

**DYWIDAG Tie Rods**



## DYWIDAG Threadbar Tie Rods

Tie Rods produced from *GEWI*® Steel and *GEWI*® Plus threadbars can be used for a variety of marine applications. Construction of marine bulkheads for various docking facilities have, for many years, benefited from the use of DYWIDAG Tie Rods. Facilities such as barge and ship docks as well as offshore service bases have found the system to be a cost effective alternative to large diameter S355 Tie Rods with upset threads.

Tie Rods produced from *GEWI*® Steel and *GEWI*® Plus threadbars offer various economical and technical advantages:

- Easy handling because of a hot rolled coarse thread over the entire length
- Up to almost 50% less weight than bars from S355.
- No threadability or assembly problems resulting from damaged or dirty threads, because of the coarse DYWIDAG threadform.
- DYWIDAG Tie Rods can be ordered slightly longer than necessary to accommodate the minor misalignments which normally occur on sheet piling. They can easily be cut to the desired length eliminating need to cut and re-weld upset rods to accommodate length changes.



### Tie Rods based on *GEWI*® Steel Threadbars

Nominal Diameter	Steel Grade	Cross-Sectional Area	Yield Load	Ultimate Load
[mm]	[N/mm <sup>2</sup> ]	[mm <sup>2</sup> ]	[kN]	[kN]
16	500/550	201	101	111
20	500/550	314	157	173
25	500/550	491	246	270
28	500/550	616	308	339
32	500/550	804	402	442
40	500/550	1257	628	691
50	500/550	1963	982	1080
63.5	555/700	3167	1758	2217

- Continuous coarse left hand thread
- Weldable
- Wide range of accessories available
- Approved double corrosion protection in accordance with EN 1537 can be applied
- No susceptibility to stress crack corrosion or hydrogen induced embrittlement
- Approved by many construction authorities worldwide
- Conformance with DIN 488
- General conformance with BS 4449
- Stock lengths 15 and 18m, other lengths on request

## Corrosion Protection

An important element in the long term durability of tie rod installation is corrosion protection. For DSI's *GEWI® Steel* and *GEWI® Plus* systems, various corrosion protection systems are available, depending on site conditions and degree of exposure.

Possible solutions are:

- Sacrificial corrosion in accordance with EN 14199, EAU or other specifications. See also table below
- The well known DYWIDAG double corrosion protection in accordance with EN 1537
- Hot dip galvanizing in accordance with ISO 1461
- Epoxy coating
- Tar coating
- Denso wrapping



### Sacrificial surface corrosion in accordance with EN 14199

Required design working life	5 years	25 years	50 years	75 years	100 years
Undistributed natural soils	0.00	0.30	0.60	0.90	1.20
Polluted natural soils and industrial grounds	0.15	0.75	1.50	2.25	3.00
Aggressive natural soils	0.20	1.00	1.75	2.50	3.25
Non-compacted and non-aggressive fills	0.18	0.70	1.20	1.70	2.20
Non-compacted and aggressive fills	0.50	2.00	3.25	4.50	5.75

## Tie Rods from *GEWI® Plus* Threadbars

Nominal Diameter [mm]	Steel Grade [N/mm <sup>2</sup> ]	Cross-Sectional Area [mm <sup>2</sup> ]	Yield Load [kN]	Ultimate Load [kN]
18	670/800	254	170	204
22	670/800	380	255	304
25	670/800	491	329	393
28	670/800	616	413	493
30	670/800	707	474	565
35	670/800	962	645	770
43	670/800	1452	973	1162
57.5	670/800	2597	1740	2077
63.5	670/800	3167	2122	2534
75	670/800	4418	2960	3535

- Continuous coarse right hand thread, thus easily distinguishable from standard *GEWI® Steel*
- Smaller pitch for easier torquing
- Wide range of accessories available
- Approved double corrosion protection in accordance with EN 1537 can be applied
- Despite its high grade, no susceptibility to stress crack corrosion or hydrogen induced embrittlement
- In accordance with the latest European geotechnical standards
- Stock lengths 15 and 18m, other lengths on request



# GEWI® Steel Waling Bolts

Waling bolts are needed to connect a standard sheet pile wall or a modular sheet pile wall to a load distributing waling.

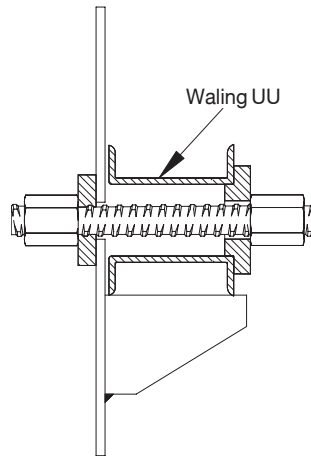
The required length of the waling bolts depends on the height of the sheet pile profile, the width of the waling, the plate thickness and the nut length.

To align sheet pile walls, waling bolts can also be prestressed.

Features and advantages:

- Continuous coarse left hand thread
- Can be cut to any length
- Weldable (for welded connections, e.g. for landside walings)

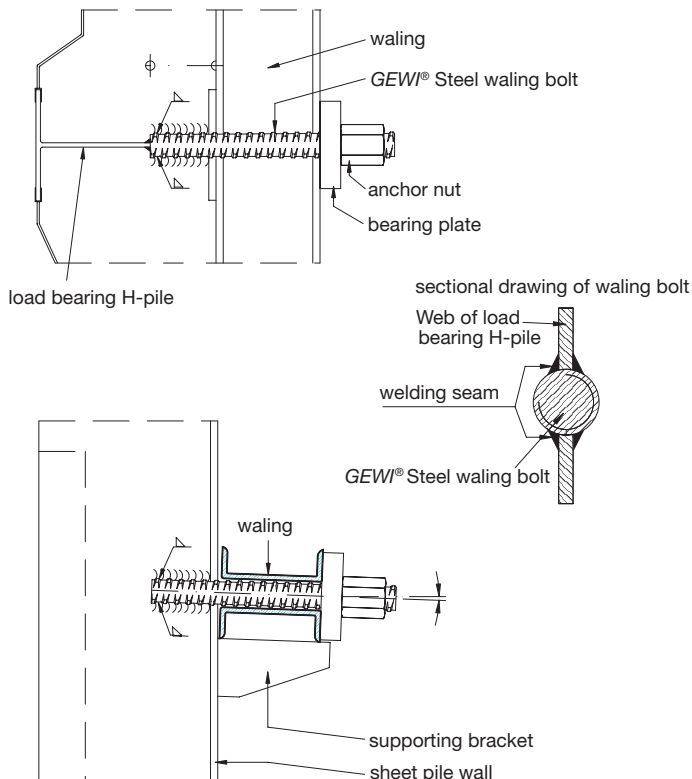
- Waling bolt in accordance with German EAU (E184)
- Front plate for sheet piling troughs of U-shaped and Z-shaped sheet piles
- Rear plate with supporting bracket
- Double bolts in sheet piling troughs of Z-shaped sheet piles
- Waling bolts shall not have bar diameters of less than 32 mm



**Dimensions of nuts for GEWI® Steel waling bolts**

Bar $\varnothing_{nom}$ [mm]	Nut	
	AF [mm]	H [mm]
32	55	60
40	65	70
50	80	85
63.5	100	115

## Example for a connection of a landside waling to a modular wall with a GEWI® Steel waling bolt welded in position (executable also with inclination)



## DYWIDAG Tie Rods with Strand Tendons

Horizontal strand tendons offer an alternative to common bar tie rods. These strand tendons have been developed for use in prestressed concrete and can also be used for marine applications, analogue to their use as unbonded post-tensioning system.

Features and advantages:

- Very high steel grades, thus low weight
- Well proven for prestressed concrete for decades
- Almost any user-defined lengths can be manufactured, due to storage and transport on coils
- High flexibility, thus easy installation also under limited work space and no danger of damage due to settlements
- Maximum utilization of the steel, due to user defined differentiation between 2 and 37 strands
- Direct influence on possible deformations due to high possible prestressing loads



### Mechanical properties

There are four different types of strands which can be used for the horizontal strand tendons for marine applications.

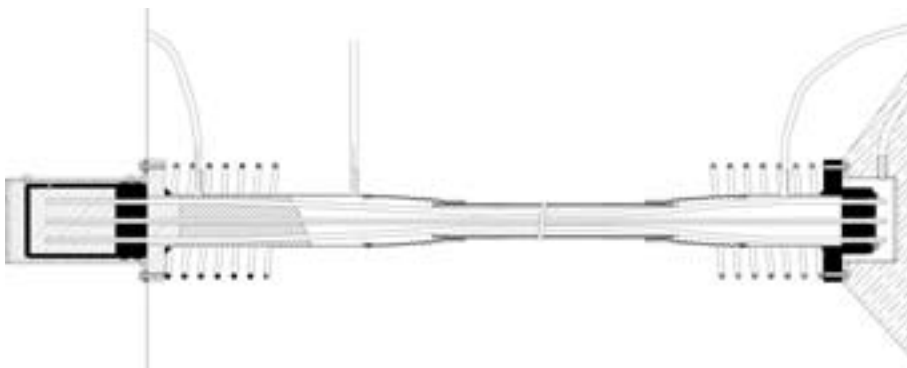
Size	Steel Grade	Cross-Sectional Area [mm <sup>2</sup> ]	0,1% Yield Load [kN]	0,2% Yield Load [kN]	Ultimate Load [kN]	Weight [kg/m]
0,6"	St 1770	140	218	220	248	1.1
0,6"	St 1860	140	230	234	260	1.1
0,62"	St 1770	150	234	236	265	1.2
0,62"	St 1860	150	246	251	279	1.2

Example: a strand tendon with 37 strands Ø 0.62", St1860, has an ultimate load of 10,323 kN.

### Corrosion protection

To ensure the durability of tie rods with horizontal strand tendons, they have to be protected against corrosion. The single strands are greased and sheathed individually.

After stressing of the horizontal strand tendons, the tendons are injected with cement grout as with permanent strand anchors in accordance with EN 1537. All exposed steel parts of the tie rod head are coated in accordance with ISO 12944-5.



**Austria**  
DYWIDAG-SYSTEMS  
INTERNATIONAL GMBH  
Wagram 49  
4061 Pasching/Linz, Austria  
Phone +43-7229-61 04 90  
Fax +43-7229-61 04 980  
E-mail: alwag@dywidag-systems.com  
www.alwag.com

DYWIDAG-SYSTEMS  
INTERNATIONAL GMBH  
Teichweg 9  
5400 Hallein, Austria  
Phone +43-6245-87 23 0  
Fax +43-6245-87 23 08 0  
E-mail: sekretariat@dywidag-systems.at  
www.dywidag-systems.at

**Belgium and Luxembourg**  
DYWIDAG-SYSTEMS  
INTERNATIONAL N.V.  
Industrieweg 25  
3190 Boortmeerbeek, Belgium  
Phone +32-16-60 77 60  
Fax +32-16-60 77 66  
E-mail: info@dywidag.be

**France**  
DSI-Artéon  
Avenue du Bicentenaire  
ZI Dagneux-BP 50053  
01122 Montluel Cedex, France  
Phone +33-4-78 79 27 82  
Fax +33-4-78 79 01 56  
E-mail: dsi.france@dywidag.fr  
www.dywidag-systems.fr

**Germany**  
DYWIDAG-SYSTEMS  
INTERNATIONAL GMBH  
Schuetzenstrasse 20  
14641 Nauen, Germany  
Phone +49 3321 44 18 32  
Fax +49 3321 44 18 18  
E-mail: suspa@dywidag-systems.com

DYWIDAG-SYSTEMS  
INTERNATIONAL GMBH  
Max-Planck-Ring 1  
40764 Langenfeld, Germany  
Phone +49 2173 79 02 0  
Fax +49 2173 79 02 20  
E-mail: suspa@dywidag-systems.com  
www.suspa-dsi.de

DYWIDAG-SYSTEMS  
INTERNATIONAL GMBH  
Germanenstrasse 8  
86343 Koenigsbrunn, Germany  
Phone +49 8231 96 07 0  
Fax +49 8231 96 07 40  
E-mail: suspa@dywidag-systems.com

DYWIDAG-SYSTEMS  
INTERNATIONAL GMBH  
Siemensstrasse 8  
85716 Unterschleissheim, Germany  
Phone +49-89-30 90 50-100  
Fax +49-89-30 90 50-120  
E-mail: dsihv@dywidag-systems.com  
www.dywidag-systems.com

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**Italy**  
DYWIT S.P.A.  
Via Grandi, 68  
20017 Mazzo di Rho (Milano), Italy  
Phone +39-02-93 46 87 1  
Fax +39-02-93 46 87 301  
E-mail: info@dywit.it

**Netherlands**  
DYWIDAG-SYSTEMS  
INTERNATIONAL B.V.  
Veilingweg 2  
5301 KM Zaltbommel, Netherlands  
Phone +31-418-57 89 22  
Fax +31-418-51 30 12  
E-mail: email@dsi-nl.nl  
www.dsi-nl.nl

**Norway**  
DYWIDAG-SYSTEMS  
INTERNATIONAL A/S  
Industrieveien 7A  
1483 Skytta, Norway  
Phone +47-67-06 15 60  
Fax +47-67-06 15 59  
E-mail: manager@dsi-dywidag.no

**Portugal**  
DYWIDAG-SYSTEMS  
INTERNATIONAL LDA  
Rua do Polo Sul  
Lote 1.01.1.1 - 2B  
1990-273 Lisbon, Portugal  
Phone +351-21-89 22 890  
Fax +351-21-89 22 899  
E-mail: dsi.lisboa@dywidag.pt

**Spain**  
DYWIDAG SISTEMAS  
CONSTRUCTIVOS, S.A.  
Avenida de la Industria, 4  
Pol. Ind. La Cantuena  
28947 Fuenlabrada (MADRID), Spain  
Phone +34-91-642 20 72  
Fax +34-91-642 27 10  
E-mail: dywidag@dywidag-sistemas.com  
www.dywidag-sistemas.com

**United Kingdom**  
DYWIDAG-SYSTEMS  
INTERNATIONAL LTD.  
Northfield Road  
Southam, Warwickshire  
CV47 0FG, Great Britain  
Phone +44-1926-81 39 80  
Fax +44-1926-81 38 17  
E-mail: sales@dywidag.co.uk  
www.dywidag-systems.com/uk

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