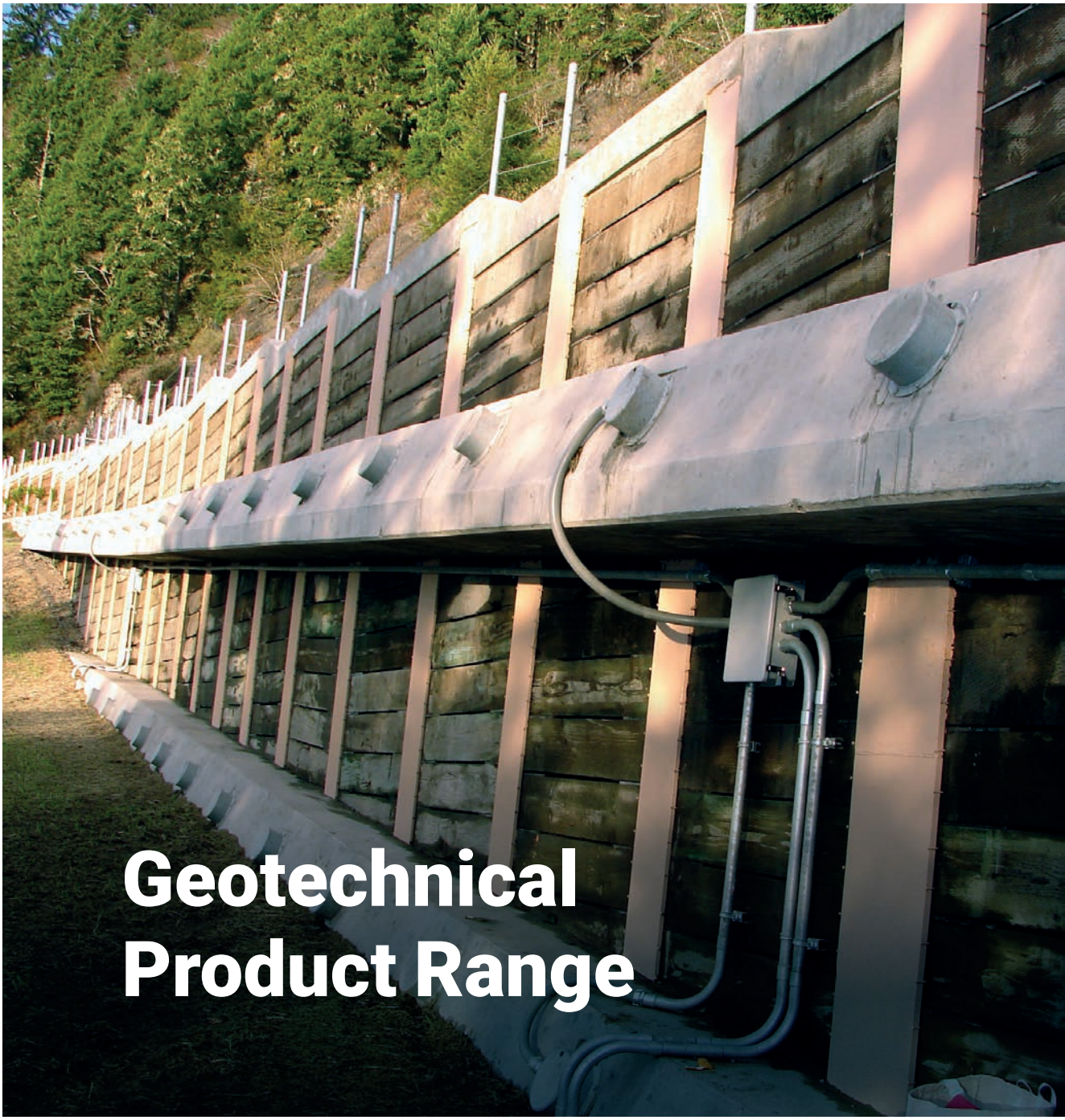
DYWIDAG



Geotechnical Product Range

dywidag.com

Contents

Leading geotechnical solutions

At DYWIDAG, we are proud to be a leading geotechnical supplier, offering a comprehensive range of ground engineering products paired with unmatched expertise since our founding in 1865.

Globally recognized for our technical competence, quality assurance, and proven product reliability, DYWIDAG has firmly established its presence in the geotechnical and civil engineering sectors worldwide.

We provide expert guidance to geotechnical drilling contractors and engineers across North America. Our services include geotechnical solutions with specialized monitoring services.

With decades of experience in developing, producing, and supporting geotechnical projects, we assure our customers of consistently high-quality products and systems.

Our specialized technical services are tailored to meet the unique requirements of each project, whether it's enhancing technical efficiency or achieving cost-effectiveness. Our team is dedicated to helping you reach your project goals.

Our extensive range of geotechnical products includes ground anchors, double corrosion protection systems, DYWIDAG THREADBAR® prestressing steel, DYWIDAG DYWI® Drill hollow bar, removable anchors, and high strength reinforcement DYWIDAG THREADBAR® systems.

In addition to our product range, we provide inspection, testing, tensioning, and maintenance services, as well as equipment rental.

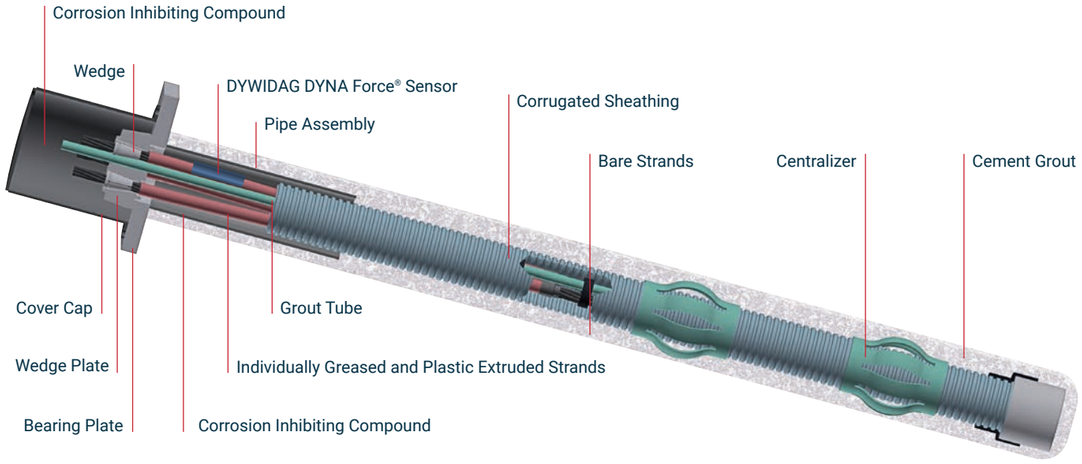
DYWIDAG Strand Anchors

DYWIDAG Permanent (DCP) Anchor –Key Features

- Long-lasting system for permanent use
- Variable anchor head and angle compensation designs
- Double Corrosion Protection (DCP) is achieved by protecting the strands with barrier against corrosion. It consists of a corrugated sheathing, a pipe welded to the bearing plate and a cover cap along with encasement in cement grout.

Fields of Application

- Retaining walls
- Rock and slope stabilization
- Tiedown anchors
- Excavations

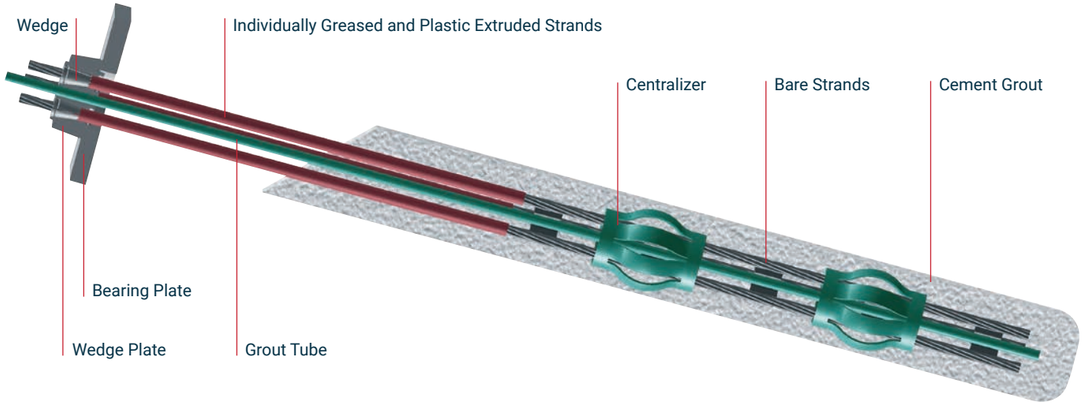


Temporary Anchor – Key Features

- Temporary system for a service life of up to two years
- Variable anchor head and angle compensation designs

Fields of Application

- Excavations
- Temporary structures



DYWIDAG Strand Anchors Properties

DYWIDAG Strand Anchors utilize 0.6" dia. 7-wire, low relaxation 270 ksi Strand conforming to ASTM A416 (bare strand) or ASTM A882 (epoxy coated strand).

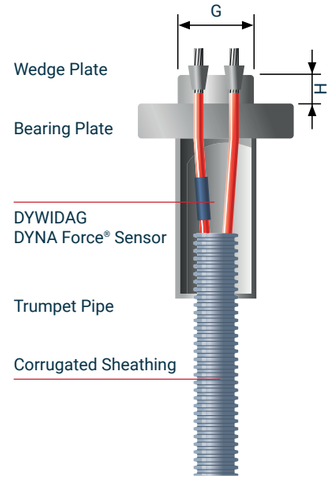
Number of Strands	Nominal Cross Section Area (A_{ps})		Ultimate Strength (F_{pu} x A_{ps})		Prestressing Force						Nominal Weight (Bare Steel only)	
					0.80 F_{pu} x A_ps		0.70 F_{pu} x A_ps		0.60 F_{pu} x A_ps			
ea	in^2	mm^2	kips	kN	kips	kN	kips	kN	kips	kN	lbs/ft	kg/m
1	0.217	140	58.6	261	46.9	208	41	182	35.2	156	0.74	1.09
2	0.434	280	117.2	521	93.7	417	82	365	70.3	313	1.48	1.64
3	0.651	420	175.8	782	140.6	625	123	547	105.5	469	2.22	3.27
4	0.868	560	234.4	1,043	187.5	834	164.1	730	140.6	626	2.96	4.46
5	1.085	700	293.0	1,303	234.4	1,043	205.1	912	175.8	782	3.70	5.51
6	1.302	840	351.6	1,564	281.3	1,251	246.1	1,095	210.9	938	4.44	6.55
7	1.519	980	410.2	1,825	328.2	1,460	287.2	1,277	246.2	1,095	5.18	7.74
8	1.736	1,120	468.8	2,085	375.0	1,668	328.1	1,460	281.3	1,251	5.92	8.78
9	1.953	1,260	527.4	2,346	421.9	1,877	369.2	1,642	316.4	1,408	6.66	9.97
12	2.604	1,680	703.2	3,128	562.6	2,503	492.3	2,190	422.0	1,877	8.88	13.24
15	3.255	2,100	879.0	3,910	703.2	3,128	615.3	2,737	527.4	2,346	11.10	16.52
19	4.123	2,660	1,113.4	4,953	890.7	3,962	779.4	3,467	668.0	2,972	14.06	20.98
27	5.859	3,780	1,582.2	7,038	1,265.8	5,631	1,107.6	4,927	949.4	4,223	19.98	29.76
37	8.029	5,180	2,168.2	9,645	1,734.6	7,716	1,517.8	6,751	1,301.0	5,787	27.38	40.78
48	10.416	6,720	2,812.8	12,512	2,250.2	10,009	1,968.9	8,758	1,687.7	7,507	35.52	52.83
54	11.718	7,560	3,164.4	14,076	2,531.5	11,261	2,215.1	9,853	1,898.6	8,446	39.96	59.38
61	13.237	8,540	3,574.6	15,901	2,859.7	12,721	2,502.2	11,131	2,144.8	9,540	45.14	67.12

A_{ps} = Area Prestressing Steel.
Fpu = Minimum Ultimate Strength.
Please consult your local sales office for systems exceeding 61 strands.

DYWIDAG DCP Strand Anchor and Wedge Plate Dimensions

Strand Range Inside Sheathing [1]	HDPE Corrugated			Trumpet Pipe		Wedge Plate Dimensions			
ea	Nom. Size in	O.D. in	O.D. mm	O.D. in	O.D. mm	ØG in	ØG mm	H in	H mm
1-3	2	2.44	62	4.5	114	4.69	119	1.8	46
4	2.5	2.92	74	4.5	114	4.69	119	1.8	46
5-6	2.5	2.92	74	4.5	114	5.61	142	2.2	56
7	3	3.60	91	4.5	114	5.61	142	2.2	56
8-9	3	3.60	91	5.63	143	5.75	146	1.69	43
10-12	4	4.60	117	5.63	143	6.75	171	1.95	50
13-15	4	4.60	117	6.63	168	7.09	180	1.97	50
16-17	4	4.60	117	8.63	219	7.87	200	2.17	55
18-19	5	5.85	149	8.63	219	7.87	200	2.17	55
20-24	5	5.85	149	8.63	219	9.45	240	2.95	75
25-27	6	6.8	173	8.63	219	9.45	240	2.95	75

1) Based on the use of a single internal grout tube. Bearing plate sizes subject to project specific requirements. Strand anchors larger than 27 strand systems also available.



DYWIDAG DYWI® Drill Hollow Bar System

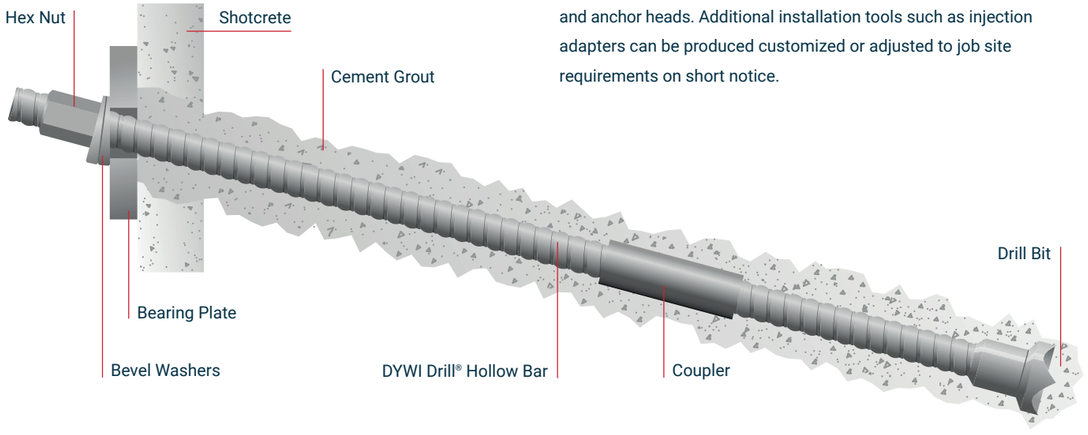
Basic Concept

The DYWIDAG DYWI® Drill Hollow Bar System consists of fully threaded steel bar sections, couplers, nuts and drill bits. It can be drilled and grouted into loose or collapsible soil without a casing. The bar sections feature a hollow center that allows for a simultaneous drilling and grouting operation. The DYWIDAG DYWI® Drill Hollow Bar serves as a drill rod. It is fitted with a lost drill bit at the front that can be adapted to different ground conditions. After each single bar section of 1 to 6 m, the subsequent bar is coupled to the previously installed section.

During drilling, cement grout is injected into the hollow core of the bar using an injection adapter that is mounted on the drill rig. The cement grout exits at the bottom end through openings in the drill bit. The injected grout initially serves as slurry to stabilize the borehole and ensures the efficient flushing of the drill spoils. Once the grout reached strength it bonds the bar to the ground. Once the required installation depth has been reached, the hollow bar serves as a steel tendon and can carry out its function as a soil nail, rock bolt or pile upon the grout reaching its required strength.

The comprehensive DYWIDAG DYWI® Drill Hollow Bar System product range offers tendons with ultimate loads from 45 kips to 832 kips including all system components such as drill bits, couplers, spacers and anchor heads. Additional installation tools such as injection adapters can be produced customized or adjusted to job site requirements on short notice.

DYWIDAG DYWI® Drill Hollow Bar – Soil Nail



Key Features

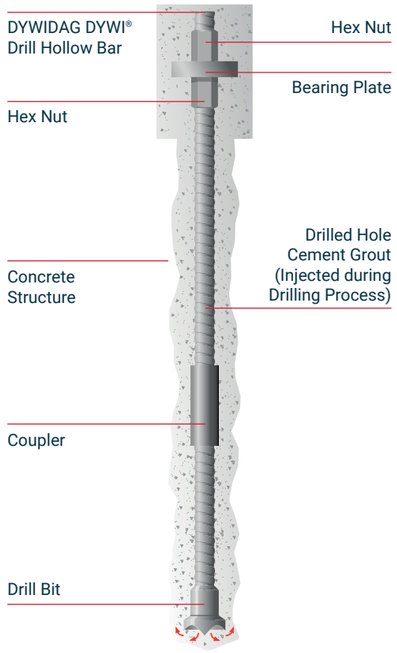
- The tendon simultaneously serves as a drill rod
- Extremely fast installation because borehole drilling is made redundant by simultaneous drilling and grouting
- System can be installed in confined spaces utilizing simple and compact drilling equipment
- Variable anchorage and angle compensation designs
- Drill bits are available for various ground conditions
- Can be used as a soil nail, rock bolt or a pile
- Irregular grout body enhances capacity

Fields of Application

- Slope, embankment and rock stabilization
- Shoring and excavations
- Fixation of rock fall mesh
- Avalanche barriers
- Foundations

VARIOUS STYLE DRILL BITS FOR DYWIDAG DYWI® DRILL

DYWIDAG DYWI® Drill Hollow Bar – Micropile



SIMULTANEOUS DRILLING AND GROUTING

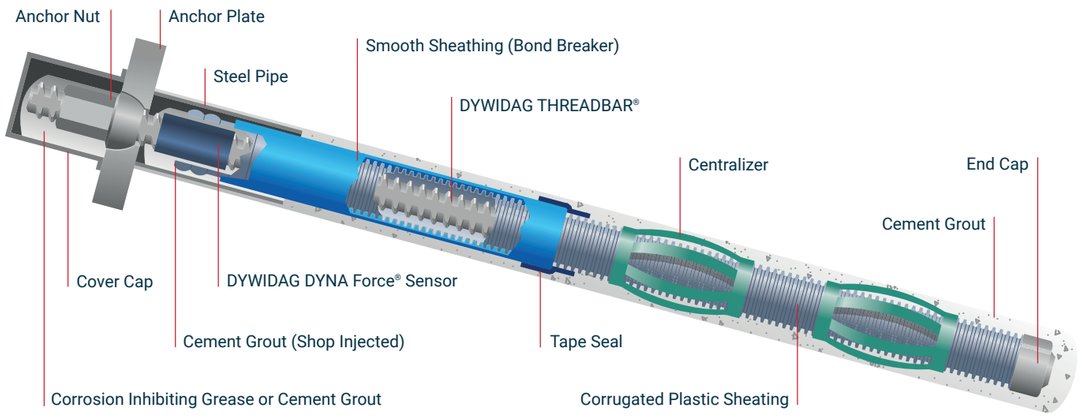
DYWIDAG DYWI® Drill Hollow Bar Properties

Bar Des.	Nominal Outer Diameter		Average Yield Strength (f_y)		Average Ultimate Tensile Strength (f_u)		Average Cross Section Area (A_s)		Yield Load (f_y x A_s)		Ultimate Load (f_u x A_s)		Nominal Weight	
	in	mm	ksi	Mpa	ksi	Mpa	in²	mm²	kips	kN	kips	kN	lbs/ft	kg/m
R25N	1.00	25	90	620	120	830	0.37	240	34	150	45	200	1.28	1.90
R32N	1.26	32	94	650	116	800	0.54	350	52	230	63	280	1.81	2.70
R32S	1.26	32	94	650	120	830	0.67	430	63	280	81	360	2.28	3.40
R38N	1.50	38	97	670	122	840	0.91	590	90	400	112	500	3.16	4.70
R51L	2.00	51	87	600	107	740	1.15	740	101	450	124	550	3.97	5.90
T40N	1.57	40	99	680	123	850	1.19	770	118	525	148	660	4.03	6.00
R51N	2.00	51	97	670	123	850	1.46	940	142	630	180	800	4.97	7.40
T76N	3.00	76	83	570	110	760	3.22	2,080	270	1,200	360	1,600	10.95	16.30
T76S	3.00	76	87	600	112	770	3.81	2,460	337	1,500	427	1,900	12.97	19.30
T103N	4.00	103	81	560	103	710	4.96	3,200	405	1,800	517	2,300	16.80	25.00
T103S	4.00	103	74	510	103	710	8.06	5,200	600	2,670	832	3,700	26.88	40.00

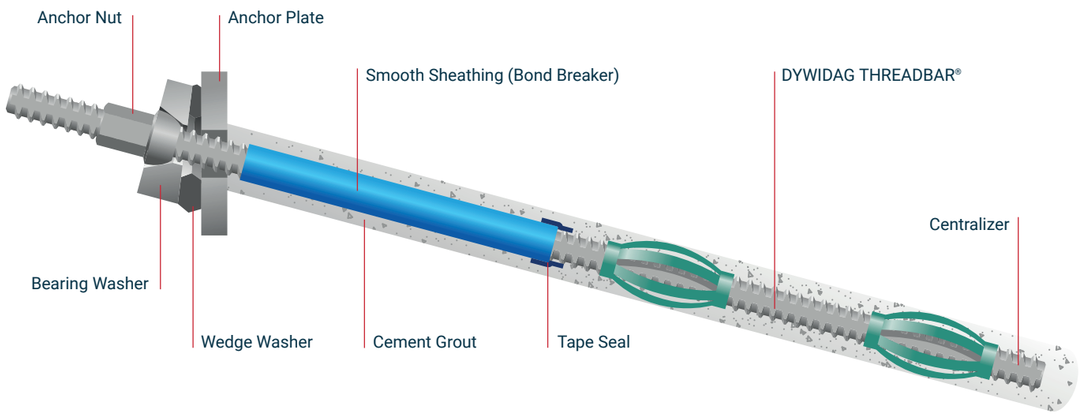
Note: Maximum allowable temporary tension is the yield load. Cross section area is based on average internal diameter of the bar.
The ultimate tensile and yield strength are calculated average values.
Standard length = 9'-10" (3 m). Other lengths available on special order.

DYWIDAG THREADBAR® Anchors

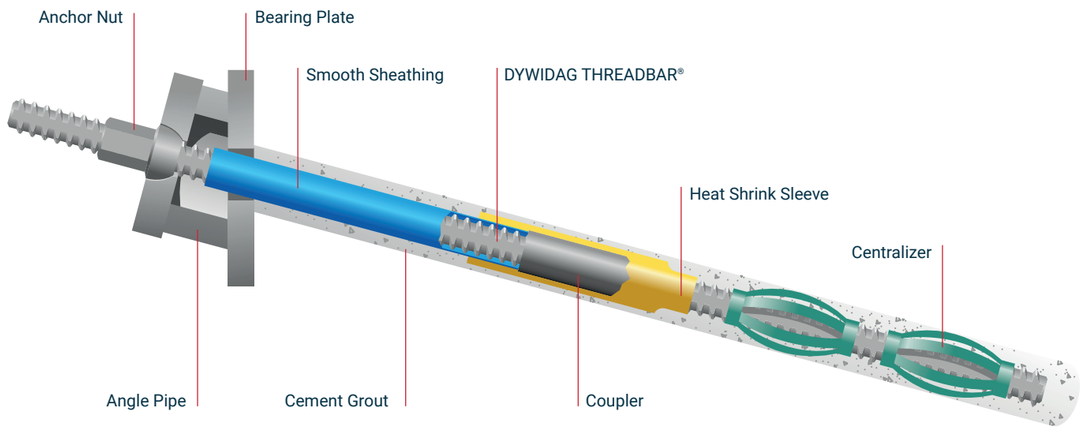
DYWIDAG THREADBAR® Anchor – Permanent (DCP)



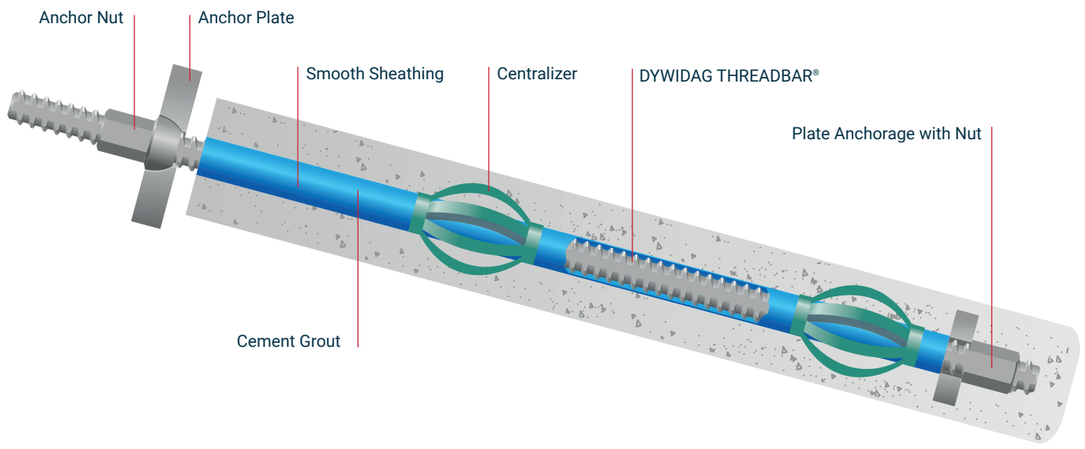
DYWIDAG THREADBAR® Anchor – Temporary



DYWIDAG THREADBAR® Anchor – Partially Removable

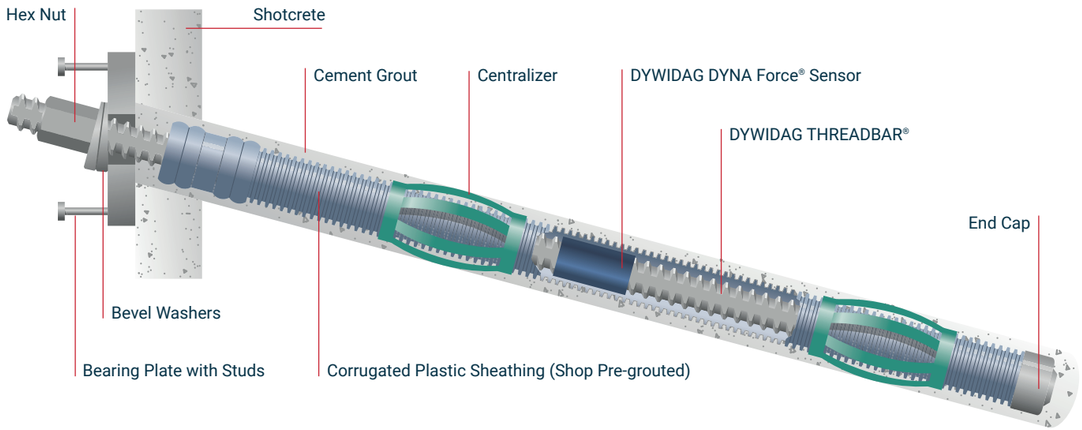


DYWIDAG THREADBAR® Anchor – Fully Removable

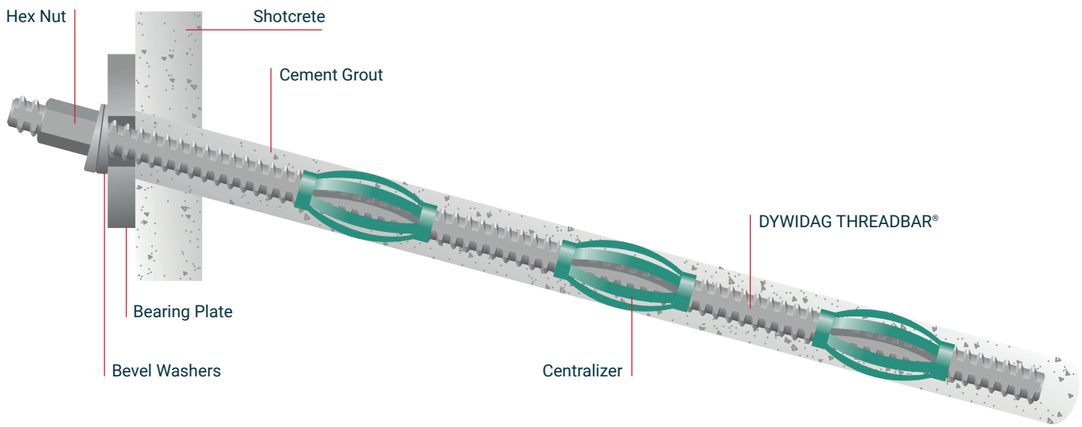


DYWIDAG Soil Nails

DYWIDAG THREADBAR® Soil Nail with Double Corrosion Protection (DCP)

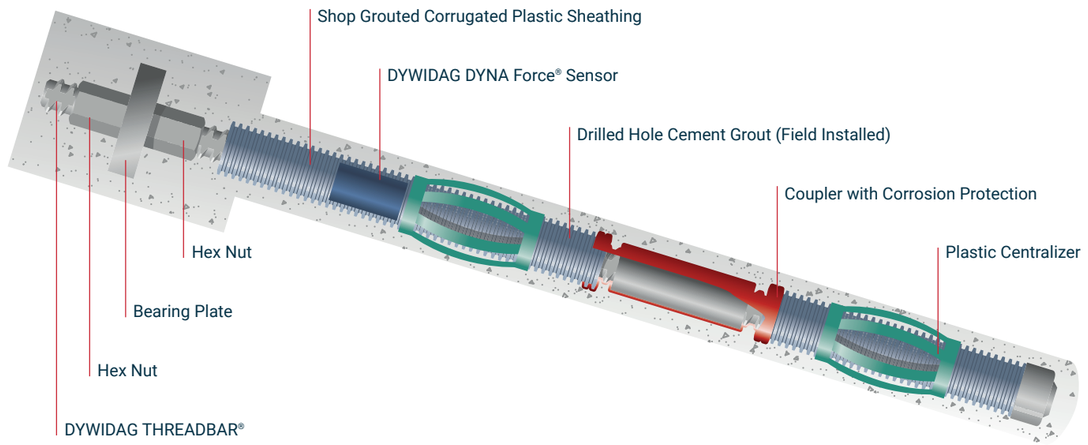


DYWIDAG THREADBAR® Soil Nail – Bare, Epoxy Coated or Galvanized

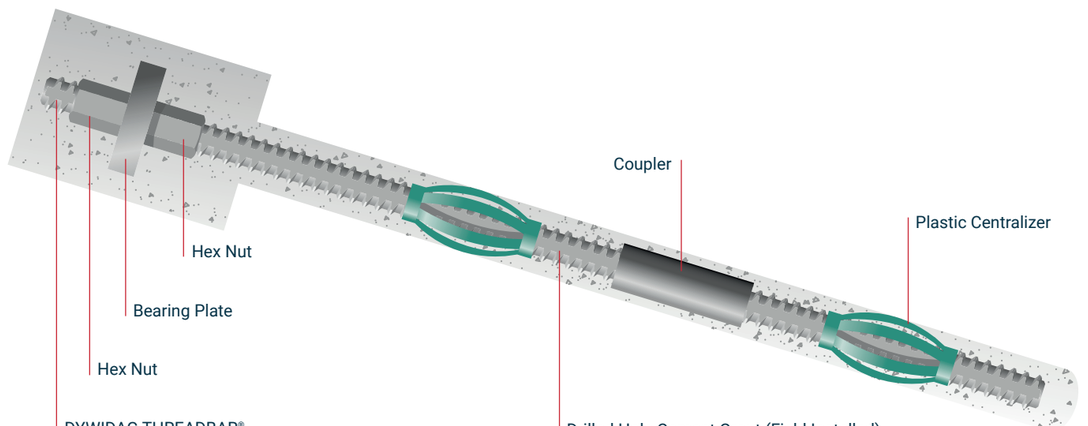


DYWIDAG Micropiles – *GEWI*® Piles

***DYWIDAG GEWI*® Pile with Single Corrosion Protection (SCP)**



***DYWIDAG GEWI*® Pile with Double Corrosion Protection (DCP)**



Basic Concept

A *DYWIDAG GEWI*® Pile is a drilled and grouted micropile, with a diameter of up to 12 inches. It is centrally reinforced with either one or a group of DYWIDAG THREADBARS®. The deformations on the bar transfer the load into the surrounding grout body and friction transfers the load from the grout into the ground.

DYWIDAG THREADBAR® Properties

GRADE 75, 80 DYWIDAG THREADBAR® – Reinforcing Steel per ASTM A615

THREADBAR® Designation		Maximum THREADBAR® Diameter		Minimum Yield Stress (f_y)		Nominal Cross Section Area (A_s)		Minimum Yield Load (f_y x A_s)		Nominal Weight	
	mm	in	mm	ksi	MPa	in²	mm²	kips	kN	lbs/ft	kg/m
#6	19	0.86	22	75	517	0.44	284	33.0	147	1.50	2.23
#7	22	0.99	25	75	517	0.60	387	45.0	200	2.04	3.04
#8	25	1.12	28	75	517	0.79	510	59.3	264	2.67	3.97
#9	29	1.26	32	75	517	1.00	645	75.0	334	3.40	5.06
#10	32	1.43	36	75	517	1.27	819	95.3	424	4.30	6.40
#11	36	1.61	41	75	517	1.56	1,006	117.0	520	5.31	7.90
#14	43	1.86	47	80	552	2.25	1,452	180.0	801	7.65	11.38
#18	57	2.50	64	80	552	4.00	2,581	320.0	1,423	13.60	20.24
#20	63	2.72	69	80	552	4.91	3,168	393.0	1,748	16.70	24.85
#24 [1)]	75	3.18	81	75	517	7.06	4,555	529.5	2,355	24.09	35.85
#28 [1)]	90	3.68	94	75	517	9.62	6,206	721.5	3,209	32.79	48.80

Note: Maximum allowable temporary tension is 95% of minimum yield load. Mill length is 60 ft (#6 through #20) and 53 ft for #24 and #28.
[1)] DYWIDAG THREADBAR® sizes not listed by ASTM A615 but yield strength is in conformance with ASTM A615 standard.

GRADE 100 DYWIDAG THREADBAR® Reinforcing Steel per ASTM A615

THREADBAR® Designation		Maximum THREADBAR® Diameter		Minimum Yield Stress (f_y)		Nominal Cross Section Area (A_s)		Minimum Yield Load (f_y x A_s)		Nominal Weight	
	mm	in	mm	ksi	MPa	in²	mm²	kips	kN	lbs/ft	kg/m
#6	19	0.86	22	100	689	0.44	284	44.0	196	1.50	2.23
#7	22	0.99	25	100	689	0.60	387	60.0	267	2.04	3.04
#8	25	1.12	28	100	689	0.79	510	79.0	351	2.67	3.97
#9	29	1.26	32	100	689	1.00	645	100.0	445	3.40	5.06
#10	32	1.43	36	100	689	1.27	819	127.0	565	4.30	6.40
#11	36	1.61	41	100	689	1.56	1,006	156.0	694	5.31	7.90
#14	43	1.86	47	100	689	2.25	1,452	225.0	1,001	7.65	11.38
#18	57	2.50	64	100	689	4.00	2,581	400.0	1,779	13.60	20.24
#20	63	2.72	69	100	689	4.91	3,168	491.0	2,184	16.70	24.85

Note: Maximum allowable temporary tension is 95% of minimum yield load. Mill length is 60 ft.

GRADE 150 DYWIDAG THREADBAR® – Prestressing Steel per ASTM A722

THREADBAR® Designation		Maximum THREADBAR® Diameter		Minimum Ultimate Tensile Strength (f_u)		Nominal Cross Section Area (A_s)		Minimum Ultimate Tensile Load (f_u x A_s)		Nominal Weight	
in	mm	in	mm	ksi	MPa	in²	mm²	kips	kN	lbs/ft	kg/m
1	26	1.20	30	150	1,034	0.85	548	127.5	567	3.01	4.48
1 ¼	32	1.445	37	150	1,034	1.25	806	187.5	834	4.39	6.53
1 ⅜	36	1.630	41	150	1,034	1.58	1,019	237.0	1,054	5.56	8.27
1 ¾	46	2.08	53	150	1,034	2.58	1,665	387.0	1,721	9.37	13.94

Note: Maximum allowable temporary test tension is 80% of minimum ultimate tensile load. Mill lengths are 60 ft. **Fully compliant ASTM A722 Grade 150 DYWIDAG THREADBAR® is hot rolled and proof stressed alloy steel with relaxation loss of under 2% when subjected to 70% of specified minimum breaking strength of the bar for 1,000 hrs. The production process is not only critical for achieving the low relaxation properties, but also provides a layer of safety by proof-stretching every individual bar to 80% of the ultimate strength, before it leaves the mill**

WARNING: DO NOT WELD on or near A722 prestressing bars or their anchorages.

GRADE 150 DYWIDAG THREADBAR® – Prestressing Steel

THREADBAR® Designation		Maximum THREADBAR® Diameter		Minimum Ultimate Tensile Strength (f_u)		Nominal Cross Section Area (A_s)		Minimum Ultimate Tensile Load (f_u x A_s)		Nominal Weight	
in	mm	in	mm	ksi	MPa	in²	mm²	kips	kN	lbs/ft	kg/m
2 ¼	57	2.482	63	150	1,034	4.08	2,632	612.0	2,722	14.55	21.65
2 ½	65	2.790	71	150	1,034	5.16	3,329	774.0	3,443	18.20	27.08
3	75	3.146	80	150	1,034	6.85	4,419	1,028	4,571	24.09	35.85

Note: Maximum allowable temporary test tension is 80% of minimum ultimate tensile load. Mill lengths are 45 ft. **Grade 150 cold drawn quenched and tempered alloy steel with cold rolled threads are also available in 2-1/4"(57mm), 2-1/2" (65mm) and 3" (75mm) diameters, meeting only the strength properties of ASTM A722, with relaxation <4.5%, when initially loaded to 70% of the specified minimum breaking strength of the bar, after 1000 hours testing).** Cold-rolled bars provided by others have been known to have significantly higher relaxation losses. Specify DYWIDAG to ensure your project is supplied to meet your expectations.

WARNING: DO NOT WELD on or near high-strength prestressing bars or their anchorages.

Relaxation

Relaxation is defined as the loss of prestress load in post-tensioning steel, subjected to a specified initial stress, while maintaining the length and the temperature constant. Relaxation tests are usually conducted at an initial load equal to 70% of the specified minimum breaking strength of the bar (see chart below). The relaxation loss after 1,000 hrs for a hot rolled THREADBAR® is <2%. The relaxation loss in DYWIDAG cold-rolled bars is <4.5%

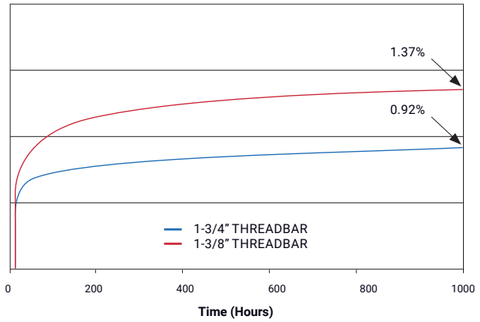
Grade 150 cold drawn quenched and tempered alloy steel, with cold rolled threads are also available in 2-1/4"(57mm), 2-1/2" (65mm) and 3" (75mm) diameters, meeting only the strength properties of ASTM A722, with relaxation <4.5%, when initially loaded to 70% of the specified minimum breaking strength of the bar after 1000 hrs of testing. Warning: Cold-rolled bars provided by others have been known to have significantly higher levels of relaxation loss.

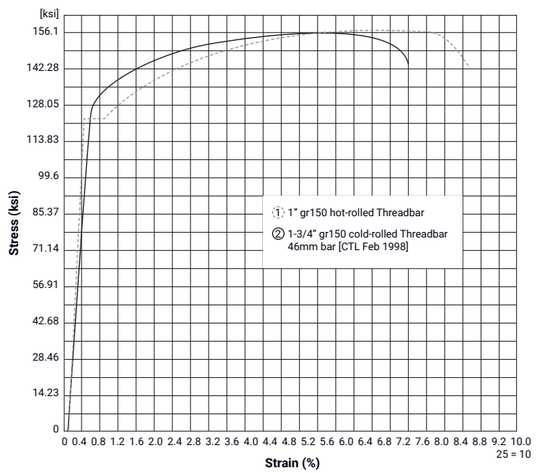
Higher relaxation properties will manifest in higher creep magnitudes during ground anchor load testing, refer to PTI Tech Note 24.

Stress-Strain Characteristics

A typical stress-strain curve for a stretched and stress relieved bar is substanially different from a typical curve produced for a cold drawn, cold threaded bar. Samples of each are illustrated below. The most notable feature is the lack of a definite yield point characteristic of cold drawn bars.

Relaxation Loss vs. Time for Hot Rolled THREADBAR





DYWIDAG Tie Rods

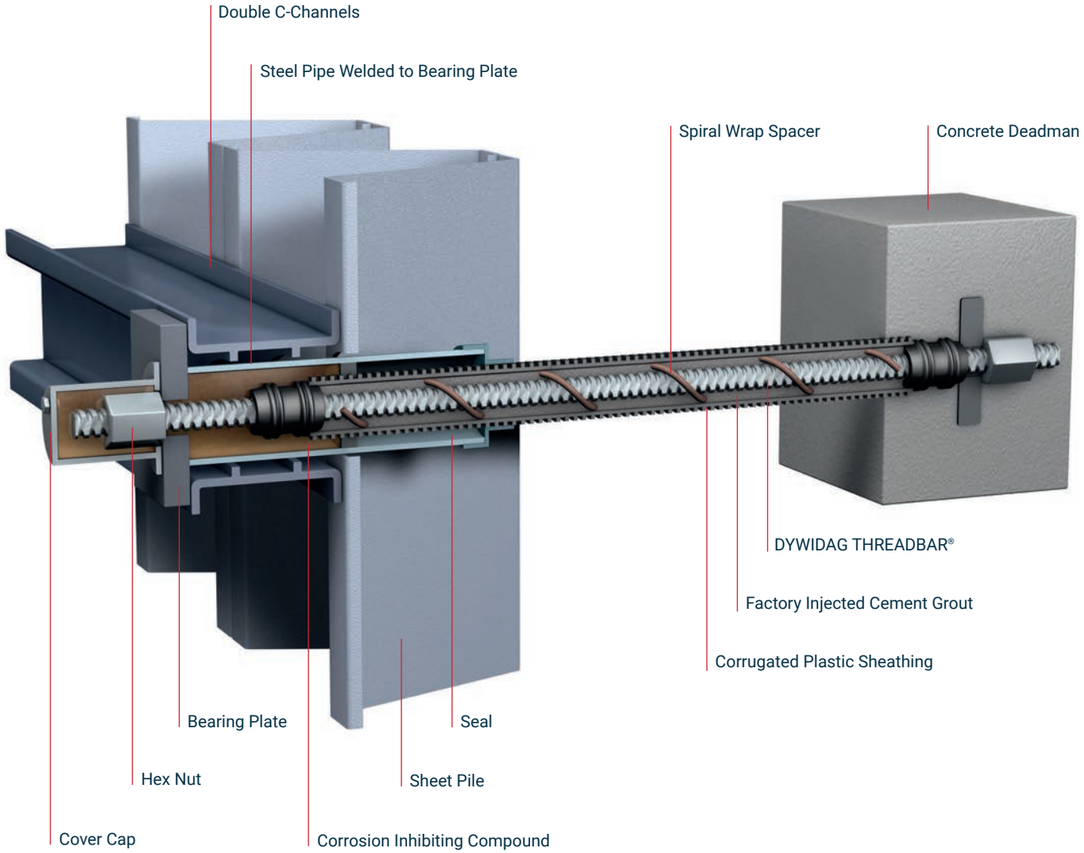
Key Features

Tie Rods produced from DYWIDAG THREADBAR® are used for marine bulkheads, docking facilities, barge and ship docks as well as offshore platforms. They are a cost-effective alternative to large diameter A36 Tie Rods with upset threads. Continuous, coarse thread allows for rough site handling and for easy on-site length adjustments since cutting or coupling of the rod is possible along its entire length.

Corrosion Protection Options

- Double Corrosion Protection (DCP)
- Hot dip galvanizing
- Epoxy coating
- Tape coating

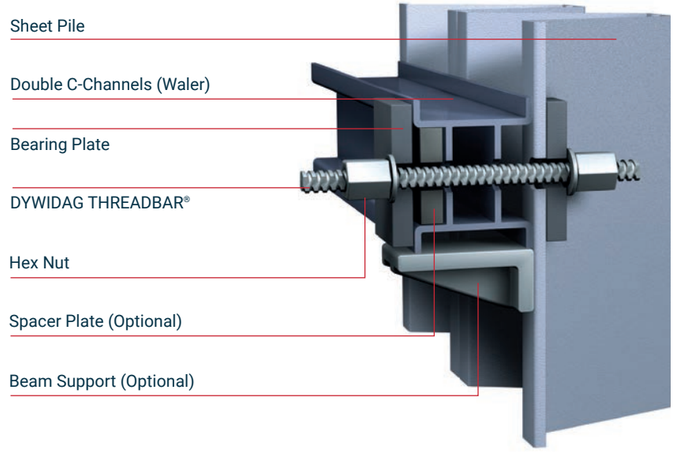
DYWIDAG Tie Rod with Double Corrosion Protection (DCP)
Recommended for permanent applications



Waler Connection

Short bolts are needed to connect a standard sheet pile wall or a modular sheet pile wall to a load distributing double channel beam. This can be done with Grade 75, 80 or 100 DYWIDAG THREADBAR®.

The required length of the bar depends on the depth of the sheet pile profile, the width of the beam, the plate thickness and the nut length.



Tie Rod Connections

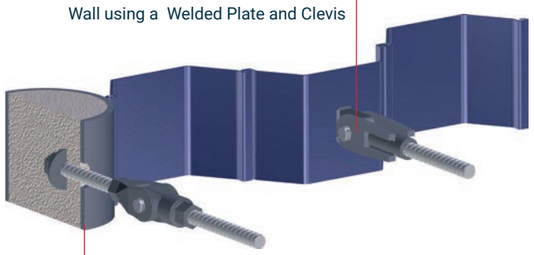
Anchorages in different variations for steel and concrete structures

- Clevis connection
- Eye anchor connection
- Welded connection
- Embedded connection
- Plate-nut connection

Features

- Articulated
- Angle compensating
- Self-aligning under load
- Tensionable

Articulated Connection at Sheet Pile Wall using a Welded Plate and Clevis



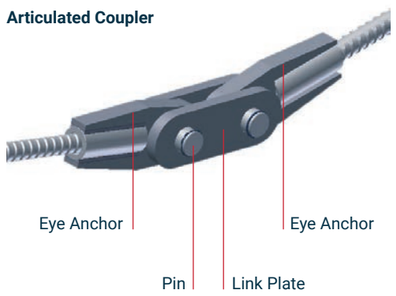
Anchorages in Concrete or Drilled Pile with Articulated Connection

Couplers and Connections

Coupler

Turnbuckle

Articulated Coupler



DYWIDAG THREADBAR® Reinforcing Systems

Introduction

DYWIDAG THREADBAR® Reinforcing Steel is available in Grades 75, 80, 100 for sizes #6 through #20, and Grade 75 to #24 and #28. DYWIDAG THREADBAR® conforms to the requirements of ASTM A615, except in markings. DYWIDAG THREADBAR® may be shipped to the job in mill lengths or fabricated to specifications.

DYWIDAG THREADBAR® Reinforcing Steel has a continous rolled-in pattern of thread-like deformations along its entire length. More durable than machined threads, the deformations allow nuts couplers to thread onto a DYWIDAG THREADBAR® at any point along its length. DYWIDAG THREADBAR® may be epoxy coated in accordance with ASTM A775 or galvanized in accordance to ASTM A123. Threaded accessories for coated bars thread over the coating.

Advantages of High-Strength THREADBAR® Reinforcement

- Fewer bars to handle
- Less congestion
- Lighter reinforcement assemblies
- Faster construction
- Easy to install coupler system
- Can replace rebar terminator with a bearing plate with top and bottom nuts

Having to hoist, handle and place a lower volume of reinforcing steel makes installation simpler and faster. And less congestion results in higher quality concrete placement with reduced risk of consolidation issues. All these advantages result in a reduced volume of steel and shorter construction time leading to a lower overall cost of the reinforced concrete structure.

Fields of Application

- Concrete reinforcement
- Micropiles
- Auger cast piles
- Caissons
- Drilled shafts

Coupler System

DYWIDAG Couplers and hex nuts develop the full ultimate load of the DYWIDAG THREADBAR®. Slippage of the coupler under stress is controlled by torquing opposing DYWIDAG THREADBAR® together or by using nuts. The magnitude of the torque required varies with the allowable slip and Threadbar size.

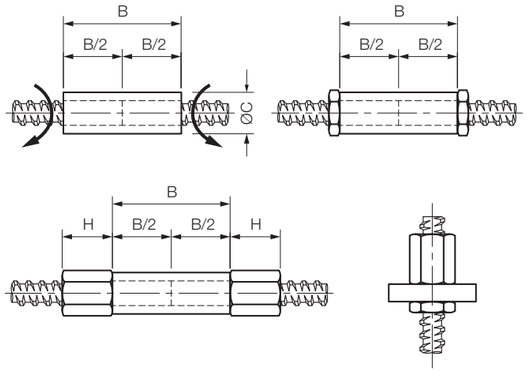
The DYWIDAG THREADBAR® reinforcing system offers a simple, reliable and economical splice. A DYWIDAG splice requires less crane time and less labor time for assembly than required for other splices. Unlike some splices, the DYWIDAG splice may be installed in adverse weather conditions and does not create a fire hazard. Opposing DYWIDAG THREADBAR® need only to be chalk marked before assembly to assure proper engagement, supervision and quality control requirements are minimized.

Coupler with Hexnuts

When opposing DYWIDAG THREADBAR® are not torqued together, hex nuts will be used on each end of the coupler and tightened against the coupler. The splice will develop the full ultimate load of the bar in tension and compression.

Coupler with Locknuts

Locknuts can also be used each side end of the coupler similar to hex nuts. The splice will develop the full load ultimate load of the bar in tension and about half the ultimate load in compression.



DYWIDAG THREADBAR® – Reinforcing Steel Hardware Dimensions

DYWIDAG THREADBAR® Designation	Hexnut Length H		Coupler Length B		Coupler Outer Diameter ØC	
	in	mm	in	mm	in	mm
GRADE 75, 80						
#6	1.43	36	3.12	79	1.22	31
#7	1.71	43	3.73	95	1.41	36
#8	1.84	47	4.03	102	1.59	40
#9	2.30	58	5.02	128	1.79	45
#10	2.56	65	5.70	145	2.02	51
#11	2.89	73	6.37	162	2.25	57
#14	3.55	90	7.82	199	2.65	67
#18	4.23	107	9.35	237	3.50	89
#20	4.85	123	10.38	264	3.86	98
#24	4.10	104	9.20	234	4.75	121
#28	4.80	122	10.61	269	5.38	137
GRADE 100						
#6	2.88	73	6.25	159	1.25	32
#7	3.13	80	7.00	178	1.50	38
#8	3.38	86	7.13	181	1.75	44
#9	3.50	89	7.25	184	1.88	48
#10	3.75	95	7.50	191	2.13	54
#11	3.88	99	8.00	203	2.38	60
#14	4.50	114	8.25	210	2.75	70
#18	5.25	133	10.50	267	3.63	92
#20	6.00	152	12.25	311	4.00	102

DYWIDAG DYNA Force®
Load Monitoring System

Infrastructure Intelligence by DYWIDAG

DYWIDAG DYNA Force® Load Monitoring System

The force measuring technique is based on the elasto-magnetic properties of ferromagnetic materials and is carried out using DYWIDAG DYNA Force® Load Monitoring Sensors.

The magnetic permeability of steel in a magnetic field changes as a function of the mechanic normal stress condition of the steel. By measuring the relative change in magnetic permeability, the normal stress in the steel tendon can be determined. The DYWIDAG DYNA Force® Monitoring System is based on the principle described above and can be used for bars, strands and wires.

The hollow cylinder monitoring sensors are available in different diameters to suit various bar and strand diameters. A readout unit measures the magnetic permeability of the steel tendon through the sensor and shows the tendon force. Each DYWIDAG DYNA Force® Load Monitoring Sensor is fitted with an integrated temperature sensor in order to automatically compensate the influence of possible temperature alterations.

The DYWIDAG DYNA Force® Load Monitoring System allows the permanent monitoring of post-tensioning forces in steel tendons. Force readings as part of inspection procedures can be done within a few minutes without the need for lift-off equipment or other cost-intensive techniques.

Key Features and Integration with Infrastructure Intelligence by DYWIDAG

- Lifetime monitoring of the post-tensioning performance in structures
- Manual and continuous remote readings
- Load check during stressing
- No large load cell at anchorages and no increased pocket depth
- Quality and support from the leading industry supplier
- Easy connection with mobile devices by WiFi and (connect) download and control option from a remotely located laptop via WiFi or GSM connection
- Sensors and source material (strand/bar) can either be calibrated on site or at factory prior to shipping to the construction site
- Installation of sensors is either done during the production of the anchors or directly at the job site before stressing the steel tendon
- Force and temperature readings by sensor via the readout unit
- Multiple readings of all sensors can be done from a central location with a single click or automatically

SLOPE STABILIZATION USING DYWIDAG STRAND ANCHOR SYSTEM AND DYNA FORCE® SYSTEM - PASEO DEL MAR ROAD AT THE WHITE POINT PRESERVE IN SAN PEDRO,CA.

Fields of Application

- Ground anchors
- Micropiles
- Soil nails
- Cable stayed bridges
- Air traffic control towers
- Post-tensioning tendons in bridges and buildings
- Wind energy towers
- Repair and strengthening of post-tensioned structures

Infrastructure Intelligence by DYWIDAG Main Features

- Highly scalable, robust and secure IoT system
- Sensor agnostic
- Built on Microsoft Azure
- Contextualize complex sites Images / Maps / Diagrams
- Advanced graphing
- Multiple alerting options
- Data analysis tool sets
- Responsive user interface
- Azure Active Directory security that provides unique user accounts, two factor authentication and the option to integrate with other Active Directory tenants to deliver a single sign-on experience using your existing corporate account
- Multi-layered user and user group security profiles that allow administrators to customise individual user permissions to meet simple or complex requirements
- Bi-directional automated connectivity with in-field devices simplifying data transfer
- Quick and easy addition of manual data (e.g. data files, photographs, engineering drawings and reports) providing supporting information that improves understanding
- In-depth project breakdown structure reducing complexity and aiding understanding of complex sites with multiple monitoring points and high volumes of data
- Powerful and intuitive project dashboard featuring maps, rendered images and photographs of the site location, GPS sensor locations and alert status
- Visual representation of data in graphical, tabular and chart formats with integrated overlaid trigger levels that enhance understanding of site conditions
- Simple and complex triggers providing automated notification of alert and alarm situations to multiple users via email or SMS
- Zoom in to individual data points, compare readings from multiple instruments or export data into excel with the interactive charting engine

INSTALLATION OF DYWIDAG DYNA FORCE® SENSOR OVER STRAND ANCHOR BOND LENGTH

ANCHOR WITH SENSOR CABLE

RESTRESSABLE ANCHOR HEADS WITH SENSOR CABLE

DYWIDAG DYNA Force® System Components

READOUT UNIT

MULTIPLEXER

DYWIDAG DYNA FORCE® SENSOR FOR STRAND OR BAR

DYWIDAG DYNA Force® Dimensions

Strand Size		Strand Grade		Sensor I.D.		Sensor O.D.		Sensor Length	
[in]	[mm]	[ksi]	[MPa]	[in]	[mm]	[in]	[mm]	[in]	[mm]
0.5" - 0.62"	12.7 - 15.7	270	1,860	0.79	20	1.42	36	5.2	132
THREADBAR® Size		**THREADBAR® Grade**		**Sensor I.D.**		**Sensor O.D.**		**Sensor Length**	
[in]	[mm]	[ksi]	[MPa]	[in]	[mm]	[in]	[mm]	[in]	[mm]
#7 - #11	16-35	75-100	517-690	1.69	43	3.15	80	7.90	178
#14	43	80-100	552-690	2.09	54	3.90	98	7.87	225
#18 - #20	57-63	80-100	552-690	2.87	71	5.71	144	12.20	308
#24	75	75-100	517-690	3.35	85	6.10	172	12.99	309
1" - 1⅜"	23-36	150	1,034	1.69	43	3.15	80	7.09	178
1¾"	46	150	1,034	2.09	54	3.90	98	7.87	225
2½"	66	150	1,034	2.87	71	5.71	144	12.20	308
3"	75	150	1,034	3.35	85	6.10	172	12.99	309

DYWIDAG DYNA Force® Load Monitoring over the entire tendon is custom made, and dimensions will be provided on request

Readout Unit

- Measurement range
  - 0-95% yield stress level of the steel tendon
  - Power supply
  - AC: 90-246 V, 60/50 Hz, 150 W
  - DC: 1/24 V
  - Solar with DC batteries
- Operating temperature
  - 32 °F - 158 °F(0 °C - 70 °C)
  - Temperatures below 32 °F (0 °C) are possible using a temperature controled enclosure

Multiplexer

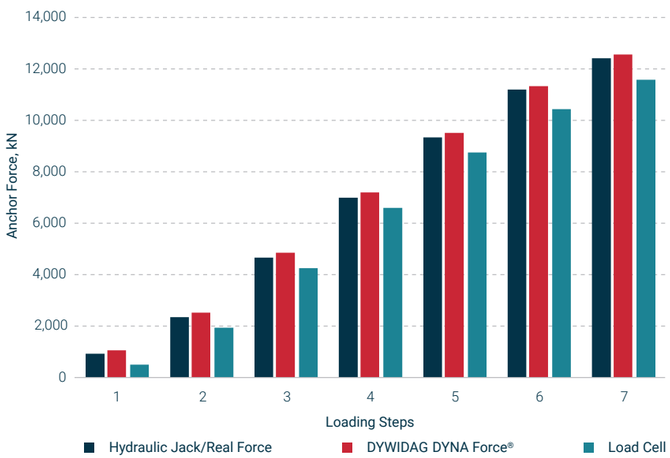
- Standard multiplexers
  - 4 channels
  - 8 channels
  - 12 channels
- Serial connection of multiplexers via main cable possible
- Standard enclosure in case of outside storage: painted steel or stainless steel available

Cables

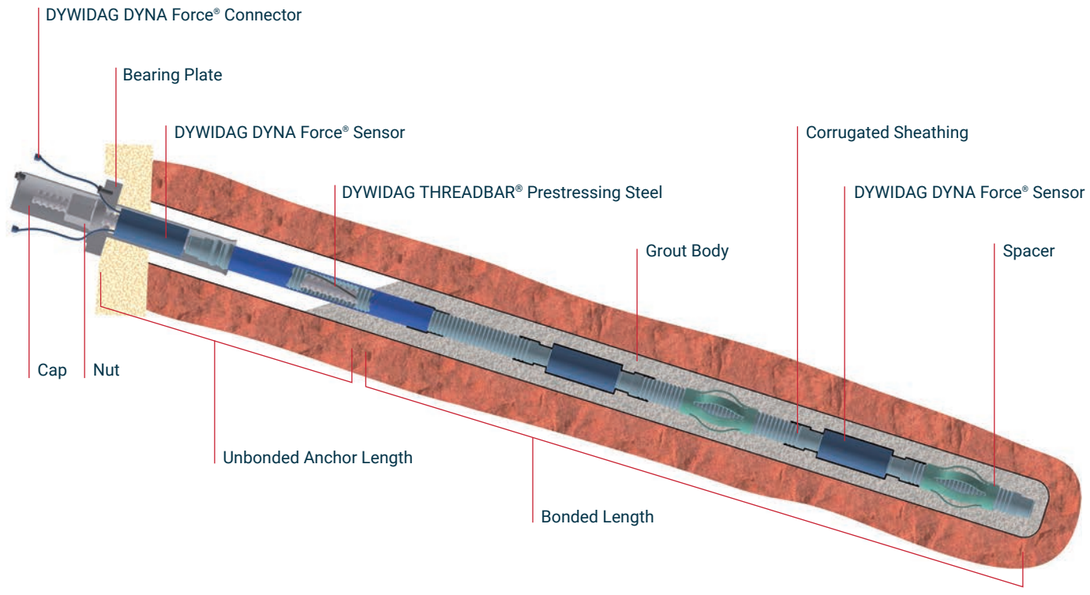
- Main cable
  - 12 pin metal connectors
  - PVC jacket
- Extension cable
  - 6 pin plastic connector
  - PVC jacket
- Maximum combined cable length 650 ft (200 m)

System Accuracy

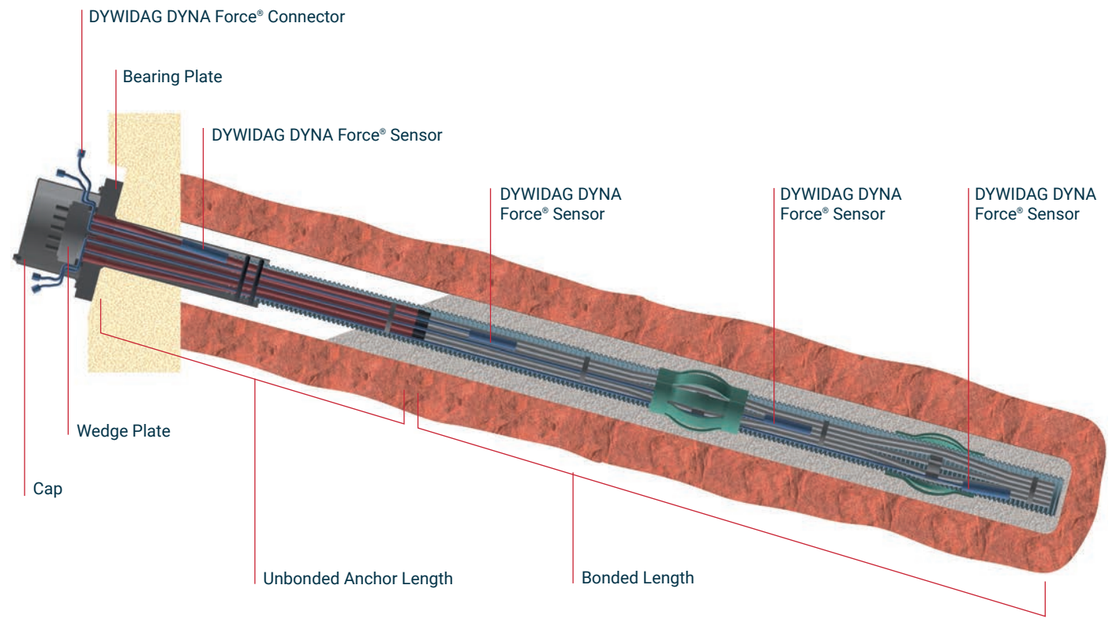
- Tests have confirmed the high measuring accuracy of the DYWIDAG DYNA Force® Sensors
- The diagram on the right shows the anchor force of a 59-0.6" strand anchor subject to different load levels
- DYWIDAG DYNA Force® Sensors correspond very closely with the jack readings during the loading stages
- Throughout the testing, the DYWIDAG DYNA Force® Sensors were consistently more accurate than the load cells



DYWIDAG Bar Anchor with DYWIDAG DYNA Force® Load Monitoring Sensors



DYWIDAG Strand Anchor with DYWIDAG DYNA Force® Load Monitoring Sensors



THE ELEPHANT TRUNK, HIGHWAY 1: STABILIZATION OF A STEEP COASTLIN
USING PERMANENT DYWIDAG STRAND ANCHORS, USA

DYWIDAG DYNA FORCE® SENSORS MONITOR DEEP EXCAVATIONS AT THE NEW
HINKLEY POINT NUCLEAR POWER STATION, GREAT BRITAN

Other products and services by DYWIDAG

Stay cables including monitoring and inspection
Design and installation of stay cable systems plus the monitoring and inspection using robotic inspection methods.

Infrastructure Intelligence
Data acquisition platform, automated alarms and alerts, tailored system to suit your project.

Repair and refurbishment
Testing and repair of existing ground anchors, refurbishment of post-tensioning systems to existing structures, rope access and wrapping of stay cables.

Structural health monitoring
Automated and manual monitoring including survey. Supply and installation of automated and manual monitoring and survey systems, this data can also be viewed on our infrastructure intelligence platform.

Post-tensioning systems
Manufacture and installation of bonded and un-bonded post tensioning systems.

DYWIDAG

Get in touch.

For local contact details, please visit our website.

dywidag.com/contact

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