BONDING AGENTS AND ADHESIVES

DURAL HS GEL

HIGH STRENGTH EPOXY GEL FOR ANCHORING AND DOWELING

EUCLID CHEMICAL

PACKAGING

627mL dual cartridge.

SHELF LIFE

28 months in original, unopened package. Store between 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.

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 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, 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 odour.
- High modulus.

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.
- General purpose epoxy adhesive.
- Setting of injection ports and sealing cracks for crack injection.

COVERAGE

627mL cartridge yields 627.6cm³ of epoxy.

TECHNICAL INFORMATION

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

PROPERTY		STANDARD	RESULT AT CONDITIONING TEMPERATURE		
			CLASS A - 3°C	CLASS B - 10°C	CLASS C - 24°C
Consistency		ASTM C881	6.4 mm		
Pot Life		ASTM C881	13 minutes		
Gel Time (60g mass)		ASTM C881	38 minutes	20 minutes	14 minutes
Bond Strength	2 Days	ASTM C882	19.7 MPa	22.8 MPa	24.7 MPa
	14 Days		19.2 MPa	28.2 MPa	27.2 MPa
Water Absorption	14 Days	ASTM D570	0.53%		
Heat Deflection Temperature	7 Days	ASTM D648	56°C		
Linear Coefficient of Shrinkage		ASTM D2566	0.002		
Compressive Modulus	7 Days	ASTM D695	1,441 MPa	1,455 MPa	1,682 MPa
Compressive Yield	1 Day	ASTM D695	-	-	78.8 MPa
	2 Days		-	-	79.2 MPa
	3 Days		-	-	78.9 MPa
	7 Days		74.9 MPa	72.3 MPa	78.7 MPa

1. The above are typical values obtained under laboratory conditions. Expect reasonable variation under field conditions.
2. Results are based on testing conducted on a representative lot(s) of product. Results will vary according to the tolerances of the given property.
3. Results may vary due to environmental factors such as temperature, moisture and type of substrate.
4. Pot life is measured as the workable time of 3.8 L of DURAL HS GEL when mixed at 24°C.

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DURAL HS GEL CURE SCHEDULE

Substrate Temperature	Working Time	Full Cure Time
4°C	36 min	72 hr
24°C	20 min	24 hr
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 4 to 43°C.
3. When ambient or substrate temperature is below 21°C, condition the DURAL HS GEL to 21 to 24°C prior to use.

DURAL HS GEL IN-SERVICE CHART

Base Material Temperature	Allowable Load Capacity Reduction Factor
2°C	1.00
21°C	1.00
43°C	0.91
57°C	0.80
66°C	0.80
82°C	0.66

Reduction factors may be linearly interpolated between listed temperatures.

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

Threaded Rod Diameter, inches	Nominal Drill Bit Diameter, inches (mm)	Embedment Depth, mm	Tension Load Based on Bond Strength/Concrete Capacity				Allowable Tension Load Based on Steel Strength		
			13.8 MPa		27.6 MPa		ASTM F1554 Grade 36 - kN	ASTM A193 Grade B7 - kN	ASTM F593 304/316 SS - kN
			Ultimate - kN	Allowable - kN	Ultimate - kN	Allowable - kN			
3/8	7/16 (11.5)	86	41.1	10.3	41.1	10.3	9.4	20.3	16.2
1/2	9/16 (14.5)	114	76.0	19.0	99.3	24.8	16.7	36.0	28.8
5/8	3/4 (19)	143	106.2	26.5	133.2	33.3	26.1	56.3	45.0
3/4	7/8 (22.5)	171	139.5	34.9	174.7	43.7	37.6	81.1	55.1
7/8	1 (25.5)	200	175.8	44.0	239.6	59.9	51.2	110.3	75.0
1	1 1/8 (28.5)	229	214.8	53.7	278.9	69.7	66.9	144.1	98.0
1 1/4	1 3/8 (35)	286	300.3	75.1	394.1	98.5	104.5	225.2	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.

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

Threaded Rod Diameter, inches	Nominal Drill Bit Diameter, inches (mm)	Embedment Depth, mm	Tension Load Based on Bond Strength/Concrete Capacity		Allowable Tension Load Based on Steel Strength		
			13.8 MPa		ASTM F1554 Grade 36 - kN	ASTM A193 Grade B7 - kN	ASTM F593 304/316 SS - kN
			Ultimate - kN	Allowable - kN			
3/8	7/16 (11.5)	86	32.0	8.0	4.8	10.4	8.4
1/2	9/16 (14.5)	114	57.2	14.3	8.6	18.6	14.8
5/8	3/4 (19)	143	101.7	25.4	13.5	29.0	23.2
3/4	7/8 (22.5)	171	143.7	35.9	19.4	41.8	28.4
7/8	1 (25.5)	200	161.1	40.3	26.4	56.8	38.7
1	1 1/81 (28.5)	229	232.0	58.0	34.4	74.2	50.5
1 1/4	1 3/8 (35)	286	307.0	76.7	53.8	116.0	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: Tensile = $0.33*F_u*A_{nom}$
5. Linear interpolation may be used for intermediate concrete compressive strengths.

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

Rebar (mm)	Nominal Drill Diameter, inches (mm)	Embedment Depth, mm	Tension Load Based on Bond Strength/ Concrete Capacity		Shear Load Based on Bond Strength/ Concrete Capacity		Allowable Load Based on Steel Strength			
			13 MPa		13.8 MPa		Tension		Shear	
			Ultimate - kN	Allowable - kN	Ultimate - kN	Allowable - kN	ASTM A615 Grade 60 - kN	ASTM A615 Grade 75 - kN	ASTM A615 Grade 60 - kN	ASTM A615 Grade 75 - kN
#4 (12.7)	5/8 (16)	114	76.0	19.0	50.0	12.5	21.4	26.7	13.6	15.1
#5 (15.87)	3/4 (19)	143	106.2	26.5	93.5	23.4	33.1	41.4	21.1	23.4
#6 (19)	7/8 (22.5)	171	143.6	34.9	139.5	35.9	47.0	58.7	29.9	33.3
#7 (22.22)	1 (25.5)	200	177.2	44.3	157.6	39.4	64.1	80.1	40.8	45.4
#8 (25.4)	1 1/8 (28.5)	229	214.8	53.7	171.6	42.9	84.3	105.4	53.8	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.

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DURAL HS GEL REDUCTION FACTORS FOR EDGE DISTANCE IN TENSION

Diam-eter inches (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19)	7/8 (22.2)	1 (25.4)	1 1/4 (31.8)
Embed-ment Depth mm	86	114	143	171	200	229	286
Critical Edge Distance mm	133	171	216	260	298	343	432
Min Edge Distance mm	44	57	70	89	102	114	146
Edge Distance mm	Allowable Load Capacity Reduction Factor						
44	0.63						
57	0.68	0.64					
70	0.73	0.68	0.66				
76	0.76	0.70	0.67				
89	0.81	0.74	0.70	0.67			
102	0.87	0.78	0.73	0.70	0.71		
114	0.92	0.82	0.76	0.72	0.73	0.74	
127	0.97	0.86	0.79	0.75	0.75	0.75	
133	1.00	0.88	0.81	0.76	0.75	0.76	
146		0.92	0.84	0.78	0.77	0.78	0.77
159		0.96	0.87	0.81	0.79	0.79	0.78
172		1.00	0.90	0.83	0.81	0.81	0.79
190			0.94	0.87	0.84	0.83	0.81
216			1.00	0.92	0.88	0.86	0.83
241				0.96	0.92	0.88	0.85
260				1.00	0.94	0.91	0.86
279					0.97	0.93	0.88
298					1.00	0.95	0.89
318						0.97	0.91
343						1.00	0.93
381							0.96
406							0.98
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

Diame-ter inches (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19)	7/8 (22.2)	1 (25.4)	1 1/4 (31.8)
Embed-ment Depth mm	86	114	143	171	200	229	286
Critical Edge Distance mm	133	171	216	260	298	343	432
Min Edge Distance mm	44	57	70	89	102	114	146
Edge Distance mm	Allowable Load Capacity Reduction Factor						
44	0.31						
57	0.41	0.29					
70	0.51	0.37	0.28				
76	0.56	0.41	0.31				
89	0.66	0.49	0.37	0.26			
102	0.75	0.57	0.44	0.32	0.26		
114	0.85	0.65	0.50	0.37	0.31	0.26	
127	0.95	0.73	0.56	0.43	0.35	0.30	
133	1.00	0.76	0.59	0.45	0.38	0.32	
146		0.84	0.65	0.51	0.43	0.36	0.25
159		0.92	0.72	0.56	0.47	0.40	0.29
172		1.00	0.78	0.62	0.52	0.44	0.32
190			0.87	0.70	0.59	0.50	0.37
216			1.00	0.81	0.69	0.59	0.44
241				0.92	0.78	0.67	0.50
260				1.00	0.86	0.73	0.55
279					0.93	0.79	0.60
298					1.00	0.86	0.65
318						0.92	0.70
343						1.00	0.77
381							0.87
406							0.93
432							1.00

1. Minimum slab thickness equals 1.5 x embedment depth
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DURAL HS GEL REDUCTION FACTORS FOR SPACING DISTANCE IN TENSION

Diameter inches (mm)	3/8 (9.5)	1/2 (12.7)	5/8 (15.9)	3/4 (19)	7/8 (22.2)	1 (25.4)	1 1/4 (31.8)
Embedment Depth mm	86	114	143	171	200	229	286
Critical Edge Distance mm	133	171	216	260	298	343	432
Min Edge Distance mm	44	57	70	89	102	114	146
Edge Distance mm	**Allowable Load Capacity Reduction Factor**						
44	0.69						
57	0.73	0.69					
70	0.76	0.72	0.69				
76	0.78	0.73	0.70				
86	0.81	0.75	0.72	0.69			
102	0.85	0.79	0.74	0.71	0.69		
114	0.89	0.81	0.77	0.73	0.71	0.69	
143	0.97	0.88	0.82	0.77	0.74	0.72	0.69
152	1.00	0.90	0.83	0.79	0.75	0.73	0.70
165		0.92	0.85	0.80	0.77	0.75	0.71
184		0.97	0.89	0.83	0.79	0.77	0.73
200		1.00	0.91	0.85	0.81	0.78	0.74
216			0.94	0.88	0.83	0.80	0.75
251			1.00	0.93	0.87	0.84	0.78
267				0.95	0.89	0.86	0.80
302				1.00	0.94	0.89	0.83
318					0.96	0.91	0.84
352					1.00	0.95	0.87
368						0.97	0.88
400						1.00	0.91
432							0.94
470							0.97
502							1.00

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

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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. 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.

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.

PRECAUTIONS/LIMITATIONS

- Working time and cure time will decrease as the temperature increases, and will increase as the temperature decreases.
- 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, the safety data sheet (SDS) must be read and understood prior.

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