



CFS Engineering Group, Inc.
Structural Engineers

**Casa Ohad
6200 SW 123rd Terrace
Pinecrest, FL**

CFS Project Number 23011.00

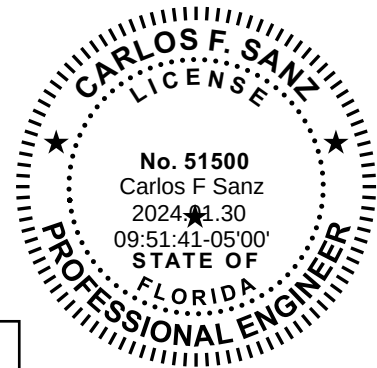
**Supplemental Structural Calculations
Underground Propane Tank Anchorage**

Prepared by

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January 30, 2024

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Carlos F. Sanz, PE
PE – 51500



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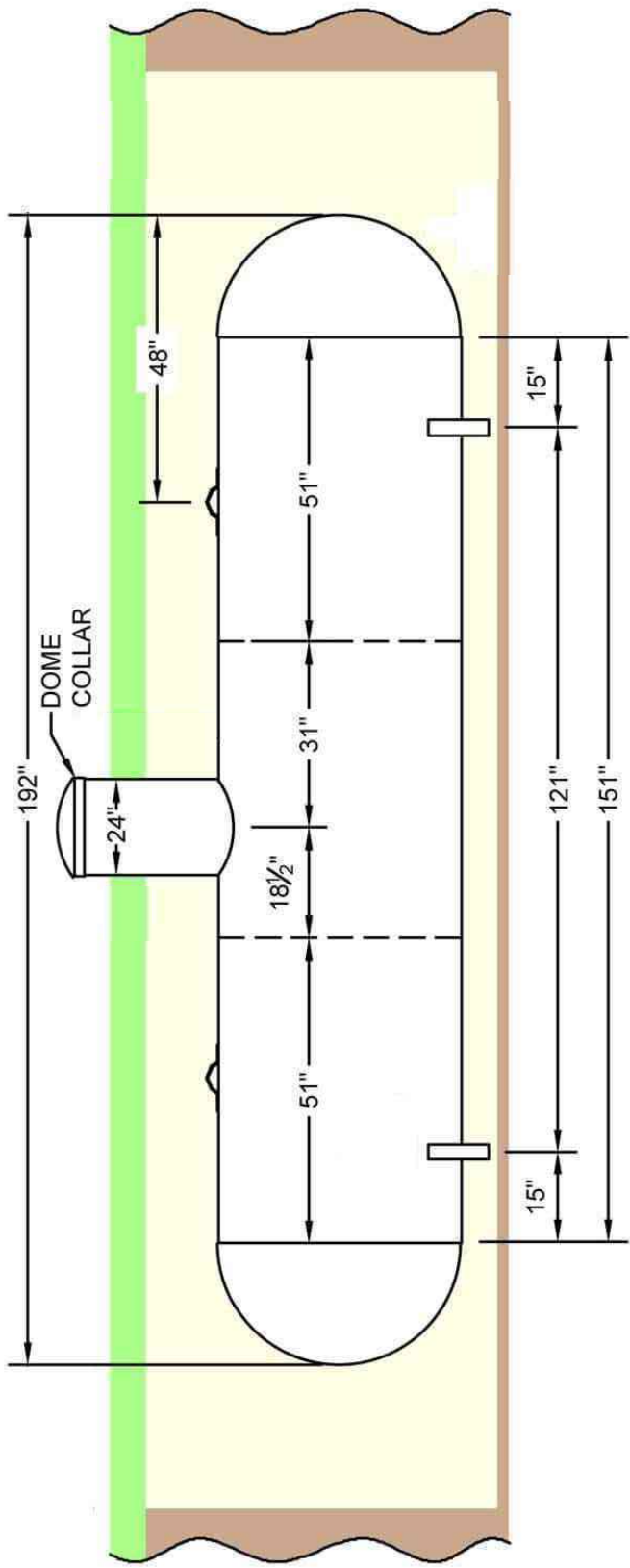
**Supplemental Structural Calculations
Underground Propane Tank Anchorage
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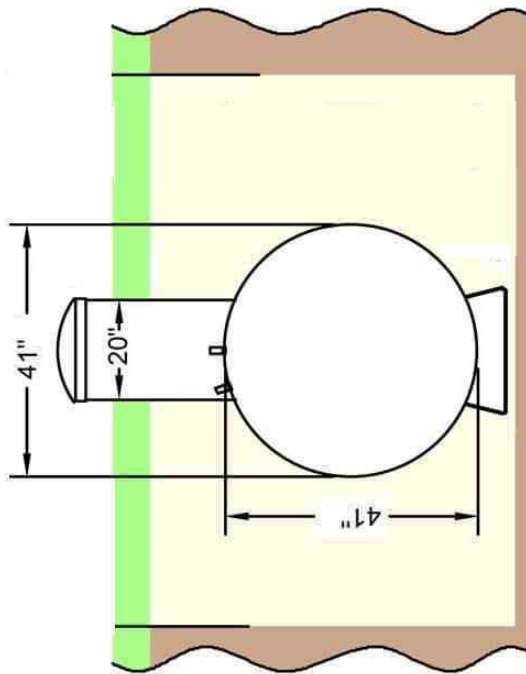


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**Underground Propane Tank
Information / Basis of Design**



SIDE VIEW



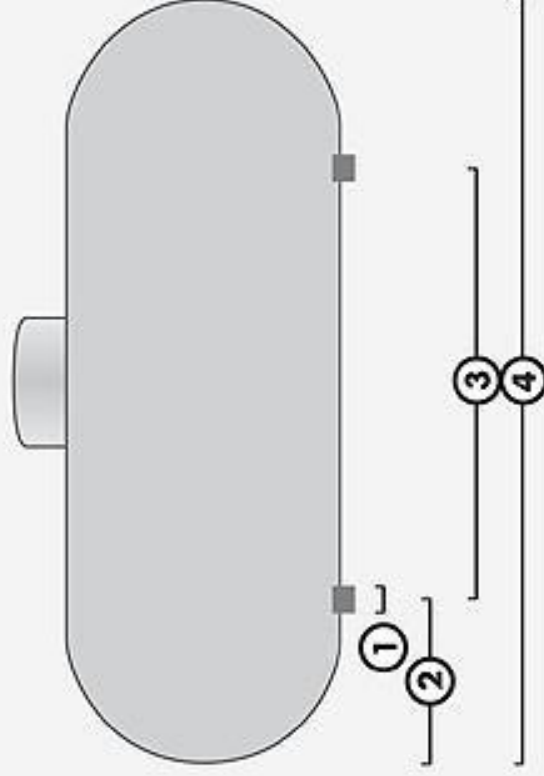
END VIEW



SIZE / TYPE / WEIGHT: 1000 GAL. UNDERGROUND 1760 lbs.

PROPANE TANK TYPE AWT-UG

Tank Specifications



Height from Top of Tank to Dome Top

AG	7.50
AG/UG	10.75
AG/UG Long	14.75
UG (SNR)	14.75
UG (LNR)	26.75

Tank Size (in gallons)	120	150	250	320	475	500	1000
Dimensions	24x67	24x82	30x92	30x114	37x113	37x120	41x190
Approximate Weight (in pounds)	260	380	480	620	920	940	1800
Shell Thickness	0.140	0.140	0.175	0.175	0.218	0.218	0.238
Head Thickness	0.138	0.138	0.148	0.148	0.184	0.184	0.201
1 Leg Width	2.5	2.5	2.5	2.5	3	3	3
2 Leg Distance from Edge of Shell	6.5	2.75	1.75	6	4	4	4
3 Leg Distance from Center to Center	34.5	59	60	60	60	60	141.5
4 Shell Width	50	67	64	87	75	81	149

All dimensions are in inches unless otherwise noted. Dimensions may vary +/- 1".



Propane & Oil Since 1932

Excavation Guidelines for Underground Propane Tanks

Proper excavation is the essential first step in the proper installation of an underground tank. Improper excavation can jeopardize the installation and can potentially lead to a hazardous gas leak.

Warning: The installation of underground LP gas tanks is governed by the LP Gas Code (NFPA 58) and must always be done by a qualified professional. Installation of tanks by unqualified persons can potentially lead to a hazardous gas leak. Be sure to call Digsafe before digging: 888-DIG-SAFE (334-7233).

Tank Size	120 Gal.	320 Gal.	500 Gal.	1000 Gal.
Tank Dimensions	5' 6" x 24" diameter	9' x 32" diameter	10' x 38" diameter	16' x 41" diameter
Weight (approx.)	252 lb.	588 lb.	921 lb.	1731 lb.
Hole Dimensions *	9' 6" L x 4' W x 44" Deep	13' L x 4' 6" W x 52" Deep	14' L x 5' W x 4' 6" Deep	20' L x 5' 6" W x 4' 6" Deep
Below the Tank-all sizes	Six inches of sand in the bottom of the hole .			
Prior to Back-filling	One 17 lb. Anode bag connected to tank. Place at least 2' away from tank and low in the hole. Pour 1 gallon of water on bag and immediately cover with sand.			
Back-fill **	Once tank is place and inspected by the local AHJ, if required, back-fill the entire hole with sand. Grade downward and away from housing dome. This prevents water from collecting and running into or standing around the housing dome.			
* If a concrete pad is required, depth of hole must be 6" deeper to accommodate a 6" concrete pad in the dimensions of the tank with 4 anchor eye bolts (one in each corner of the pad). Attach stainless steel or similar strapping from lifting lugs down to eye bolts.				
** Touch up any scratches or marks on tanks or lifting lugs with proper coating materials before back-filling. Be sure to keep at least half of riser (dome) above ground. Marking the halfway point before back-filling is helpful, especially if finishing with top soil. Filling in more than halfway can cause future water/freezing problems and must be avoided.				

Gas Line Trench Specifications: The trench for buried coated copper tubing or polyethylene pipe and tubing shall be installed with a minimum 12 in. of clean fill or sand. Do not backfill until inspected by the local AHJ, if required. The minimum cover shall be increased to 18 in. if external damage to the pipe or tubing from vehicles is likely to result. Tracer wire (required for PE pipe & tubing only) along with yellow caution tape (*Caution Gas Line Buried Below*) shall be properly installed by a qualified service technician.

Tank Dome - Half of the dome must be above the ground. Grade downward and away from dome.

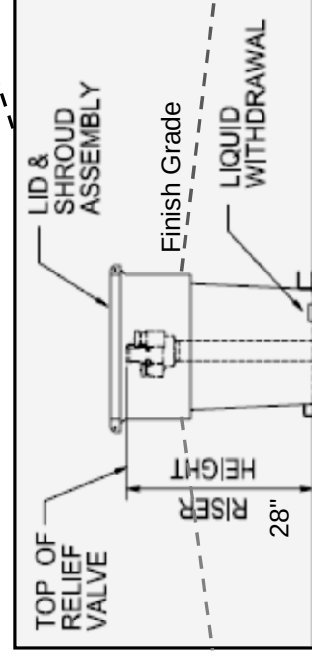
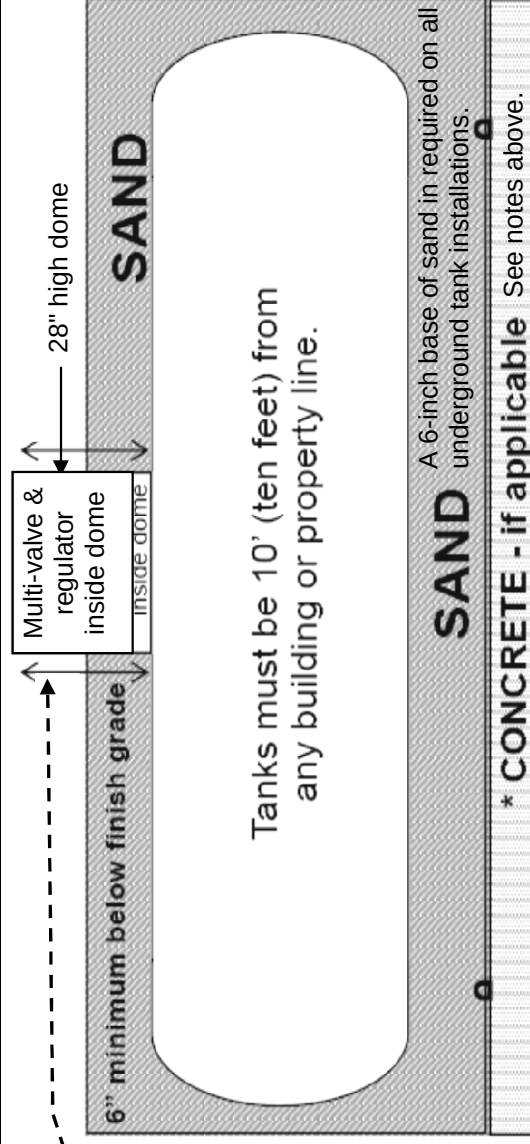


fig. A. Detail of dome





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Analysis / Design of Underground
Propane Tank Anchorage

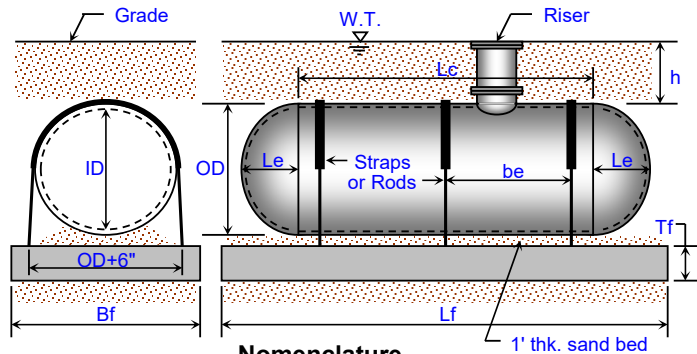
UNDERGROUND STORAGE TANK ANCHORAGE DESIGN

For a Buried Horizontal Tank
Anchored to a Reinforced Concrete Spread Foundation

Job Name:	Casa Ohad	Subject:	Underground Propane Tank Anchorage
Job Number:	23011.00	Originator:	C.F. Sanz
		Checker:	

Input Data:

Factor of Safety for Uplift, FS =	1.50	
Tank Inside Diameter, ID =	3.3770	ft.
Tank Wall Thickness, t =	0.2380	in.
Tank Configuration at Ends =	Spherical	
Tank Cylinder Length, Lc =	12.5833	ft.
Tank End Lengths, Le =	1.7083	ft.
Unit Wt. of Tank Material, w =	490.00	pcf
Soil Dry Unit Weight, we =	105.00	pcf
Buried Depth to Top/Tank, h =	1.0000	ft.
Concrete Compressive Strength, fc =	4.000	ksi.
Steel Reinforcing Yield Strength, fy =	60.00	ksi.
Number of Risers, Nr =	1	
Riser Inside Dia., Dr =	1.7937	ft.
Misc. Weight (incl. Risers), Wm =	0.07	kips
Spread Foundation Length, Lf =	18.0000	ft.
Spread Foundation Width, Bf =	5.5000	ft.
Spread Foundation Thickness, Tf =	1.000	ft.
Anchor Strap Width, bs =	3.000	in.
No. Anchor Straps/Rods Used, Na =	2	



Nomenclature

Assumptions and Criteria:

1. Soil is saturated, with no voids, and water table at grade.
2. Tank is empty and is centered on foundation.
3. Tension straps or rods with turnbuckles may be used.
4. Distance between each end of a strap or rod = OD + 6".
5. 12" thick sand bed between bottom/tank and top/fdn.

Results:

Determine Empty Weight of Tank:

Outside Dia., OD =	3.4167	ft.
Total Tank Length, L(total) =	15.9999	ft.
Tank End Areas, Ae =	36.67	ft.^2
Tank Cylinder Area, Ac =	135.07	ft.^2
Total Surface Area, A(total) =	171.74	ft.^2
Weight of Ends of Tank, We =	0.36	kips
Weight of Cylinder of Tank, Wc =	1.31	kips
Total Weight of Tank, W(total) =	1.74	kips

$$OD = ID + 2 \cdot (t/12)$$

$$L(\text{total}) = L_c + 2 \cdot L_e$$

$$A_e = 2 \cdot (\pi \cdot (OD^2/4 + Le^2)/4)$$

$$A_c = \pi \cdot OD \cdot L_c$$

$$A(\text{total}) = A_c + A_e$$

$$W_e = A_e \cdot (t/12) \cdot w$$

$$W_c = A_c \cdot (t/12) \cdot w$$

$$W(\text{total}) = W_c + W_e + W_m$$

Determine Uplift (Buoyant) Force:

Volume of Ends of Tank, Ve =	20.16	ft.^3
Volume of Cylinder of Tank, Vc =	112.71	ft.^3
Volume of Riser(s), Vr =	2.53	ft.^3
Total Volume of Tank, V(total) =	135.40	ft.^3
Uplift Force on Tank Ends, Ue =	1.26	kips
Uplift Force on Cylinder of Tank, Uc =	7.03	kips
Uplift Force on Risers, Ur =	0.16	kips
Total Uplift Force on Tank, U(total) =	8.45	kips

$$V_e = 2 \cdot (\pi \cdot (Le - t/12) \cdot (3 \cdot OD^2/4 + (Le - t/12)^2)/24)$$

$$V_c = \pi \cdot ID^2/4 \cdot L_c$$

$$V_r = N_r \cdot (\pi \cdot Dr^2/4 \cdot h)$$

$$V(\text{total}) = V_c + V_e + V_r$$

$$U_e = (62.4 \cdot V_e)/1000$$

$$U_c = (62.4 \cdot V_c)/1000$$

$$U_r = (62.4 \cdot V_r)/1000$$

$$U(\text{total}) = U_c + U_e + U_r$$

Determine Weight of Soil Above Spread Foundation:

Volume of Soil, Vs =	400.86	ft.^3
Buoyed Soil Unit Weight, ws =	42.60	pcf
Weight of Soil, Ws =	17.08	kips

$$V_s = ((h + OD + 1.0') \cdot L_f \cdot B_f) - V(\text{total})$$

$$w_s = w_e - 62.4 \text{ (unit weight of water = 62.4 pcf)}$$

$$W_s = (V_s \cdot w_s)/1000$$

(continued)

Determine Thickness of Spread Foundation:

Req'd. Weight of Conc. Fdn., Wf =	0.00	kips
Buoyed Concrete Weight, wc =	87.60	pcf
Req'd. Volume of Conc. Fdn., Vf =	0.00	ft.^3
Req'd. Fdn. Thickness, Tf(req'd) =	0.000	ft.

$$Wf = (U(\text{total}) * FS) - (W(\text{total}) + Ws) \geq 0$$

$$wc = 150 - 62.4 \quad (\text{assume concrete unit wt.} = 150 \text{ pcf})$$

$$Vf = Wf / (wc / 1000)$$

$$Tf(\text{req'd}) = Vf / (Lf * Bf)$$

Use 0.5 ft. minimum foundation thickness

Determine Anchor Strap Requirements:

Tension per Strap, Ts =	1.68	kips
Allowable Tension Stress, Ft =	21.60	ksi
Req'd. Tension Strap Thk., ts =	0.0259	in.
Tension Strap Thk. Used, ts(used) =	0.1875	in. = 3/16 in thick
Anchor Strap Allowable Load, Ta =	12.2	kips

$$Ts = (U(\text{total}) - W(\text{total})) / (2 * Na)$$

$$Ft = 0.60 * Fy \quad (Fy \text{ assumed} = 36.0 \text{ ksi for strap})$$

$$ts = Ts / (bs * Ft)$$

$$Ta = (ts(\text{used}) * bs) * Ft$$

Determine Anchor Rod Requirements:

Tension per Anchor Rod, Tr =	1.68	kips
Allowable Tension Stress, Ft =	19.10	ksi
Req'd. Size of Anchor Rod, D =	0.334	in.
Size of Anchor Rod Used, D(used) =	0.500	in.
Anchor Rod Allowable Load, Ta =	3.8	kips

$$Tr = (U(\text{total}) - W(\text{total})) / (2 * Na)$$

$$Ft = 0.33 * Fu = 19.1 \text{ for A-36 threaded rod (assumed)}$$

$$D = \text{SQRT}(4 * Tr / (\pi * Ft))$$

$$Ta = Ft * (\pi * D(\text{used})^2 / 4) \geq Tr$$

Use Hilti KB3 Expansion Anchors in lieu of Anchor Rods:

Tension per Anchor, Tr = 1.68 kips (Service Load)

Try 1/2" dia. Hilti KB3 stainless steel expansion anchors (tables attached)

Nominal design strength tension capacity in concrete, $\phi N_n = 4.96 \text{ kips}$ (Controls)

Nominal stainless steel design strength tension capacity, $\phi N_{sa} = 9.49 \text{ kips}$

Load adjustment factors for tension: Anchor Spacing = 1.0 Edge Distance = 1.0

To convert design strength values to allowable stress design values, divide by 2.0 (load factor for flood loads)

Allowable stress design tension capacity of expansion anchor, $N_{all} = 4.96 \text{ kips} / 2.0 = 2.48 \text{ kips} > Tr$ **OK**

3.3.8 KWIK Bolt 3 Expansion Anchor

Table 11 - Hilti KWIK Bolt 3 stainless steel design strength with concrete / pullout failure in uncracked concrete^{1,2,3,4}

Nominal anchor diameter	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
			$f'_c = 2500$ psi lb (kN)	$f'_c = 3000$ psi lb (kN)	$f'_c = 4000$ psi lb (kN)	$f'_c = 6000$ psi lb (kN)	$f'_c = 2500$ psi lb (kN)	$f'_c = 3000$ psi lb (kN)	$f'_c = 4000$ psi lb (kN)	$f'_c = 6000$ psi lb (kN)
1/4	1-1/2 (38)	1-3/4 (44)	730 (3.2)	770 (3.4)	840 (3.7)	950 (4.2)	1,545 (6.9)	1,690 (7.5)	1,950 (8.7)	2,390 (10.6)
3/8	2 (51)	2-3/8 (60)	1,925 (8.6)	2,110 (9.4)	2,440 (10.9)	2,985 (13.3)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
1/2	2 (51)	2-1/4 (57)	2,150 (9.6)	2,355 (10.5)	2,720 (12.1)	3,335 (14.8)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
	3-1/4 (83)	3-1/2 (89)	3,920 (17.4)	4,295 (19.1)	4,960 (22.1)	6,070 (27.0)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
5/8	3-1/8 (79)	3-1/2 (89)	4,050 (18.0)	4,435 (19.7)	5,120 (22.8)	6,275 (27.9)	9,280 (41.3)	10,165 (45.2)	11,740 (52.2)	14,380 (64.0)
	4 (102)	4-3/8 (111)	5,090 (22.6)	5,575 (24.8)	6,440 (28.6)	7,885 (35.1)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
3/4	3-3/4 (95)	4-1/4 (108)	5,560 (24.7)	6,090 (27.1)	7,035 (31.3)	8,615 (38.3)	12,200 (54.3)	13,365 (59.5)	15,430 (68.6)	18,900 (84.1)
	5 (127)	5-1/2 (140)	7,040 (31.3)	7,710 (34.3)	8,905 (39.6)	10,905 (48.5)	18,785 (83.6)	20,575 (91.5)	23,760 (105.7)	29,100 (129.4)
1	4 (102)	4-1/2 (114)	6,240 (27.8)	6,835 (30.4)	7,895 (35.1)	9,665 (43.0)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
	5-3/4 (146)	6-1/4 (159)	10,110 (45.0)	11,070 (49.2)	12,785 (56.9)	15,660 (69.7)	23,165 (103.0)	25,375 (112.9)	29,300 (130.3)	35,885 (159.6)

1 See section 3.1.7.3 to convert design strength value to ASD value.

2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.

3 Apply spacing, edge distance, and concrete thickness factors in tables 14 to 19 as necessary. Compare to steel values in table 12. 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, $\lambda_a = 0.68$; for all-lightweight, $\lambda_a = 0.60$

KWIK Bolt 3 Expansion Anchor 3.3.8

Table 12 - Steel design strength for Hilti KWIK Bolt 3 stainless steel anchors^{1,2}

Nominal anchor diameter	Nominal embedment in. (mm)	Tensile ³ ϕN_{sa} lb (kN)	Shear ⁴ ϕV_{sa} lb (kN)
1/4	1-3/4 (44)	1,725 (7.7)	1,090 (4.8)
3/8	2-3/8 (60)	5,175 (23.0)	3,235 (14.4)
1/2	2-1/4 (57)	9,490 (42.2)	2,725 (12.1)
	3-1/2 (89)		4,510 (20.1)
5/8	3-1/2 (89)	14,665 (65.2)	5,820 (25.9)
	4-3/8 (111)		9,295 (41.3)
3/4	4-1/4 (108)	16,200 (72.1)	7,735 (34.4)
	5-1/2 (140)		15,305 (68.1)
1	4-1/2 (114)	31,735 (141.2)	8,130 (36.2)
	6-1/4 (159)		17,775 (79.1)

- 1 See section 3.1.7.3 to convert design strength value to ASD value.
- 2 KWIK Bolt 3 stainless steel anchors are to be considered ductile steel elements.
- 3 Tensile $\phi N_{sa} = \phi A_{se,N} f_{uta}$ as noted in ACI 318 Appendix D.
- 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 Appendix D.

KWIK Bolt 3 Expansion Anchor 3.3.8

Table 15 - Load adjustment factors for 3/8-in. diameter KWIK Bolt 3 stainless steel anchor in uncracked concrete^{1,2}

3/8-in. KB3 stainless steel uncracked concrete		Spacing factor in tension f_{AN}	Edge distance factor in tension f_{RN}	Spacing factor in shear ³ f_{AV}	Edge distance in shear		Concrete thickness factor in shear ⁴ f_{HV}
					⊥ toward edge f_{RV}	to edge f_{RV}	
Embedment h_{nom}		2-3/8	2-3/8	2-3/8	2-3/8	2-3/8	2-3/8
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)	in. (mm)	(60)	(60)	(60)	(60)	(60)	(60)
	2 (51)	0.67	0.51	0.58	0.35	0.51	n/a
	2-1/2 (64)	0.71	0.60	0.60	0.49	0.60	n/a
	3 (76)	0.75	0.69	0.62	0.64	0.69	n/a
	3-1/2 (89)	0.79	0.80	0.64	0.81	0.81	n/a
	4 (102)	0.83	0.91	0.67	0.99	0.99	0.81
	4-1/2 (114)	0.88	1.00	0.69	1.00	1.00	0.86
	5 (127)	0.92		0.71			0.91
	6 (152)	1.00		0.75			1.00
	7 (178)			0.79			
	8 (203)			0.83			
	9 (229)			0.87			
	10 (254)			0.91			
	11 (279)			0.95			
	12 (305)			1.00			
	14 (356)						

Table 16 - Load adjustment factors for 1/2-in. diameter KWIK Bolt 3 stainless steel anchor in uncracked concrete^{1,2}

1/2-in. KB3 stainless steel uncracked concrete		Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear ³ f_{AV}		Edge distance in shear				Concrete thickness factor in shear ⁴ f_{HV}	
								⊥ toward edge f_{RV}		∥ to edge f_{RV}			
Embedment h_{nom}		2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2	2-1/4	3-1/2
Spacing (s) / edge distance (c_a) / concrete thickness (h) - in. (mm)	in. (mm)	(57)	(89)	(57)	(89)	(57)	(89)	(57)	(89)	(57)	(89)	(57)	(89)
	1-5/8 (41)	n/a	n/a	n/a	0.39	n/a	n/a	n/a	0.07	n/a	0.15	n/a	n/a
	2 (51)	n/a	n/a	n/a	0.42	n/a	n/a	n/a	0.10	n/a	0.20	n/a	n/a
	2-1/8 (54)	n/a	0.61	n/a	0.43	n/a	0.54	n/a	0.11	n/a	0.22	n/a	n/a
	2-1/2 (64)	0.71	0.63	0.54	0.47	0.61	0.55	0.53	0.14	0.54	0.28	n/a	n/a
	3 (76)	0.75	0.65	0.62	0.52	0.63	0.55	0.70	0.19	0.70	0.37	n/a	n/a
	3-1/2 (89)	0.79	0.68	0.72	0.57	0.65	0.56	0.88	0.23	0.88	0.47	n/a	n/a
	4 (102)	0.83	0.71	0.82	0.62	0.68	0.57	1.00	0.29	1.00	0.57	0.84	n/a
	4-1/2 (114)	0.88	0.73	0.92	0.68	0.70	0.58		0.34		0.68	0.89	n/a
	5 (127)	0.92	0.76	1.00	0.74	0.72	0.59		0.40		0.74	0.94	n/a
	6 (152)	1.00	0.81		0.89	0.76	0.61		0.53		0.89	1.00	0.66
	7 (178)		0.86		1.00	0.81	0.63		0.66		1.00		0.71
	8 (203)		0.91			0.85	0.64		0.81				0.76
	9 (229)		0.96			0.89	0.66		0.97				0.81
	10 (254)		1.00			0.94	0.68		1.00				0.85
	11 (279)					0.98	0.70						0.89
	12 (305)					1.00	0.72						0.93
	14 (356)						0.75						1.00
	16 (406)						0.79						
	18 (457)						0.83						
	20 (508)						0.86						
	> 24 (610)						0.93						

1 Linear interpolation not permitted.

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318 Appendix D.

3 Spacing factor reduction in shear, f_{AV} , assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

4 Concrete thickness reduction factor in shear, f_{HV} , assumes an influence of a nearby edge. If no edge exists, then $f_{HV} = 1.0$.

 If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 13 and figure 3 of this section to calculate permissible edge distance, spacing and concrete thickness combinations. Use of Hilti KWIK Bolt 3 anchors with edge distance and spacing dimensions smaller than what is noted in this table is permitted.

3.1 Anchor Principles and Design

3.1.7.3 Allowable Stress Design (ASD)

The values of N_{des} and V_{des} developed from Section 3.1.7.2 are design strengths and are to be compared to the required strength in tension and shear from factored load combinations of ACI 318 Chapter 9.

The design strength can be converted to an ASD value as follows:

$$N_{des,ASD} = \frac{N_{des}}{\alpha_{ASD}}$$

$$V_{des,ASD} = \frac{V_{des}}{\alpha_{ASD}}$$

where:

α_{ASD} = Conversion factor calculated as a weighted average of the load factors for the controlling load combination.

An example for the calculation of α_{ASD} is as follows:

Controlling strength design load combination is 1.2D + 1.6L, % contribution is 30% D, 70% L

$$\alpha_{ASD} = 1.2 \times 0.30 + 1.6 \times 0.70 = 1.48$$

3.1.7.4 Seismic design

To determine the seismic design strength a reduction factor, α_{seis} , is applied to the applicable table values. This value of α_{seis} will be in the footnotes of the relevant design tables.

The value of α_{seis} for concrete / bond / pullout failure is based on 0.75 times a reduction factor determined from testing. The total reduction is footnoted in the tables.

The value of α_{seis} for steel failure is based on testing and is typically only applied for shear. There is no additional 0.75 factor. The reduction is footnoted in the tables.

The factored load and associated seismic load combinations that will be compared to the design strength can be determined from ACI and national or local code requirements. An additional value for $\phi_{non-ductile}$ may be needed based on failure mode or ductility of the attached components.

3.1.7.5 Sustained loads and overhead use

Sustained loading is calculated by multiplying the value of ΦN_n by 0.55 and comparing the value to the tension dead load contribution (and any sustained live loads or other loads) of the factored load. Edge, spacing, and concrete thickness influences do not need to be accounted for when evaluating sustained loads.

Consideration of sustained loads is based on ACI 318-11 Appendix D.

3.1.7.6 Accuracy of the Hilti Simplified Strength Design Tables

Calculations using the Hilti Simplified Strength Design Tables have the potential of providing a design strength that is exactly what would be calculated using equations from ACI 318 Appendix D.

The tables for the single anchor design strength for concrete / bond / pullout / pryout failure or steel failure have the same values that will be computed using the provisions of ACI.

The load adjustment factors for edge distance influences are based on a single anchor near an edge. The load adjustment factors for spacing are determined from the influence of two adjacent anchors. Each reduction factor is calculated for the minimum value of either concrete or bond failure. When more than one edge distance and/or spacing condition exists, the load adjustment factors are multiplied together. This will result in a conservative design when compared to a full calculation based on ACI. Additionally, if the failure mode in the single anchor tables is controlled by concrete failure, and the reduction factor is controlled by bond failure, this will also give a conservative value (and vice versa).

The following is a general summary of the accuracy of the simplified tables:

- Single anchor tables have values equivalent to a calculation according to ACI.
- Since the table values, including load adjustment factors, are calculated using equations that are not linear, linear interpolation is not permitted. Use the smaller of the two table values listed. This provides a conservative value if the application falls between concrete compressive strengths, embedment depths, or spacing, edge distance, and concrete thickness.
- For one anchor near one edge, applying the edge distance factor typically provides accurate values provided the failure mode of the table values is the same. If the failure mode is not the same, the values are conservative.
- For two to four anchors in tension with no edge reductions, applying the spacing factors provides a value that is equivalent to the ACI calculated values, provided the controlling failure modes of the table values are the same. If the failure mode is not the same, the values are conservative.