BONDING AGENTS AND ADHESIVES

Master Format #: 03 05 00

DURAL HS GEL

HIGH STRENGTH EPOXY GEL FOR ANCHORING AND DOWELING

EUCLID CHEMICAL

PACKAGING

21.2 oz (627 mL) dual cartridge
(case of 12)
Code: 070HS 94
53 oz (1.6 L) cartridge
(case of 6)
Code: 070HS 96 (MTO)

CLEAN UP

Clean tools and application equipment immediately with acetone, xylene, or MEK. Clean spills or drips with the same solvents while still wet. Hardened DURAL HS GEL will require mechanical abrasion for removal.

SHELF LIFE

28 months in original, unopened package
Store between 40 and 95 °F (4 to 35 °C)

SPECIFICATIONS AND COMPLIANCES

- Complies with ASTM C881-14 Types I, II, IV, and V, Grade 3, Classes A, B, and C
- Meets the requirements of AASHTO M 235
- U.S. DOT Not Regulated (non-corrosive)

DESCRIPTION

DURAL HS GEL is a two component, 1:1 mix ratio, structural epoxy system that offers exceptional strength in anchoring and doweling applications and can be installed from 40 to 110 °F (4 to 43 °C). DURAL HS GEL has been tested in accordance with ASTM E488 and ASTM E1512 for its ability to resist static, dynamic, seismic and wind loads in uncracked concrete for both threaded rod and rebar.

PRODUCT CHARACTERISTICS

FEATURES/BENEFITS

- Moisture insensitive - allowing installation and curing in damp environments
- Withstands freeze-thaw conditions
- Little to no odor
- High modulus
- DOT Not Regulated (non-corrosive)

PRIMARY APPLICATIONS

- Anchoring threaded rods, bolts and rebar dowels into uncracked concrete
- Short and long term tensile anchoring
- Grouting dowel bars and tie bars
- Pick-proof sealant for jails/prisons and kennels
- Bonding agent for fresh to hardened concrete, and hardened to hardened concrete

APPEARANCE

Part A liquid is white in color and Part B liquid is black in color.

COVERAGE

One 21.2 oz (627 mL) cartridge yields 38.3 in^3 (627.6 cm^3) of epoxy
One 53 oz (1.6 L) cartridge yields 97.6 in^3 (1,600 cm^3) of epoxy

TECHNICAL INFORMATION

The following are typical values obtained under laboratory conditions. Expect reasonable variation under field conditions.

PERFORMANCE OF DURAL HS GEL TO ASTM C881-14

Test Method	Property	Result at Conditioning Temperature		
		Class A 38 °F (3 °C)	Class B 50 °F (10 °C)	Class C 75 °F (24 °C)
ASTM C881	Consistency	< 1/4" (6.4 mm)		
ASTM C881	Pot Life	13 minutes		
ASTM C881	Gel Time (60g mass)	38 minutes	20 minutes	14 minutes
ASTM C882	Bond Strength	2 days: 2,850 psi (19.7 MPa) 14 days: 2,790 psi (19.2 MPa)	2 days: 3,300 psi (22.8 MPa) 14 days: 4,090 psi (28.2 MPa)	2 days: 3,580 psi (24.7 MPa) 14 days: 3,940 psi (27.2 MPa)
ASTM D570	Water Absorption	14 days: 0.53%		
ASTM D648	Heat Deflection Temperature	7 days: 132 °F (56 °C)		
ASTM D2566	Linear Coefficient of Shrinkage	0.002		
ASTM D695	Compressive Modulus	7 days: 209,000 psi (1,441 MPa)	7 days: 211,000 psi (1,455 MPa)	7 days: 244,000 psi (1,682 MPa)
ASTM D695	Compressive Yield	7 days: 10,860 psi (74.9 MPa)	7 days: 10,490 psi (72.3 MPa)	1 day: 11,430 psi (78.8 MPa) 2 days: 11,480 psi (79.2 MPa) 3 days: 11,440 psi (78.9 MPa) 7 days: 11,410 psi (78.7 MPa)

1. Results are based on testing conducted on a representative lot(s) of product. Results will vary according to the tolerances of the given property
2. Results may vary due to environmental factors such as temperature, moisture and type of substrate
3. Pot life is measured as the workable time of 1 gallon (3.8 L) of DURAL HS GEL when mixed at 75 °F (24 °C)

DURAL HS GEL CURE SCHEDULE

Substrate Temperature	Working Time	Full Cure Time
40 °F (4 °C)	36 min	72 hr
75 °F (24 °C)	20 min	24 hr
110 °F (43 °C)	12 min	18 hr

1. Working and full cure times are approximate and may be linearly interpolated between listed temperatures
2. Substrate and ambient air temperature should be from 40 to 110 °F (4 to 43 °C)
3. When ambient or substrate temperature is below 70 °F (21°C), condition the DURAL HS GEL to 70 to 75 °F (21 to 24 °C) prior to use

DURAL HS GEL IN-SERVICE CHART

Base Material Temperature	Allowable Load Capacity Reduction Factor
35 °F (2 °C)	1.00
70 °F (21 °C)	1.00
110 °F (43 °C)	0.91
135 °F (57 °C)	0.80
150 °F (66 °C)	0.80
180 °F (82 °C)	0.66

Reduction factors may be linearly interpolated between listed temperatures

TECHNICAL INFORMATION

DURAL HS GEL ULTIMATE AND ALLOWABLE TENSION LOADS FOR THREADED ROD IN NORMAL WEIGHT CONCRETE

Threaded Rod Diameter, inches	Nominal Drill Bit Diameter, inches	Embedment Depth, inches (mm)	Tension Load Based on Bond Strength/ Concrete Capacity				Allowable Tension Load Based on Steel Strength		
			f'c ≥ 2,000 psi (13.8 MPa)		f'c ≥ 4,000 psi (27.6 MPa)		ASTM F1554 Grade 36 lbs (kN)	ASTM A193 Grade B7 lbs (kN)	ASTM F593 304/316 SS lbs (kN)
			Ultimate lbs (kN)	Allowable lbs (kN)	Ultimate lbs (kN)	Allowable lbs (kN)			
3/8	7/16	3 3/8 (86)	9,248 (41.1)	2,312 (10.3)	9,248 (41.1)	2,312 (10.3)	2,114 (9.4)	4,556 (20.3)	3,645 (16.2)
1/2	9/16	4 1/2 (114)	17,076 (76.0)	4,269 (19.0)	22,328 (99.3)	5,582 (24.8)	3,758 (16.7)	8,099 (36.0)	6,480 (28.8)
5/8	3/4	5 5/8 (143)	23,865 (106.2)	5,966 (26.5)	29,950 (133.2)	7,488 (33.3)	5,872 (26.1)	12,655 (56.3)	10,124 (45.0)
3/4	7/8	6 3/4 (171)	31,371 (139.5)	7,843 (34.9)	39,278 (174.7)	9,820 (43.7)	8,456 (37.6)	18,224 (81.1)	12,392 (55.1)
7/8	1	7 7/8 (200)	39,532 (175.8)	9,883 (44.0)	53,862 (239.6)	13,466 (59.9)	11,509 (51.2)	24,804 (110.3)	16,867 (75.0)
1	1 1/8	9 (229)	48,299 (214.8)	12,075 (53.7)	62,697 (278.9)	15,674 (69.7)	15,033 (66.9)	32,398 (144.1)	22,030 (98.0)
1 1/4	1 3/8	11 1/4 (286)	67,500 (300.3)	16,875 (75.1)	88,594 (394.1)	22,149 (98.5)	23,488 (104.5)	50,621 (225.2)	34,423 (153.1)

1. Allowable bond strength/concrete capacity was calculated using a safety factor of 4.0
2. Load adjustment factors for edge distance, spacing distance and in-service temperature should be applied if applicable
3. The lower value of either the adjusted allowable bond strength/concrete capacity or steel strength should be used as the allowable tension value for design
4. Allowable steel strengths calculated in accordance with AISC Manual of Steel Construction: Tensile = $0.33*F_u*A_{nom}$
5. Linear interpolation may be used for intermediate concrete compressive strengths

DURAL HS GEL ULTIMATE AND ALLOWABLE SHEAR LOADS FOR THREADED ROD IN NORMAL WEIGHT CONCRETE

Threaded Rod Diameter, in	Nominal Drill Bit Diameter, in	Embedment Depth, inches (mm)	Shear Load Based on Bond Strength/Concrete Capacity		Allowable Shear Load Based on Steel Strength		
			f'c ≥ 2,000 psi (13.8 MPa)		ASTM F1554 Grade 36 lbs. (kN)	ASTM A193 Grade B7 lbs. (kN)	ASTM F593 304/316 SS lbs. (kN)
			Ultimate lbs (kN)	Allowable lbs (kN)			
3/8	7/16	3 3/8 (86)	7,189 (32.0)	1,797 (8.0)	1,089 (4.8)	2,347 (10.4)	1,878 (8.4)
1/2	9/16	4 1/2 (114)	12,863 (57.2)	3,216 (14.3)	1,936 (8.6)	4,172 (18.6)	3,338 (14.8)
5/8	3/4	5 5/8 (143)	22,855 (101.7)	5,714 (25.4)	3,025 (13.5)	6,519 (29.0)	5,216 (23.2)
3/4	7/8	6 3/4 (171)	32,304 (143.7)	8,076 (35.9)	4,356 (19.4)	9,388 (41.8)	6,384 (28.4)
7/8	1	7 7/8 (200)	36,214 (161.1)	9,054(40.3)	5,929 (26.4)	12,778 (56.8)	8,689 (38.7)
1	1 1/8	9 (229)	52,151 (232.0)	13,038 (58.0)	7,744 (34.4)	16,690 (74.2)	11,349 (50.5)
1 1/4	1 3/8	11 1/4 (286)	69,011 (307.0)	17,253 (76.7)	12,100 (53.8)	26,078 (116.0)	17,733 (78.9)

1. Allowable bond strength/concrete capacity was calculated using a safety factor of 4.0
2. Load adjustment factors for edge distance, spacing distance and in-service temperature should be applied if applicable
3. The lower value of either the adjusted allowable bond strength/concrete capacity or steel strength should be used as the allowable tension value for design
4. Allowable steel strengths calculated in accordance with AISC Manual of Steel Construction: Shear = $0.17*F_u*A_{nom}$

TECHNICAL INFORMATION

DURAL HS GEL ULTIMATE AND ALLOWABLE TENSION & SHEAR LOADS FOR REBAR IN NORMAL WEIGHT CONCRETE

Rebar Size	Nominal Drill Diameter, in	Embedment Depth, in (mm)	Tension Load Based on Bond Strength/ Concrete Capacity		Shear Load Based on Bond Strength/ Concrete Capacity		Allowable Load Based on Steel Strength			
			f'c ≥ 2,000 psi (13.8 MPa)		f'c ≥ 2,000 psi (13.8 MPa)		Tension		Shear	
			Ultimate lbs (kN)	Allowable lbs (kN)	Ultimate lbs (kN)	Allowable lbs (kN)	ASTM A615 Grade 60 lbs. (kN)	ASTM A615 Grade 75 lbs. (kN)	ASTM A615 Grade 60 lbs. (kN)	ASTM A615 Grade 75 lbs. (kN)
#4	5/8	4 1/2 (114)	17,076 (76.0)	4,269 (19.0)	11,240 (50.0)	2,810 (12.5)	4,800 (21.4)	6,000 (26.7)	3,060 (13.6)	3,400 (15.1)
#5	3/4	5 5/8 (143)	23,865 (106.2)	5,966 (26.5)	21,024 (93.5)	5,256 (23.4)	7,440 (33.1)	9,300 (41.4)	4,743 (21.1)	5,270 (23.4)
#6	7/8	6 3/4 (171)	31,371 (143.6)	7,843 (34.9)	32,288 (139.5)	8,072 (35.9)	10,560 (47.0)	13,200 (58.7)	6,732 (29.9)	7,480 (33.3)
#7	1	7 7/8 (200)	39,835 (177.2)	9,959 (44.3)	35,434 (157.6)	8,859 (39.4)	14,400 (64.1)	18,000 (80.1)	9,180 (40.8)	10,200 (45.4)
#8	1 1/8	9 (229)	48,299 (214.8)	12,075 (53.7)	38,580 (171.6)	9,645 (42.9)	18,960 (84.3)	23,700 (105.4)	12,087 (53.8)	13,430 (59.7)

1. Allowable bond strength/concrete capacity was calculated using a safety factor of 4.0
2. Load adjustment factors for edge distance, spacing distance and in-service temperature should be applied if applicable
3. The lower value of either the adjusted allowable bond strength/concrete capacity or steel strength should be used as the allowable tension value for design
4. Allowable steel strengths calculated in accordance with AISC Manual of Steel Construction: Tensile = $(Fy*A_{nom})/2.5$, Shear = $0.17*F_u*A_{nom}$
5. Values for bond strength of #7 rebar were linearly interpolated from #6 & #8 data

DURAL HS GEL REDUCTION FACTORS FOR EDGE DISTANCE IN TENSION

Diameter	Inches	3/8	1/2	5/8	3/4	7/8	1	1 1/4
Embedment Depth	Inches (mm)	3 3/8 (86)	4 1/2 (114)	5 5/8 (143)	6 3/4 (171)	7 7/8 (200)	9 (229)	11 1/4 (286)
Critical Edge Distance	Inches (mm)	5 1/4 (133)	6 3/4 (171)	8 1/2 (216)	10 1/4 (260)	11 3/4 (298)	13 1/2 (343)	17 (432)
Min Edge Distance	Inches (mm)	1 3/4 (44)	2 1/4 (57)	2 3/4 (70)	3 1/2 (89)	4 (102)	4 1/2 (114)	5 3/4 (146)
Edge Distance		Allowable Load Capacity Reduction Factor						
Inches	mm							
1 3/4	44	0.63						
2 1/4	57	0.68	0.64					
2 3/4	70	0.73	0.68	0.66				
3	76	0.76	0.70	0.67				
3 1/2	89	0.81	0.74	0.70	0.67			
4	102	0.87	0.78	0.73	0.70	0.71		
4 1/2	114	0.92	0.82	0.76	0.72	0.73	0.74	
5	127	0.97	0.86	0.79	0.75	0.75	0.75	
5 1/4	133	1.00	0.88	0.81	0.76	0.75	0.76	
5 3/4	146		0.92	0.84	0.78	0.77	0.78	0.77
6 1/4	159		0.96	0.87	0.81	0.79	0.79	0.78
6 3/4	172		1.00	0.90	0.83	0.81	0.81	0.79
7 1/2	190			0.94	0.87	0.84	0.83	0.81
8 1/2	216			1.00	0.92	0.88	0.86	0.83
9 1/2	241				0.96	0.92	0.88	0.85
10 1/4	260				1.00	0.94	0.91	0.86
11	279					0.97	0.93	0.88
11 3/4	298					1.00	0.95	0.89
12 1/2	318						0.97	0.91
13 1/2	343						1.00	0.93
15	381							0.96
16	406							0.98
17	432							1.00

1. Minimum slab thickness equals 1.5 x embedment depth
2. Linear interpolation may be used for intermediate edge distances

DURAL HS GEL REDUCTION FACTORS FOR EDGE DISTANCE IN SHEAR

Diameter	Inches	3/8	1/2	5/8	3/4	7/8	1	1 1/4
Embedment Depth	Inches (mm)	3 3/8 (86)	4 1/2 (114)	5 5/8 (143)	6 3/4 (171)	7 7/8 (200)	9 (229)	11 1/4 (286)
Critical Edge Distance	Inches (mm)	5 1/4 (133)	6 3/4 (171)	8 1/2 (216)	10 1/4 (260)	11 3/4 (298)	13 1/2 (343)	17 (432)
Min Edge Distance	Inches (mm)	1 3/4 (44)	2 1/4 (57)	2 3/4 (70)	3 1/2 (89)	4 (102)	4 1/2 (114)	5 3/4 (146)
Edge Distance		Allowable Load Capacity Reduction Factor						
Inches	mm							
1 3/4	44	0.31						
2 1/4	57	0.41	0.29					
2 3/4	70	0.51	0.37	0.28				
3	76	0.56	0.41	0.31				
3 1/2	89	0.66	0.49	0.37	0.26			
4	102	0.75	0.57	0.44	0.32	0.26		
4 1/2	114	0.85	0.65	0.50	0.37	0.31	0.26	
5	127	0.95	0.73	0.56	0.43	0.35	0.30	
5 1/4	133	1.00	0.76	0.59	0.45	0.38	0.32	
5 3/4	146		0.84	0.65	0.51	0.43	0.36	0.25
6 1/4	159		0.92	0.72	0.56	0.47	0.40	0.29
6 3/4	172		1.00	0.78	0.62	0.52	0.44	0.32
7 1/2	190			0.87	0.70	0.59	0.50	0.37
8 1/2	216			1.00	0.81	0.69	0.59	0.44
9 1/2	241				0.92	0.78	0.67	0.50
10 1/4	260				1.00	0.86	0.73	0.55
11	279					0.93	0.79	0.60
11 3/4	298					1.00	0.86	0.65
12 1/2	318						0.92	0.70
13 1/2	343						1.00	0.77
15	381							0.87
16	406							0.93
17	432							1.00

1. Minimum slab thickness equals 1.5 x embedment depth
2. Linear interpolation may be used for intermediate edge distances

DURAL HS GEL REDUCTION FACTORS FOR SPACING DISTANCE IN TENSION

Diameter	Inches	3/8	1/2	5/8	3/4	7/8	1	1 1/4
Embedment Depth	Inches (mm)	3 3/8 (86)	4 1/2 (114)	5 5/8 (143)	6 3/4 (171)	7 7/8 (200)	9 (229)	11 1/4 (286
Critical Spacing Distance	Inches (mm)	5 1/4 (133)	6 3/4 (171)	8 1/2 (216)	10 1/4 (260)	11 3/4 (298)	13 1/2 (343)	17 (432)
Min Spacing Distance	Inches (mm)	1 3/4 (44)	2 1/4 (57)	2 3/4 (70)	3 1/2 (89)	4 (102)	4 1/2 (114)	5 3/4 (146)
Spacing Distance		Allowable Load Capacity Reduction Factor						
Inches	mm							
1 3/4	44	0.69						
2 1/4	57	0.73	0.69					
2 3/4	70	0.76	0.72	0.69				
3	76	0.78	0.73	0.70				
3 3/8	86	0.81	0.75	0.72	0.69			
4	102	0.85	0.79	0.74	0.71	0.69		
4 1/2	114	0.89	0.81	0.77	0.73	0.71	0.69	
5 5/8	143	0.97	0.88	0.82	0.77	0.74	0.72	0.69
6	152	1.00	0.90	0.83	0.79	0.75	0.73	0.70
6 1/2	165		0.92	0.85	0.80	0.77	0.75	0.71
7 1/4	184		0.97	0.89	0.83	0.79	0.77	0.73
7 7/8	200		1.00	0.91	0.85	0.81	0.78	0.74
8 1/2	216			0.94	0.88	0.83	0.80	0.75
9 7/8	251			1.00	0.93	0.87	0.84	0.78
10 1/2	267				0.95	0.89	0.86	0.80
11 7/8	302				1.00	0.94	0.89	0.83
12 1/2	318					0.96	0.91	0.84
13 7/8	352					1.00	0.95	0.87
14 1/2	368						0.97	0.88
15 3/4	400						1.00	0.91
17	432							0.94
18 1/2	470							0.97
19 3/4	502							1.00

1. Minimum slab thickness equals 1.5 x embedment depth
2. Linear interpolation may be used for intermediate edge distances

DIRECTIONS FOR USE

Drilling and Cleaning Holes: Using a rotary hammer drill, and a bit that conforms to ANSI B212.15 and is the appropriate size for the anchor diameter to be installed, drill the hole to the specified embedment depth. Always wear appropriate personal protection equipment (PPE) for eyes, ears & skin and avoid inhalation of dust during the drilling and cleaning process. Refer to the Safety Data Sheet (SDS) for details prior to proceeding.

Remove any standing water from hole prior to beginning the cleaning process. Using oil free compressed air with a minimum pressure of 80 psi, insert the air wand to the bottom of the drilled hole and blow out the debris with an up/down motion for a minimum of 4-5 seconds.

Select the correct wire brush size for the drilled hole diameter, making sure that the brush is long enough to reach the bottom of the drilled hole. Reaching the bottom of the hole, brush in an up & down and twisting motion. The brush should contact the walls of the hole. If it does not, the brush is either too worn or small and should be replaced with a new brush of the correct diameter. Blow the hole out once more to remove brush debris using oil free compressed air with a minimum pressure of 80 psi. Visually inspect the hole to confirm it is clean. If installation will be delayed for any reason, cover cleaned holes to prevent contamination.

Preparing Cartridges: Remove the protective cap from the DURAL HS GEL cartridge and insert the cartridge into the dispensing tool. Before attaching static mixer, balance the cartridge by dispensing a small amount of material until both components are flowing evenly. Only after the cartridge has been balanced, attach the static mixer to the cartridge. Take note of the air and base material temperatures and review the working/full cure time chart prior to starting the injection process.

Dispense the initial amount of material from the mixing static mixer onto a disposable surface until the product is a uniform gray color with no streaks, as adhesive must be properly mixed in order to perform as published. Dispose of the initial amount of adhesive prior to injection into the drill hole. When changing cartridges, never re-use static mixers. A new static mixer should be used with each new cartridge.

Installation and Curing: Insert the static mixer into the bottom of the hole and fill from the bottom to the top approximately two-thirds full, being careful not to withdraw the nozzle too quickly as this may trap air in the adhesive. When using a pneumatic dispensing tool, ensure that pressure is set at 90 psi maximum. Do not disturb, torque or apply any load to the installed anchor until the specified full cure time has passed. The amount of time needed to reach full cure is base material temperature dependent. Refer to the Cure Schedule table for the full cure time.

Prior to inserting the threaded rod or rebar into the hole, make sure it is clean and free of oil and dirt and that the necessary embedment depth is marked on the anchor element. Insert the anchor element into the hole while turning 1-2 rotations prior to the anchor reaching the bottom of the hole. Excess adhesive should be visible on all sides of the fully installed anchor. For horizontal installations, wedges should be used to center and support the anchor while the adhesive is curing. Use extra care with deep embedment or high temperature installations to ensure that the working time has not elapsed prior to the anchor being fully installed.

Setting ports & sealing cracks: Place a small amount of mixed DURAL HS GEL on the back of the port and carefully place it centered over the crack. Be careful to not fill the hole of the injection port. Place neat DURAL HS GEL over the face of the cracks to be pressure injected, and around each injection port. Allow DURAL HS GEL to sufficiently harden before injecting, to prevent blowouts.

PRECAUTIONS/LIMITATIONS

- Working time and cure time will decrease as the temperature increases, and will increase as the temperature decreases
- Install DURAL HS GEL with a high quality, professional grade gun with a gear ratio of at least 26:1 for ease of application and best results
- Do not thin DURAL HS GEL as this may affect cure and performance
- DURAL HS GEL will discolor upon prolonged exposure to ultraviolet light and high-intensity artificial lighting
- Not recommended for any overhead application where there may be a sustained tensile load
- For anchoring applications, concrete must be a minimum of 21 days old prior to anchor installation
- Performance characteristics, such as seismic and long term load resistance, were tested in accordance with ASTM E488-96 (2003) & E1512-01 (2015) provisions and not that of ACI 355.4, and are therefore not applicable in the concrete tension zone. Always consult with a design professional prior to use to ensure product applicability
- In all cases, consult the product Safety Data Sheet before use

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