The following excerpt are pages from the North American Product Technical Guide, Volume 2: Anchor Fastening, Edition 19.

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
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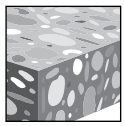
3.3.3 HSL-GR STAINLESS STEEL HEAVY DUTY EXPANSION ANCHORS

PRODUCT DESCRIPTION

HSL-GR stainless steel heavy-duty expansion anchors

Anchor System	Features and Benefits
HSL-GR Heavy-duty Expansion Anchor 	• Type 316 stainless steel • High load capacity • Reliable clamping to help overcome gaps between fixture and concrete • Force-controlled expansion • HSL-GR will not spin during application of installation torque



Uncracked concrete

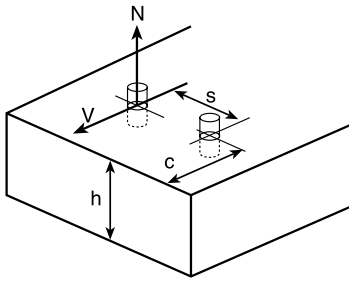
Approvals/Listings	
ICC-ES (International Code Council)	ESR-1545 in concrete per ACI 318-14 Ch. 17 / ACI 355.2/ ICC-ES AC193
European Technical Approval	ETA-02/0042
City of Los Angeles	Research Report No. 25903
Nuclear Quality Assurance	Qualified under NQA-1 Nuclear Quality Program

MATERIAL SPECIFICATIONS

Stainless steel threaded rod conforms to DIN 267, Type A4-70, f_{ya} = 65 ksi, f_{uta} ≥ 102 ksi.
Stainless steel expansion sleeve conforms to DIN 17440, f_{uta} ≥ 102 ksi.
Stainless steel cone conforms to DIN 17440, f_{uta} ≥ 102 ksi.
Stainless steel washer conforms to DIN 17441, 74 ksi ≤ f_{uta} ≤ 103 ksi.
Stainless steel nut conforms to DIN 934.
Collapsible sleeve is made of Acetal resin plastic.

DESIGN DATA IN CONCRETE PER ALLOWABLE STRESS DESIGN

Anchor spacing and edge distance guidelines



Anchor spacing adjustment factors

s = Actual spacing

$s_{min} = 1.0\ h_{nom}$

$s_{cr} = 3.0\ h_{ef}$

Edge distance adjustment factors

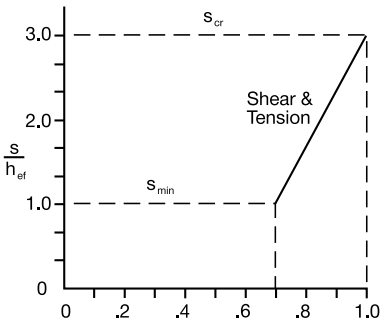
c = Actual edge distance

$c_{min} = 1.0\ h_{nom}$ $c_{cr} = 2.5\ h_{ef}$	Tension
$c_{min} = 1.0\ h_{nom}$ $c_{cr} = 2.5\ h_{nom}$	Shear

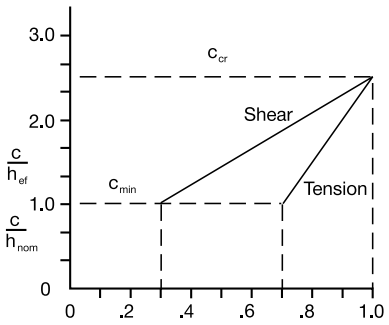
Anchor Size	h_{nom} mm	(in.)
M10	75	(3)
M12	80	(3-3/16)
M16	105	(4-1/8)
M20	130	(5-1/8)

h_{ef} - actual embedment depth

h_{nom} - standard embedment depth



Anchor Spacing Adjustment Factor (f_A)



Edge Distance Adjustment Factor (f_{RV}, f_{RN})

Load adjustment factors (anchor spacing) f_A						Load adjustment factors (edge distance) f_R									
Tension/Shear						Tension f_{RN}						Shear f_{RV}			
Spacing s		Anchor diameter				Edge distance c		Anchor diameter				Anchor diameter			
mm	(in.)	M10	M12	M16	M20	mm	(in.)	M10	M12	M16	M20	M10	M12	M16	M20
65	(2-1/2)					65	(2-1/2)								
75	(3)	.70				75	(3)	.70				.30			
80	(3-1/8)	.71	.70			80	(3-1/8)	.71	.70			.33	.30		
105	(4-1/8)	.76	.74	.70		105	(4-1/8)	.78	.76	.70		.48	.44	.30	
130	(5-1/8)	.81	.79	.73	.70	130	(5-1/8)	.85	.83	.74	.70	.64	.59	.41	.30
155	(6-1/8)	.86	.84	.77	.72	155	(6-1/8)	.91	.88	.79	.73	.80	.74	.52	.39
175	(6-7/8)	.90	.87	.80	.75	162	(6-3/8)	.93	.90	.80	.75	.84	.78	.55	.41
195	(7-5/8)	.94	.91	.82	.77	187	(7-3/8)	1.0	.96	.85	.78	1.0	.92	.66	.50
225	(8-7/8)	1.0	.97	.87	.80	200	(7-7/8)		1.0	.88	.80		1.0	.72	.55
240	(9-3/8)		1.0	.89	.82	225	(8-7/8)			.92	.84			.83	.64
275	(10-3/4)			.94	.86	265	(10-3/8)			1.0	.91			1.0	.79
315	(12-3/8)			1.0	.91	275	(10-3/4)				.92			1.0	.82
350	(13-3/4)				.95	300	(11-3/4)				.96				.91
395	(15-1/2)				1.0	325	(12-3/4)				1.0				1.0
430	(17)					350	(13-3/4)								
470	(18-1/2)					390	(15-3/8)								

$s_{min} = 1.0\ h_{nom}$ $s_{cr} = 3.0\ h_{ef}$

$$f_A = 0.15\ \frac{s}{h_{ef}} + 0.55$$

for $s_{cr} > s > s_{min}$

$c_{min} = 1.0\ h_{nom}$ $c_{cr} = 2.5\ h_{ef}$

$$f_{RN} = (0.30)\left(\frac{c - 1.0\ h_{nom}}{2.5\ h_{ef} - 1.0\ h_{nom}}\right) + 0.70$$

for $c_{cr} > c > c_{min}$

$c_{min} = 1.0\ h_{nom}$ $c_{cr} = 2.5\ h_{nom}$

$$f_{RV} = 0.47\ \frac{c}{h_{nom}} - 0.17$$

for $c_{cr} > c > c_{min}$

Table 2 - Stainless steel Hilti HSL-GR allowable loads in normal-weight concrete[1]

Nominal anchor diameter	Nominal embedment mm (in.)	f'_c = 2,000 psi		f'_c = 3,000 psi		f'_c = 4,000 psi		f'_c = 6,000 psi	
		Tension kN (lb)	Shear kN (lb)	Tension kN (lb)	Shear kN (lb)	Tension kN (lb)	Shear kN (lb)	Tension kN (lb)	Shear kN (lb)
M10	75 (3)	6.8 (1,535)	13.7 (3,090)	9.1 (2,055)	14.8 (3,325)	11.5 (2,575)	15.8 (3,560)	11.5 (2,595)	16.4 (3,690)
M12	80 (3-3/16)	8.7 (1,960)	20.2 (4,540)	11.3 (2,530)	21.8 (4,890)	13.8 (3,105)	23.3 (5,245)	17.5 (3,925)	25.0 (5,615)
M16	105 (4-1/8)	17.6 (3,965)	34.7 (7,805)	20.9 (4,705)	39.9 (8,965)	24.2 (5,450)	45.0 (10,125)	30.7 (6,900)	46.9 (10,550)
M20	130 (5-1/8)	25.1 (5,650)	52.9 (11,900)	30.7 (6,910)	58.7 (13,195)	36.4 (8,175)	64.5 (14,490)	44.5 (10,005)	64.5 (14,490)

1 Allowable loads calculated using a factor of safety of 3.5.

3.3.3

Table 3 - Stainless steel Hilti HSL-GR ultimate loads in normal-weight concrete

Nominal anchor diameter	Nominal embedment mm (in.)	f'_c = 2,000 psi		f'_c = 3,000 psi		f'_c = 4,000 psi		f'_c = 6,000 psi	
		Tension kN (lb)	Shear kN (lb)	Tension kN (lb)	Shear kN (lb)	Tension kN (lb)	Shear kN (lb)	Tension kN (lb)	Shear kN (lb)
M10	75 (3)	23.8 (5,350)	47.8 (10,785)	31.9 (7,165)	51.6 (11,595)	40.0 (8,985)	55.2 (12,410)	40.3 (9,055)	57.3 (12,880)
M12	80 (3-3/16)	30.4 (6,830)	70.5 (15,845)	39.3 (8,830)	75.9 (17,070)	48.2 (10,835)	81.4 (18,300)	60.9 (13,700)	87.1 (19,590)
M16	105 (4-1/8)	61.6 (13,840)	121.1 (27,220)	73.0 (16,420)	139.1 (31,270)	84.5 (19,005)	157.1 (35,320)	107.0 (24,065)	163.7 (36,800)
M20	130 (5-1/8)	87.7 (19,715)	184.7 (41,510)	107.3 (24,115)	204.7 (46,025)	126.9 (28,520)	224.8 (50,540)	155.3 (34,910)	224.8 (50,540)

Combined shear and tension loading

$$\left(\frac{N_d}{N_{rec}}\right)^{5/3} + \left(\frac{V_d}{V_{rec}}\right)^{5/3} \leq 1.0$$

INSTALLATION INSTRUCTIONS

Installation Instructions For Use (IFU) 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.

ORDERING INFORMATION

Stainless Steel Heavy-duty Expansion Anchor (31655)

Description	Box qty
M 10/20	20
M 12/25	20
M 16/25	10
M 20/30	6