for complete details on this product including data development, product specifications, general suitability, installation, corrosion and spacing and edge distance guidelines.
US&CA: https://submittals.us.hilti.com/PTGVol2/

To consult directly with a team member regarding our anchor fastening products, contact Hilti's team of technical support specialists between the hours of 7:00am – 6:00pm CST.
US: 877-749-6337 or HNATechnicalServices@hilti.com
CA: 1-800-363-4458, ext. 6 or CATechnicalServices@hilti.com

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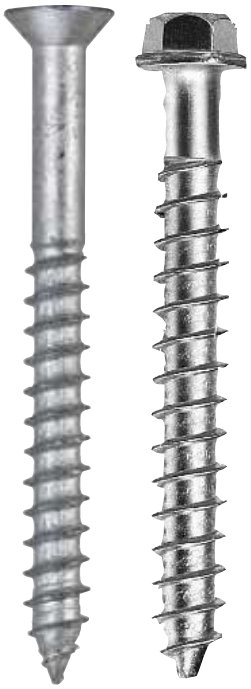
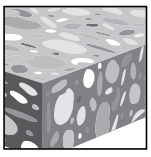
3.3.20 KWIK-CON+ CONCRETE AND MASONRY SCREW

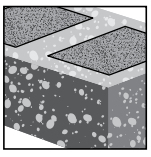
PRODUCT DESCRIPTION

KWIK-CON+ concrete and masonry screw anchors

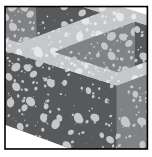
Anchor System		Features and Benefits
	KWIK-CON+ fastener	• Zinc coating with proprietary finish that exceeds 1000 hours of protection from red rust per ASTM B117 • Salt spray testing per ASTM G85 • Coating is more durable than zinc plating alone • Base material specific carbide tipped bits optimize performance in concrete or masonry • Torx Hex washer head for fast secure installations into base material • Torx or Phillips flat head for countersunk applications • Load data available for installations in concrete, grout-filled and hollow concrete masonry units (CMU) and brick • Available in AISI Type 410 Stainless Steel
	KWIK-CON+ drive tool and installation accessories	



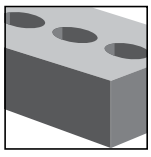
Uncracked concrete



Grout-filled concrete masonry



Ungrouted concrete masonry



Brick

Approvals/Listings	
Metro-Dade County	NOA 19-1113.04

Table 1 — Material Properties

Property	Carbon Steel		Stainless Steel	
	Fastener Diameter (inches)		Fastener Diameter (inches)	
	3/16	1/4	3/16	1/4
Minimum Tensile Strength (ksi)	150		130	
Minimum Yield Strength (ksi)	120		105	
Coating	Zinc with organic top coat		N/A	

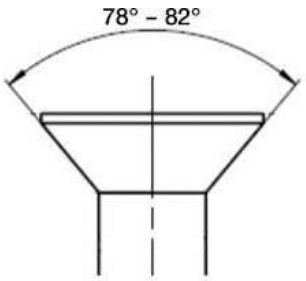


Figure 1 — Flathead KWIK CON+ Head Angle

Table 2 — Physical Dimensions

Characteristic	Nominal anchor diameter (inches)					
	3/16			1/4		
Head Style	Tapered Flat Head	Tapered Flat Head	5/16-in. Hex Washer	Tapered Flat Head	Tapered Flat Head	5/16-in. Hex Washer
Internal recess	#3 Phillips	T-25 TORX	T-25 TORX	#3 Phillips	T-27 TORX	T-25 TORX
Maximum Head Diameter (inches)	0.507	0.385	0.433	0.507	0.507	0.433
Major Thread Diameter (inches)	0.217			0.283		
Minor Diameter (inches)	0.145			0.190		
Shank Diameter (inches)	0.170			0.224		

INSTALLATION

Table 3 — KWIK CON+ Installation Specifications

Setting information	Symbol	Nominal anchor diameter (inches)			
		3/16		1/4	
Embedment (inches)	h_{nom}	1	1-3/4	1	1-3/4
Nominal drill bit diameter (inches)[1]	d_{bit}	3/16		1/4	
Minimum fixture hole diameter (inches)	d_h	1/4		5/16	
Minimum hole depth (inches)	h_o	1-1/4	2	1-1/4	2
Minimum member thickness (inches)	h_{min}	2-1/2	3-1/4	2-1/2	3-1/4
Minimum anchor spacing (inches)	s_{min}	2-1/4		2-1/2	
Critical anchor spacing (inches)	s_{cr}	3	4	3	4
Minimum edge distance (inches)	c_{min}	1-1/8		1-1/2	
Critical edge distance (inches)	c_{cr}	2-1/2	3-1/2	2-1/2	3-1/2

1 Requires matched tolerance drill bit from Hilti, TKC drill bits for concrete, TKB drill bits for other materials.

Table 4 — Load adjustment factors for Hilti KWIK CON+ screw anchors in concrete

Load adjustment factors for anchor spacing f_A						Load adjustment factors for edge distance f_R									
Tension/Shear loads						Tension						Shear			
Embedment (inches)		1	1-3/4	1	1-3/4	Embedment (inches)		1	1-3/4	1	1-3/4	1	1-3/4	1	1-3/4
Spacing (s)		Anchor diameter				Edge Distance		Anchor Diameter				Anchor Diameter			
in.	(mm)	3/16		1/4		in.	(mm)	3/16		1/4		3/16		1/4	
2-1/4	(57)	0.80	0.80			1-1/8	(29)	0.80	0.80			0.30	0.30		
2-1/2	(64)	0.87	0.83	0.80	0.80	1-1/4	(32)	0.82	0.81			0.36	0.34		
2-3/4	(70)	0.93	0.86	0.90	0.86	1-1/2	(38)	0.85	0.83	0.80	0.80	0.49	0.41	0.30	0.30
3	(76)	1.00	0.89	1.00	0.89	1-3/4	(44)	0.89	0.85	0.85	0.83	0.62	0.48	0.48	0.39
3-1/4	(83)		0.91		0.91	2	(51)	0.93	0.87	0.90	0.85	0.75	0.56	0.65	0.48
3-1/2	(89)		0.94		0.94	2-1/4	(57)	0.96	0.89	0.95	0.88	0.87	0.63	0.83	0.56
3-3/4	(95)		0.97		0.97	2-1/2	(64)	1.00	0.92	1.00	0.90	1.00	0.71	1.00	0.65
4	(102)		1.00		1.00	3	(76)		0.96		0.95		0.85		0.83
						3-1/2	(89)		1.00		1.00		1.00		1.00

1 Reduction factors are multiplicative and linear interpolation between s_{cr} and s_{min}, c_{cr} and c_{min} is permitted.

DESIGN INFORMATION IN CONCRETE PER ALLOWALBLE STRESS DESIGN

Table 5 — Tension and shear allowable loads in concrete [1, 2,3]

Nominal anchor diameter (in.)	Nominal embedment in. (mm)	f'_c = 2,000 psi		f'_c = 4,000 psi		f'_c = 6,000 psi	
		Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)
3/16	1 (25)	100 (0.4)	260 (1.2)	125 (0.6)	260 (1.2)	185 (0.8)	280 (1.3)
3/16	1-3/4 (44)	275 (1.2)	260 (1.2)	295 (1.3)	265 (1.2)	325 (1.5)	300 (1.3)
1/4	1 (25)	190 (0.9)	325 (1.4)	240 (1.1)	390 (1.7)	275 (1.2)	540 (2.4)
1/4	1-3/4 (44)	425 (1.9)	560 (2.5)	475 (2.1)	600 (2.8)	525 (2.3)	600 (2.7)

1 Screws installed in holes drilled with Hilti TKC carbide bits.
2 Allowable loads are based on a factor of safety of 4.
3 Apply spacing and edge distance reduction factors in Table 4 as needed.

Table 6 — Tension and shear ultimate loads in concrete[1]

Nominal anchor diameter (in.)	Nominal embedment in. (mm)	f'_c = 2,000 psi		f'_c = 4,000 psi		f'_c = 6,000 psi	
		Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)
3/16	1 (25)	400 (1.8)	1,050 (4.7)	500 (2.2)	1,050 (4.7)	750 (3.3)	1,150 (5.1)
3/16	1-3/4 (44)	1,100 (4.9)	1,050 (4.7)	1,180 (5.3)	1,070 (4.8)	1,300 (5.8)	1,200 (5.3)
1/4	1 (25)	760 (3.4)	1,300 (5.8)	970 (4.3)	1,575 (7.0)	1,100 (4.9)	2,175 (9.7)
1/4	1-3/4 (44)	1,700 (7.6)	2,250 (10.0)	1,900 (8.5)	2,400 (11.3)	2,100 (9.34)	2,400 (10.7)

1 Screws installed in holes drilled with TKC bits.

Table 7 — Tension and shear allowable loads in grout-filled and hollow concrete masonry units (CMU)[1,2,3,4,5]

Nominal anchor diameter (in.)	Nominal embedment in. (mm)	Tension lb (kN)	Shear lb (kN)
3/16	1 (25)	150 (0.7)	225 (1.0)
3/16	1-3/4 (44)	290 (1.3)	300 (1.3)
1/4	1 (25)	165 (0.7)	275 (1.2)
1/4	1-3/4 (44)	310 (1.4)	400 (1.8)

1 All values for anchors installed in grout-filled or hollow concrete masonry (CMU) with a minimum prism strength of 1,500 psi. CMU may be lightweight, medium-weight or normal-weight conforming to ASTM C90.
2 Screws installed in holes drilled with TKB bits.
3 Allowable loads calculated using a factor of safety of 4.
4 Installation in the mortar joints is outside the scope of the published data.
5 C_{min}, S_{min} equals 4 inches

Table 8 — Tension and shear allowable loads in brick[1,2,3,4,5]

Nominal anchor diameter (in.)	Nominal embedment in. (mm)	Tension lb (kN)	Shear lb (kN)
3/16	1 (25)	125 (0.6)	235 (1.0)
3/16	1-3/4 (44)	350 (1.6)	300 (1.3)
1/4	1 (25)	205 (0.9)	415 (1.8)
1/4	1-3/4 (44)	350 (1.6)	500 (2.2)

1 This test was performed on individual specimens of ASTM C62 common brick. Due to the wide variations encountered in the compressive strength of brick, these values should be considered guide values.
2 Allowable loads are based on a factor of safety of 4.
3 Installation in the mortar joints is outside the scope of the published data.
4 KWIK CON+ installed with TKB bits.
5 C_{min}, S_{min} equals 4 inches

Load values are for anchors installed a minimum of sixteen diameters on center and a minimum edge distance of sixteen diameters. Anchor spacing may be reduced to twelve diameters provided loads are reduced by 20 percent. Edge distance may be reduced to six diameters provided loads are reduced by 20 percent in tension and 70 percent in shear.

Combined shear and tension loading

$$\left(\frac{N_d}{N_{rec}}\right) + \left(\frac{V_d}{V_{rec}}\right) \leq 1.0$$

INSTALLATION INSTRUCTIONS

Installation Instructions For Use (IFU) / Operating Instructions (OI) throughout the document are included with each product package. They can also be viewed or downloaded online at www.hilti.com. 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)/Operating Instructions (OI).

ORDERING INFORMATION[1]

KWIK-CON+ fasteners

5/16 - in. Magnetic nut setter or T-25 TORX bit

Description	Diameter	Total length	Thread length	Shank length
KWIK-CON+ 3/16 X 1-1/4 THH	3/16	1-1/4	1-1/4	0
KWIK-CON+ 3/16 X 1-3/4 THH	3/16	1-3/4	1-3/4	0
KWIK-CON+ 3/16 X 2-1/4 THH	3/16	2-1/4	1-3/4	1/2
KWIK-CON+ 3/16 X 2-3/4 THH	3/16	2-3/4	1-3/4	1
KWIK-CON+ 3/16 X 3-1/4 THH	3/16	3-1/4	1-3/4	1-1/2

5/16 - in. Magnetic nut setter or T-25 TORX bit

Description	Diameter	Total length	Thread length	Shank length
KWIK CON+ 1/4 X 1-1/4 THH	1/4	1-1/4	1-1/4	0
KWIK CON+ 1/4 X 1-3/4 THH	1/4	1-3/4	1-3/4	0
KWIK CON+ 1/4 X 2-1/4 THH	1/4	2-1/4	1-3/4	1/2
KWIK CON+ 1/4 X 2-3/4 THH	1/4	2-3/4	1-3/4	1
KWIK CON+ 1/4 X 3-1/4 THH	1/4	3-1/4	1-3/4	1-1/2
KWIK CON+ 1/4 X 3-3/4 THH	1/4	3-3/4	1-3/4	2
KWIK CON+ 1/4 X 4 THH	1/4	4	1-3/4	2-1/4
KWIK CON+ 1/4 X 1-1/4 THH SS	1/4	1-1/4	1-1/4	0
KWIK CON+ 1/4 X 2-1/4 THH SS	1/4	2-1/4	1-3/4	1/2

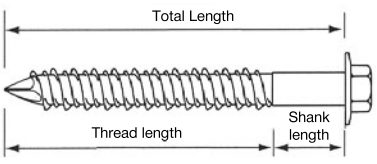
T-25 TORX bit

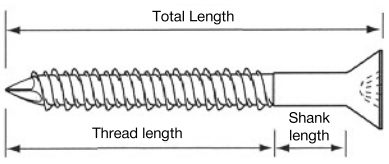
Description	Diameter	Total length	Thread length	Shank length
KWIK-CON+ 3/16 X 1-1/4 TFH	3/16	1-1/4	1-1/8	0
KWIK-CON+ 3/16 X 1-3/4 TFH	3/16	1-3/4	1-5/8	0
KWIK CON+ 3/16 X 2-1/4 TFH	3/16	2-1/4	1-3/4	1/2
KWIK-CON+ 3/16 X 2-3/4 TFH	3/16	2-3/4	1-3/4	7/8
KWIK-CON+ 3/16 X 3-1/4 TFH	3/16	3-1/4	1-3/4	1-3/8
KWIK-CON+ 3/16 X 3-3/4 TFH	3/16	3-3/4	1-3/4	1-7/8

T-27 TORX bit

Description	Diameter	Total length	Thread length	Shank length
KWIK CON+ 1/4 X 1-1/4 TFH	1/4	1-1/4	1-1/4	0
KWIK CON+ 1/4 X 1-3/4 TFH	1/4	1-3/4	1-3/4	0
KWIK CON+ 1/4 X 2-1/4 TFH	1/4	2-1/4	1-3/4	1/2
KWIK CON+ 1/4 X 2-3/4 TFH	1/4	2-3/4	1-3/4	1
KWIK CON+ 1/4 X 3-1/4 TFH	1/4	3-1/4	1-3/4	1-1/2
KWIK CON+ 1/4 X 4 TFH	1/4	4	1-3/4	2-1/4

1 All dimensions in inches





#3 Phillips bit

Description	Diameter	Total length	Thread length	Shank length
KWIK CON+ 3/16 X 1-1/4 PFH	3/16	1-1/4	1-1/4	0
KWIK CON+ 3/16 X 2-1/4 PFH	3/16	2-1/4	1-3/4	1/2
KWIK CON+ 3/16 X 3-1/4 PFH	3/16	2-3/4	1-3/4	1
KWIK CON+ 3/16 X 2-3/4 PFH	3/16	3-1/4	1-3/4	1-1/2
KWIK CON+ 3/16 X 2-3/4 PFH SS	3/16	1-1/4	1-1/4	0
KWIK CON+ 3/16 X 1-1/4 PFH SS	3/16	2-3/4	1-3/4	1

#3 Phillips bit

Description	Diameter	Total length	Thread length	Shank length
KWIK CON+ 1/4 X 1-1/4 PFH	1/4	1-1/4	1-1/4	0
KWIK CON+ 1/4 X 2-1/4 PFH	1/4	2-1/4	1-3/4	1/2
KWIK CON+ 1/4 X 2-3/4 PFH	1/4	2-3/4	1-3/4	1
KWIK CON+ 1/4 X 3-1/4 PFH	1/4	3-1/4	1-3/4	1-1/2
KWIK CON+ 1/4 X 3-3/4 PFH	1/4	3-3/4	1-3/4	2

KWIK-CON+ hex driver system

Description	Qty / pack
KWIK-CON Hex Driver Deluxe Kit	1
KWIK-CON Hex Driver	1
5/16-in. Hex Driver for all THH	1
5/16-in. Hex Nut Setter/Depth Locator	1
Insert Bit Holder/Depth Locator	1
#3 Phillips Driver for all PFH	1
T-25 TORX Driver for 3/16-in. TFH	1

KWIK-CON+ matched tolerance drill bits

Description
For 1/4-in. KWIK-CON+ Applications in normal-weight concrete
TKC Large Concrete Bit SDS+ Hex
TKC Large Concrete Bit Smooth Shank
For 1/4-in. KWIK-CON+ Applications in lightweight concrete, brick or CMU
TKB Large CMU Bit SDS+ Hex
TKB Large CMU Bit Smooth Shank
For 3/16-in. KWIK-CON+ Applications in normal-weight concrete
TKC Small Concrete Bit SDS+ Hex
TKC Small Concrete Bit Smooth Shank
For 3/16-in. KWIK-CON+ Applications in lightweight concrete, brick or CMU
TKB Small CMU Bit SDS+ Hex
TKB Small Block Bit Smooth Shank

4.0 REFERENCE

4.1 REFERENCE STANDARDS

4.1.1 ASTM STANDARDS FOR MATERIALS

Standard	Title
A36	Standard Specification for Structural Steel
A193	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
A307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
A563	Standard Specification for Carbon and Alloy Steel Nuts
A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
B695	Specifications for Coatings of Zinc Mechanically Deposited on Iron and Steel
C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
C33	Standard Specification for Concrete Aggregates
C34	Standard Specification for Structural Clay Load-Bearing Wall Tile
C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C42	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
C62	Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
C90	Standard Specification for Load-Bearing Concrete Masonry Units
C150	Standard Specification for Portland Cement
C270	Standard Specification for Mortar for Unit Masonry
C330	Standard Specification for Lightweight Aggregates for Structural Concrete
C332	Standard Specification for Lightweight Aggregates for Insulating Concrete
C652	Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
C942	Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory
D638	Standard Test Method for Tensile Properties of Plastics
D648	Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
D695	Standard Test Method for Compressive Properties of Rigid Plastics
E8	Standard Test Methods for Tension Testing of Metallic Materials
E119	Standard Test Methods for Fire Tests of Building Construction and Materials
E488	Standard Test Methods for Strength of Anchors in Concrete Elements
E1190	Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members
E1512	Standard Test Methods for Testing Bond Performance of Bonded Anchors
F436	Standard Specification for Hardened Steel Washers
F593	Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs
F594	Standard Specification for Stainless Steel Nuts
F606	Standard Test Methods for Determining the Mechanical Properties of Externally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets
F844	Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
F1554	Standard Specification for Anchor Bolts, 36, 55, and 105-ksi Yield Strength
F1941-16	Electrodeposited Coatings on Mechanical Fasteners
G85	Standard Practice for Modified Salt Spray (Fog) Testing

4.1.2 ASTM PLATING STANDARDS

Standard	Title
A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
B633	Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
B695	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

4.1.3 FEDERAL SPECIFICATIONS

Standard	Title
A-A-1922A	Shield, Expansion (Caulking Anchors, Single Lead)
A-A-1923A	Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)
A-A-1924A	Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors)
A-A-55615	Shield, Expansion (Wood Screw and Lag Bolt Self-Threading Anchors)
A-A-55614	Shield, Expansion (Non-drilling Expansion Anchors)

4.1.4 ANSI STANDARDS

Standard	Title
B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
B18.22.1	Plain Washers (Inch Series)
B212.15	Carbide-Tipped Masonry Drills and Blanks for Carbide – Tipped Masonry Drills
Standard 61 Effects	Drinking Water System Components – Health

4.2 TECHNICAL REFERENCES

4.2.1 METRIC CONVERSIONS AND EQUIVALENTS

The Metric Conversion Act of 1975, as amended by the Omnibus Trade and Competitiveness Act of 1988, establishes the SI or System International metric system as the preferred system of measurement in the United States.

Many products are currently manufactured and supplied in SI or hard metric sizes such as anchor bolts of 10 mm, 12 mm, 26 mm, etc. diameter. Where the inch-pound system is given or used, soft metric conversion can sometimes be used. This is not the case when selecting a drill bit for installing mechanical anchors, where it is critical to only use the specified Imperial or Metric diameter bit. The soft conversion diameters for anchor bolts is given by Table 1. Standard metric conversion factors commonly used for fastening products are given in Tables 2 and 3.

Table 1— Diameters

in.	Hard metric conversion mm	Use for soft metric mm
1/4	6.35	6
5/16	7.94	8
3/8	9.52	10
1/2	12.70	12
5/8	15.88	16
3/4	19.05	20
1	25.40	25
1-1/4	31.75	32

Table 2 — Imperial units to SI units

To convert	Into	Multiply by
Length		
inch (in.)	millimeter (mm)	25.4000
foot (ft)	meter (m)	0.3048
Area		
square inch (in^2)	square millimeter (mm^2)	645.1600
square inch (in^2)	square centimeter (cm^2)	6.4516
square foot (ft^2)	square meter (m^2)	0.0929
Volume		
cubic inch (in^3)	cubic centimeter (cm^3)	16.3871
cubic foot (ft^3)	cubic meter (m^3)	0.0283
gallon (US gal)	liter (L)	3.7854
Force		
pound force (lbf)	newton (N)	4.4482
pound force (lbf)	kilonewton (kN)	0.0044
Pressure		
pound/square inch (psi)	newton/square millimeter (N/mm^2)	0.0069
pound/square inch (psi)	mega pascal (MPa)	0.0069
Kip/square inch (ksi)	mega pascal (MPa)	6.8946
pounds/square foot (psf)	newton/square meter (N/m^2)	47.8801
Torque or Bending Moment		
foot pound (ft-lb)	newton meter (N/m)	1.3558
inch pound (in-lb)	newton meter (N/m)	0.1130
Diaphragm Shear		
pounds/foot (plf)	newton/meter (N/m)	14.5939

Table 3 — SI units to Imperial units

To convert	Into	Multiply by
Length		
millimeter (mm)	inch (in.)	0.0394
meter (m)	foot (ft)	3.2808
Area		
square millimeter (mm^2)	square inch (in^2)	0.0016
square centimeter (cm^2)	square inch (in^2)	0.1550
square meter (m^2)	square foot (ft^2)	10.7639
Volume		
cubic centimeter (cm^3)	cubic inch (in^3)	0.0610
cubic meter (m^3)	cubic foot (ft^3)	35.3147
liter (L)	gallon (US gal)	0.2642
Force		
newton (N)	pound force (lbf)	0.2248
kilonewton (kN)	pound force (lbf)	224.8089
Pressure		
newton/square millimeter (N/mm^2)	pound/square inch (psi)	145.0400
mega pascal (MPa)	pound/square inch (psi)	145.0400
mega pascal (MPa)	Kip/square inch (ksi)	0.1450
newton/square meter (N/m^2)	pounds/square foot (psf)	0.0209
Torque or Bending Moment		
newton meter (N/m)	foot pound (ft-lb)	0.7376
newton meter (N/m)	inch pound (in-lb)	8.8496
Diaphragm Shear		
newton/meter (N/m)	pounds/lineal foot (plf)	0.0685

4.2.2 MECHANICAL PROPERTIES OF MATERIALS

Table 4 — Mechanical properties of carbon steel

Grade designation	Nominal size in.	Min. yield strength ksi	(MPa)	Min. ultimate strength ksi	(MPa)
ASTM A36	All	36	(248)	58	(400)
ASTM A193, B7	1/4 thru 2-1/2	105	(724)	125	(862)
AISI 1038 (As Rec'd)	1/4 thru 1-1/4	41	(282)	75	(517)
AISI 11L41	over 5/8 thru 1	75	(517)	90	(620)
AISI 1110 M (As Rec'd)	1/4 thru 5/8	44	(303)	53	(365)
AISI 12L14	5/8 thru 1-1/2	60	(414)	78	(538)
AISI 1010 (As Rec'd)	1/4 thru 3/4	44	(303)	53	(365)
ASTM A307	1/4 thru 4	–	–	60	(414)
ASTM A325	1/2 thru 1	92	(634)	120	(827)
	over 1 thru 1-1/2	81	(558)	105	(724)
ASTM A449	1/4 thru 1	92	(634)	120	(827)
	over 1 thru 1-1/2	81	(558)	105	(724)
ASTM A510	3/8 thru 3/4	70	(480)	87	(600)
SAE Grade 2	1/4 thru 3/4	57	(393)	74	(510)
	over 3/4 thru 1-1/2	36	(248)	60	(414)
SAE Grade 5	1/4 thru 1	92	(634)	120	(827)
	over 1 thru 1-1/2	81	(558)	105	(724)
SAE Grade 8	1/4 thru 1-1/2	130	(896)	150	(1034)
ISO 898-1 Class 5.8	All	58	(400)	72.5	(500)
ISO 898-1 Class 8.8	All	92.8	(640)	116	(800)

Table 5 — Mechanical properties of stainless steel

Grade ASTM/AISI	Nominal size in.	Yield strength ksi	(MPa)	Ultimate strength ksi	(MPa)
F593 / 304 / 316	1/4 thru 5/8	65	(448)	100	(689)
	3/4 thru 1-1/2	45	(310)	85	(586)
A193, B8 / 304 / 316	1/4 thru 1-1/2	30	(205)	75	(515)
A276 / 304	1/4 thru 9/16	76	(524)	90	(620)
	Larger than 9/16	64	(441)	75	(524)
A276 / 316	1/4 thru 9/16	76	(524)	90	(620)
	Larger than 9/16	64	(441)	75	(524)
A493 / 304	All	60	(414)	90	(627)
A582 / 303	All	60	(414)	100	(689)
DIN 267 Part 11, A4-70	All	65.3	(450)	101.5	(700)

4.2.3 BOLT THREAD DATA

Table 6 — Basic dimensions for UNC Coarse Thread Series—ANSI B1.1-1982

Nominal size	Basic diameter		Threads per Inch (n)	Area		
	Major in. (D)	Minor in.		Nominal in^2	Minor[1] in^2	Tensile stress[2] in^2
No. 10	0.1900	0.1449	24	0.0284	0.0145	0.0175
No. 12	0.2160	0.1709	24	0.0366	0.0206	0.0242
1/4	0.2500	0.1959	20	0.0491	0.0269	0.0318
5/16	0.3125	0.2524	18	0.0767	0.0454	0.0524
3/8	0.3750	0.3073	16	0.1104	0.0678	0.0775
7/16	0.4375	0.3602	14	0.1503	0.0933	0.1063
1/2	0.5000	0.4167	13	0.1963	0.1257	0.1419
9/16	0.5625	0.4723	12	0.2485	0.1620	0.1819
5/8	0.6250	0.5266	11	0.3068	0.2017	0.2260
3/4	0.7500	0.6417	10	0.4418	0.3019	0.3345
7/8	0.8750	0.7547	9	0.6013	0.4192	0.4617
1	1.0000	0.8647	8	0.7854	0.5509	0.6057
1-1/8	1.1250	0.9704	7	0.9940	0.6929	0.7633
1-1/4	1.2500	1.0954	7	1.2272	0.8896	0.9691

1 Minor area = $0.7854\ (D - 1.3/n)^2$
2 Tensile stress area = $0.7854\ (D - 0.9743/n)^2$

Figure 1 - Basic profile for screw threads

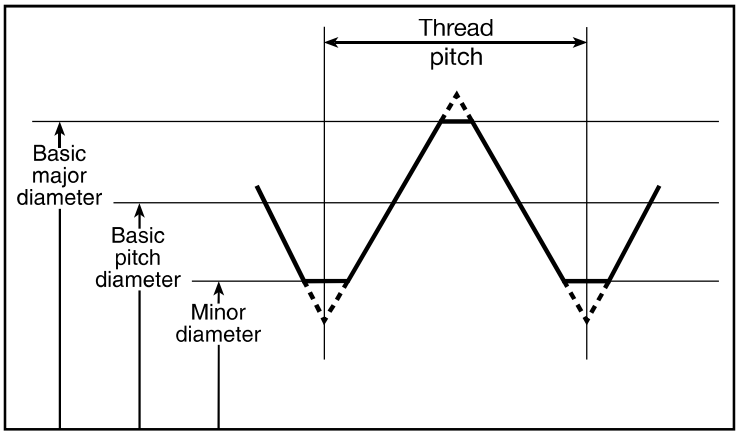


Table 7 — Basic dimensions for M profile metric thread series – ANSI B1.13M-1979

Nominal size	Basic diameter		Thread pitch mm (P)	Area	
	Major mm (D)	Minor mm		Nominal mm^2	Tensile stress[1] mm^2
M8	8	6.62	1.25	50.3	36.6
M10	10	8.34	1.50	78.5	58.0
M12	12	10.07	1.75	113.1	84.3
M16	16	13.80	2.00	201.1	157.0
M20	20	17.25	2.50	314.2	245.0
M24	24	20.70	3.00	452.4	353.0

1 Tensile stress area = $0.7854\ (D - 0.9382\ P)^2$

4.2.4 CONCRETE REINFORCING BAR DATA

Table 8 — ASTM basic dimensions for deformed steel bars for concrete reinforcement, Imperial units

Bar designation No.[1]	Nominal weight lb/ft	Nominal dimensions[2]		
		Diameter in.	Area in²	Perimeter in.
3	0.376	0.375	0.11	1.178
4	0.668	0.500	0.20	1.571
5	1.043	0.625	0.31	1.963
6	1.502	0.750	0.44	2.356
7	2.044	0.875	0.60	2.749
8	2.670	1.000	0.79	3.142
9	3.400	1.128	1.00	3.544
10	4.303	1.270	1.27	3.990
11	5.313	1.410	1.56	4.430
14	7.65	1.693	2.25	5.32
18	13.60	2.257	4.00	7.09

1 Bar designation numbers are based on the number of eighths of an inch included in the nominal diameter.
2 The nominal dimensions of a deformed bar are approximate, being shown as equivalent to those of a plain round bar having the same weight per foot as the deformed bar.

Table 9 — ASTM basic dimensions for deformed steel bars for concrete reinforcement, SI units

Bar designation No.[1]	Nominal mass kg/m	Nominal dimensions[2]		
		Diameter mm	Area mm²	Perimeter mm
10	0.560	9.5	71	29.9
13	0.994	12.7	129	39.9
16	1.552	15.9	199	49.9
19	2.235	19.1	284	59.8
22	3.042	22.2	387	69.8
25	3.973	25.4	510	79.8
29	5.060	28.7	645	90.0
32	6.404	32.3	819	101.3
36	7.907	35.8	1006	112.5
43	11.38	43.0	1452	135.1
57	20.24	57.3	2581	180.0

1 Bar designation numbers approximate the number of millimeters of the nominal diameter of the bar.
2 The nominal dimensions of a deformed bar are approximate, being shown as equivalent to those of a plain round bar having the same mass per meter as the deformed bar.

Table 10 — CSA G30.12 & G30.16 basic dimensions for deformed steel bars for concrete reinforcement, SI units (Canada only)

Bar number[1]	Nominal mass kg/m	Nominal dimensions[2]		
		Diameter mm	Area mm²	Perimeter mm
10M	0.785	11.3	100	36
15M	1.570	16.00	200	50
20M	2.355	19.5	300	61
25M	3.925	25.2	500	79
30M	5.495	29.9	700	94
35M	7.850	35.7	1000	112
45M	11.775	43.7	1500	137
55M	19.625	56.4	2500	177

1 Bar numbers are based on the rounded off nominal diameter of the bars.
2 Nominal dimensions are equivalent to those of a plain round bar having the same mass per meter as the deformed bar.

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Table 1 — HIT-HY 200 Design Strength (Factored Resistance) for HIT-Z(-R) Rods in Uncracked Concrete[1,2,3,4,5,6,7,8]

Anchor Diameter in. (mm)	Effective Embed. Depth in. (mm)	Tension – ΦN_n or N_r				Shear – ΦV_n or V_r				
		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 (41.4 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 (41.4 MPa) lb (kN)	f'_c = 8,000 psi (55.2 MPa) lb (kN)
3/8 (9.5)	2-3/8 (60)	2,855 (12.7)	3,125 (13.9)	3,610 (16.1)	4,425 (19.7)	3,075 (13.7)	3,370 (15.0)	3,890 (17.3)	4,765 (21.2)	5,500 (24.5)
	4-1/2 (114)	5,560 (24.7)	5,560 (24.7)	5,560 (24.7)	5,560 (24.7)	16,035 (71.3)	17,570 (78.2)	20,285 (90.2)	24,845 (110.5)	26,690 (127.6)
1/2 (12.7)	2-3/4 (70)	3,555 (15.8)	3,895 (17.3)	4,500 (20.0)	5,510 (24.5)	7,660 (34.1)	8,395 (37.3)	9,690 (43.1)	11,870 (52.8)	13,705 (61.0)
	6 (152)	7,935 (35.3)	7,935 (35.3)	7,935 (35.3)	7,935 (35.3)	24,690 (109.8)	27,045 (120.3)	31,230 (138.9)	38,250 (170.1)	44,170 (196.5)
5/8 (15.9)	3-3/4 (95)	5,665 (25.2)	6,205 (27.6)	7,165 (31.9)	8,775 (39.0)	12,200 (54.3)	13,365 (59.5)	15,430 (68.6)	18,900 (84.1)	21,825 (97.1)
	7-1/2 (191)	14,950 (66.5)	14,950 (66.5)	14,950 (66.5)	14,950 (66.5)	34,505 (153.5)	37,800 (168.1)	43,650 (194.2)	53,455 (237.8)	61,725 (274.6)

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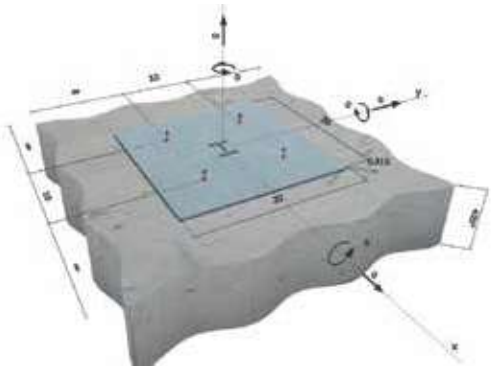

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