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to Article 29 of the Regulation (EU)
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MEMBER OF EOTA



European Technical Assessment ETA-13/0523 of 2018/04/03

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S

Trade name of the construction product:

GH screws and GH ring shanked nails

Product family to which the above construction product belongs:

Nails and screws for use in nailing plates in timber structures

Manufacturer:

GH Baubeschläge GmbH
Austrasse 34
D-73235 Weilheim / Teck
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Internet: www.holzverbinder.de

Manufacturing plant:

GH Baubeschläge GmbH
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This European Technical Assessment contains:

12 pages including 2 annexes which form an integral part of the document

This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:

EAD 130033-00-0603 - Nails and screws for use in nailing plates in timber structures

This version replaces:

The previous ETA with the same number issued on 2013-05-28 and expiry on 2018-05-28

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II SPECIFIC PART OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical description of product and intended use

Technical description of the product

GH Connector Nails are made from cold formed steel thread. The shank is cylindrical and made with annular rings on part of the shank.

GH Connector screws are self-tapping screws to be used in single shear steel-to-timber connections in timber structures. GH Connector screws shall be threaded over the full length.

The nails and screws shall be produced from carbon steel wire. Where corrosion protection is required, the material or coating shall be declared in accordance with the relevant specification given in Annex A of EN 14592. See Annex A for drawings including material and dimensions of the nails covered by this ETA.

Geometry

The range covers nails with 2 different diameters; 4,0 mm and 6,0 mm and screws with a diameter of 5,0 mm. For nails with a diameter of 4 mm the length varies from 35 mm to 100 mm. For nails with a diameter of 6 mm the length varies from 60 mm to 100 mm. These nails are all ring shanked nails. For screws with a diameter of 5,0 mm the length varies from 25 mm to 70 mm. Other dimensions appear from Annex A.

No breaking of screws shall be observed at a bend angle, α , of less than $(45/d^{0.7} + 20)$ degrees.

2 Specification of the intended use in accordance with the applicable EAD

The nails are used for steel and aluminium nailing plates and three-dimensional steel and aluminium nailing plates up to 6 mm thick for connections in load bearing timber structures with members of for example solid timber, glued laminated timber, cross laminated timber and similar glued members of wood-based structural members, where requirements for mechanical resistance and stability and safety in use in the sense of the Basic Works Requirements 1 and 4 of Regulation (EU) 305/2011 shall be fulfilled.

Steel plates shall only be located on the side of the nail or screw head. The following wood-based panels may be used for GH nails or screws:

- Plywood according to EN 636 or ETA
- Solid wood panels according to EN 13353 13353 and EN 13986 and cross laminated timber according to ETA
- Laminated Veneer Lumber according to EN 14374 or ETA
- FST according to ETA-14/0354
- Engineered wood products according to ETA if the ETA of the product includes provisions for the use of self-tapping screws, the provisions of the ETA of the engineered wood product apply

The following wood-based panels may be used only for GH screws:

- Particleboard of technical classes P4 to P7 according to EN 312 or ETA
- Oriented Strand Board OSB/3 and OSB/4 according to EN 300 or ETA

With the exception of Beech LVL or FST according to ETA-14/0354, the nails and screws shall be driven into the wood without pre-drilling.

The design of the connections shall be based on the characteristic load-carrying capacities of the nails or screws. The design capacities shall be derived from the characteristic capacities in accordance with Eurocode 5 or an appropriate national code.

The nails and screws are intended for use for connections subject to static or quasi static loading.

The scope of the screws regarding resistance to corrosion shall be defined according to national provisions that apply at the installation site considering environmental conditions. Section 3.10 of this ETA contains the corrosion protection for GH Connector Nails and screws made from carbon steel.

The provisions made in this European Technical Assessment are based on an assumed intended working life of the GH Nails and GH Screws of 50 years.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or Assessment Body, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

| Characteristic | Assessment of characteristic |
|--|--|
| 3.1 Mechanical resistance and stability*) (BWR1) | |
| Withdrawal and lateral load-carrying capacity | See Annex B |
| Tensile capacity | Characteristic value $f_{\text{tens,k}}$: GH Connector nail d = 4,0 mm: 6,9 kN GH Connector nail d = 6,0 mm: 11,4 kN GH Connector screw d = 5,0 mm: 8,5 kN |
| Torsional strength of screws | Characteristic value $f_{\text{tor,k}}$: GH Connector screw d = 5,0 mm: 5,0 Nm 68 Nm |
| Insertion moment | Ratio of the characteristic torsional strength to the mean insertion moment of GH Connector screws: $f_{\text{tor,k}} / R_{\text{tor,mean}} \geq 1,5$ |
| 3.2 Safety in case of fire (BWR2) | |
| Reaction to fire | The nails and screws are made from steel classified as Euroclass A1 in accordance with EN 13501-1 and Commission Delegated Regulation 2016/364 |
| 3.3 Hygiene, health and the environment (BWR3) | |
| Influence on air quality | The product does not contain/release dangerous substances specified in TR 034, dated March 2012 (**) |
| 3.8 General aspects related to the performance of the product | The nails and screws have been assessed as having satisfactory durability and serviceability when used in timber structures using the timber species described in Eurocode 5 and subject to the conditions defined by service class 1 and 23 |

*) See additional information in section 3.8 – 3.9.

**) In addition to the specific clauses relating to dangerous substances contained in this European Technical Assessment, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

3.9 Mechanical resistance and stability

The load-carrying capacities for GH Connector nails and screws are applicable to the wood-based materials mentioned in paragraph 1 even though the term timber has been used in the following.

The characteristic lateral load-carrying capacities and the characteristic axial withdrawal capacities of GH Connector nails and screws should be used for designs in accordance with Eurocode 5 or an appropriate national code. The formulas for the load-carrying capacities are restricted to characteristic densities of the non-predrilled wood-based materials up to 480 kg/m³ for GH Connector nails except GH Connector nails 4,0x35 and up to 600 kg/m³ for GH Connector screws. Even though the non-predrilled wood-based material may have a larger density, this must not be used in the formulas. For predrilled wood-based members, the characteristic density is limited to a maximum of 730 kg/m³.

The capacities stated below are applicable to connections with metal plates.

The inner thread diameter d_1 of the screws or the diameter of the nails shall be greater than the maximum width of the gaps in the layers of the cross laminated timber. The tip of the screw shall not be used in the withdrawal design of the screws when inserted in particleboards or OSB. The screw tip must penetrate the whole panel thickness.

ETA's for structural members or wood-based panels must be considered where applicable.

3.9.1 GH Connector nails

Withdrawal capacity

The characteristic withdrawal capacity, $F_{ax,Rk}$, of a GH Connector nail in non-predrilled members shall be calculated from:

$$F_{ax,Rk} = 7,5 \cdot d \cdot \ell_{ef} \cdot \left(\frac{\rho_k}{350} \right)^{0,8} \quad [N]$$

For 4,0 mm nails in non-predrilled Beech LVL or FST according to ETA-14/0354 the characteristic withdrawal capacity, $F_{ax,Rk}$, of a GH Connector nail with a maximum penetration length of 34 mm may be calculated from:

$$F_{ax,Rk} = 25 \cdot d \cdot \ell_{ef} \cdot \left(\frac{\rho_k}{730} \right)^{0,8} \quad [N]$$

For 4,0 mm nails in predrilled Beech LVL or FST according to ETA-14/0354 the characteristic withdrawal capacity, $F_{ax,Rk}$, of a GH Connector nail may be calculated from:

$$F_{ax,Rk} = 17 \cdot d \cdot \ell_{ef} \cdot \left(\frac{\rho_k}{730} \right)^{0,8} \quad [N]$$

Where:

- ℓ_{ef} is the nominal threaded length of the nail including the point in mm,
- d is the nominal diameter of the nail in mm,
- ρ_k is the characteristic timber density, $\rho_k \leq 480$ kg/m³ for nails with a penetration length of more than 34 mm in non-predrilled members

Lateral capacity

The characteristic lateral load-carrying capacity of a GH Connector nail in a metal plate shall be calculated from:

$$F_{v,Rk} = \min \left\{ \begin{array}{l} 0,4 \cdot f_{h,k} \cdot t_1 \cdot d \\ 1,15 \cdot \sqrt{2 \cdot M_{y,Rk} \cdot f_{h,k} \cdot d} + \frac{F_{ax,Rk}}{2} \end{array} \right. \quad [N]$$

for thin metal plates, and

$$F_{v,Rk} = \min \left\{ \begin{array}{l} f_{h,k} \cdot t_1 \cdot d \\ f_{h,k} \cdot t_1 \cdot d \left[\sqrt{2 + \frac{4 \cdot M_{y,Rk}}{f_{h,k} \cdot d \cdot t_1^2}} - 1 \right] + \frac{F_{ax,Rk}}{2} \\ 2,3 \cdot \sqrt{M_{y,Rk} \cdot f_{h,k} \cdot d} + \frac{F_{ax,Rk}}{2} \end{array} \right. \quad [N]$$

for thick metal plates.

For densities exceeding 480 kg/m³ thin metal plates must always be assumed and $F_{ax,Rk}$ shall be determined as:

$$F_{ax,Rk} = \min \left\{ f_{ax,k} \cdot d \cdot \ell_{ef}; f_{tens,k} - \sqrt{6 \cdot M_{y,k} \cdot f_{h,k} \cdot d} \right\}$$

Where

$f_{h,k}$ is the characteristic embedding strength [MPa] of the timber or wood-based panel according to EN 1995-1-1.

For 4,0 mm nails in Beech LVL or FST according to ETA-14/0354 the characteristic embedding strength may be calculated from

$$f_{h,k} = \frac{75}{\left(0,7 \cdot \sin^2 \alpha + \cos^2 \alpha \right) \cdot \left(1,2 \cdot \cos^2 \beta + \sin^2 \beta \right)}$$

α is the angle between load and grain direction,

β is the angle between the nail axis and the LVL's wide face,

t_1 is the minimum of the nail penetration length including the tip or the timber thickness [mm],

d is the nominal nail diameter [mm],

$M_{y,Rk}$ is the characteristic nail yield moment [Nmm],

$f_{tens,k}$ is the characteristic nail tensile strength [N];

Yield moment

The characteristic yield moment $M_{y,Rk}$, of a GH Connector Nail is stated in Table B.2 in Annex B depending on the nail diameter.

Thick metal plates may be assumed for the following plate thicknesses for nails in wood-based materials with a characteristic density up to 480 kg/m³:

GH Connector nail Ø 4,0 mm: $t_{thick} \geq 1,5$ mm

GH Connector nail Ø 6,0 mm: $t_{thick} \geq 3,0$ mm

The following plate thicknesses apply for thin metal plates for nails in wood-based materials with a characteristic density up to 480 kg/m³:

GH Connector nail Ø 4,0 mm: $t_{thin} \geq 0,9$ mm

GH Connector nail Ø 6,0 mm: $t_{thin} \geq 2,0$ mm

Minimum metal plate thicknesses are:

GH Connector nail Ø 4,0 mm:

$$t_{min} = \max \left\{ 0,9 \text{ mm}; \frac{F_{v,Rk}}{2 \cdot d \cdot f_{u,k}} \right\}$$

GH Connector nail Ø 6,0 mm:

$$t_{min} = \max \left\{ 2,0 \text{ mm}; \frac{F_{v,Rk}}{2 \cdot d \cdot f_{u,k}} \right\}$$

Where

$f_{u,k}$ is the characteristic tensile strength [MPa] of the metal plate.

For plate thicknesses between minimum thickness t_{min} and the thickness t_{thick} linear interpolation may be used.

Combined laterally and axially loaded nails

For nailed connections subjected to a combination of axial and lateral load, the following expression should be satisfied:

$$\left(\frac{F_{ax,Ed}}{F_{ax,Rd}} \right)^2 + \left(\frac{F_{v,Ed}}{F_{v,Rd}} \right)^2 \leq 1$$

where

$F_{ax,Ed}$ axial design load of the nail
 $F_{v,Ed}$ lateral design load of the nail
 $F_{ax,Rd}$ design load-carrying capacity of an axially loaded nail
 $F_{v,Rd}$ design load-carrying capacity of a laterally loaded nail

3.9.2 GH Connector screws

Withdrawal capacity

The characteristic withdrawal capacity, $F_{ax,Rk}$, of a GH Connector screw in non-predrilled members shall be calculated from:

$$F_{ax,Rk} = 10,5 \cdot d \cdot \ell_{ef} \cdot \left(\frac{\rho_k}{350} \right)^{0,8} \quad [\text{N}]$$

For screws in the wide face of predrilled Beech LVL or FST according to ETA-14/0354 the characteristic withdrawal capacity, $F_{ax,Rk}$, of a GH Connector screw may be calculated from:

$$F_{ax,Rk} = 35 \cdot d \cdot \ell_{ef} \cdot \left(\frac{\rho_k}{730} \right)^{0,8} \quad [\text{N}]$$

For screws in the edge face of LVL or FST according to ETA-14/0354 the characteristic withdrawal capacity shall be reduced by one third.

Where:

ℓ_{ef} is the nominal threaded length of the screw including the point in mm,

d is the nominal diameter of the screw in mm,

ρ_k is the characteristic timber density,

$\rho_k \leq 730$ kg/m³; for OSB and particleboard,

$\rho_k = 450$ kg/m³ shall be assumed.

Lateral capacity

The characteristic lateral load-carrying capacity of a GH Connector screw in a metal plate shall be calculated from:

$$F_{v,Rk} = \min \left\{ \begin{array}{l} 2 \cdot f_{h,k} \cdot t_1 \\ 257 \cdot \sqrt{f_{h,k}} + \frac{F_{ax,Rk}}{4} \end{array} \right. \quad [\text{N}]$$

for thin metal plates with $t_{thin} = 1,5$ mm, and

$$F_{v,Rk} = \min \left\{ \begin{array}{l} f_{h,k} \cdot t_1 \cdot 5 \\ f_{h,k} \cdot t_1 \cdot 5 \left[\sqrt{2 + \frac{4000}{f_{h,k} \cdot t_1^2}} - 1 \right] + \frac{F_{ax,Rk}}{4} \\ 364 \cdot \sqrt{f_{h,k}} + \frac{F_{ax,Rk}}{4} \end{array} \right. \quad [\text{N}]$$

for thick metal plates with $t_{thick} \geq 2,0$ mm.

Minimum metal plate thicknesses are:

$$t_{min} = \max \left\{ 1,5 \text{ mm}; \frac{F_{v,Rk}}{2 \cdot d \cdot f_{u,k}} \right\}$$

For densities exceeding 480 kg/m³ thin metal plates must always be assumed and $F_{ax,Rk}$ shall be determined as:

$$F_{ax,Rk} = \min \left\{ f_{ax,k} \cdot d \cdot \ell_{ef}; f_{tens,k} - \sqrt{6 \cdot M_{y,k} \cdot f_{h,k} \cdot d} \right\}$$

Where

$f_{h,k}$ is the characteristic embedding strength [MPa] of the timber or wood-based panel according to EN 1995-1-1,

For screws in Beech LVL or FST according to ETA-14/ 0354 the characteristic embedding strength may be calculated from

$$f_{h,k} = \frac{47}{(0,7 \cdot \sin^2 \alpha + \cos^2 \alpha) \cdot (1,2 \cdot \cos^2 \beta + \sin^2 \beta)}$$

- α is the angle between load and grain direction,
 β is the angle between the nail axis and the LVL's wide face,
 t_1 is the minimum of the screw penetration length including the tip or the timber thickness [mm],
 $f_{tens,k}$ is the characteristic screw tensile strength [N].

For plate thicknesses between minimum thickness t_{min} and the thickness t_{thick} linear interpolation may be used.

Combined laterally and axially loaded screws

For screwed connections subjected to a combination of axial and lateral load, the following expression should be satisfied:

$$\left(\frac{F_{ax,Ed}}{F_{ax,Rd}} \right)^2 + \left(\frac{F_{v,Ed}}{F_{v,Rd}} \right)^2 \leq 1$$

where

- $F_{ax,Ed}$ axial design load of the screw
 $F_{v,Ed}$ lateral design load of the screw
 $F_{ax,Rd}$ design load-carrying capacity of an axially loaded screw
 $F_{v,Rd}$ design load-carrying capacity of a laterally loaded screw

3.10 Aspects related to the performance of the product

3.10.1 Corrosion protection in service class 1 and 2.

The GH Connector nails and screws are produced from carbon wire. They are brass-plated, nickel-plated bronze finished or electrogalvanised and e.g. yellow or blue chromated. The minimum thickness of the zinc coating is 7 μ m.

3.11 General aspects related to the fitness for use of the product

The nails and screws are manufactured in accordance with the provisions of this European Technical Assessment using the manufacturing processes as identified in the inspection of the plant by the notified inspection body and laid down in the technical documentation.

The installation shall be carried out in accordance with Eurocode 5 or an appropriate national code unless otherwise is defined in the following. Instructions from GH Baubeschlage GmbH should be considered for installation.

For structural members according to ETA's the terms of the ETA's must be considered.

For steel-to-timber connections with Beech LVL or FST according to ETA-14/0354 GH Connector nails with diameter 6 mm must not be used.

GH Connector nails with a penetration length exceeding 34 mm or GH Connector screws shall be driven into Beech LVL or FST according to ETA-14/0354 after predrilling with a drill hole diameter of 3,5 mm.

4 Attestation and verification of constancy of performance (AVCP)

4.1 AVCP system

According to the decision 97/638/EC of the European Commission¹, as amended, the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011) is 2+.

5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD

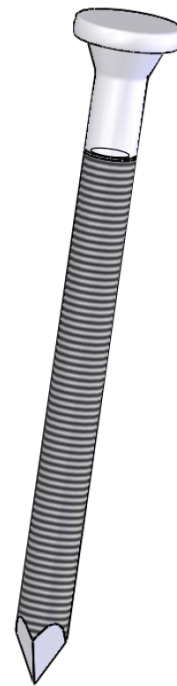
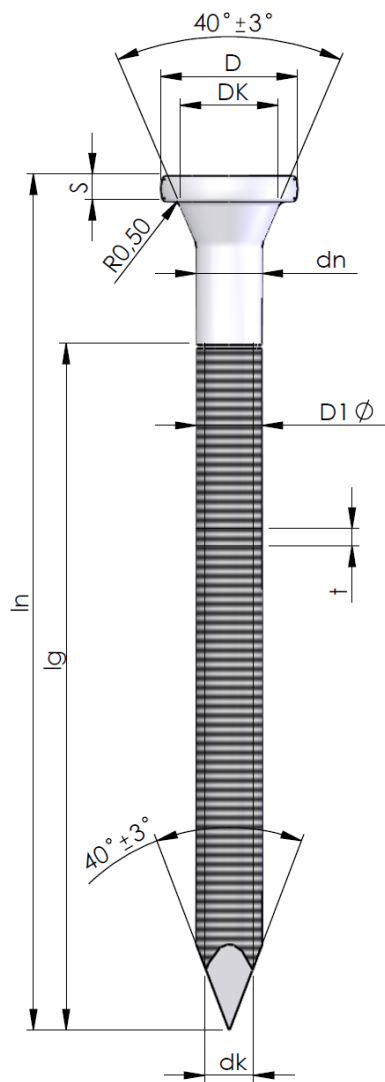
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark prior to CE marking.

Issued in Copenhagen on 2018-04-03 by



Thomas Bruun
Managing Director, ETA-Danmark

Annex A
Drawings of GH Connector nails and screws

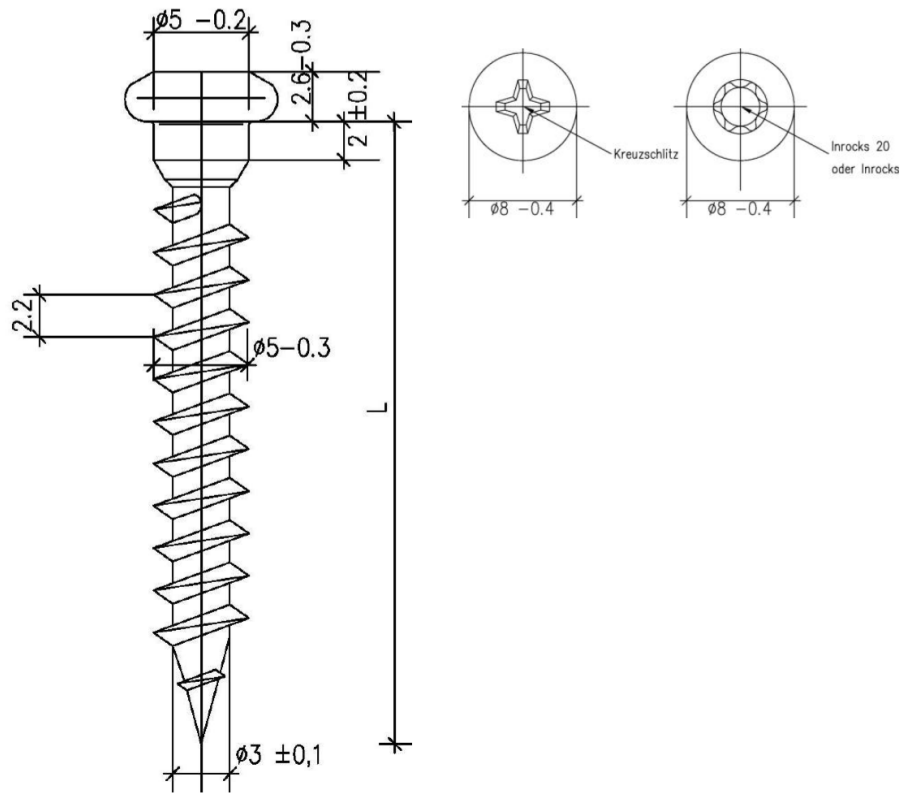


Werkstoff: C9D nach EN 10016
Zugfestigkeit: $F_u > 600 \text{ N/mm}^2$
Oberfläche: $> 7 \mu\text{m}$

Werk

| Abmessung | l_n (mm) | l_g (mm) | ϕ_{dn} (mm) | ϕ_{d1} (mm) | ϕ_{dk} (mm) | t (mm) | ϕ_D (mm) | ϕ_{DK} (mm) | S (mm) |
|-----------|------------|------------|------------------|------------------|------------------|--------|---------------|------------------|--------|
| 4,0x35 | 35 | 25 | 4,0 | 4,4 | 3,6 | 1,3 | 8,0 | 5,4 | 1,4 |
| 4,0x40 | 40 | 30 | 4,0 | 4,4 | 3,6 | 1,3 | 8,0 | 5,4 | 1,4 |
| 4,0x50 | 50 | 40 | 4,0 | 4,4 | 3,6 | 1,3 | 8,0 | 5,4 | 1,4 |
| 4,0x60 | 60 | 50 | 4,0 | 4,4 | 3,6 | 1,3 | 8,0 | 5,4 | 1,4 |
| 4,0x75 | 75 | 60 | 4,0 | 4,4 | 3,6 | 1,3 | 8,0 | 5,4 | 1,4 |
| 4,0x100 | 100 | 80 | 4,0 | 4,4 | 3,6 | 1,3 | 8,0 | 5,4 | 1,4 |
| 6,0x60 | 60 | 50 | 6,0 | 6,5 | 5,5 | 1,5 | 12,0 | 7,5 | 2 |
| 6,0x80 | 80 | 70 | 6,0 | 6,5 | 5,5 | 1,5 | 12,0 | 7,5 | 2 |
| 6,0x100 | 100 | 80 | 6,0 | 6,5 | 5,5 | 1,5 | 12,0 | 7,5 | 2 |

| | | | | |
|-----------------------------------|---------------------------|------------|------------|----------|
| TOLERANZEN: LINEAR: WINKEL: | GH Baubeschläge | OBERFLÄCHE | WERKSTOFF: | ÄNDERUNG |
|-----------------------------------|---------------------------|------------|------------|----------|



Werkstoff: C20D nach EN 10016
 Oberfläche $\geq 7 \mu\text{m}$
 oder
 Werksto
 1.4401; :

| Abmessungen [mm] | | | |
|------------------|---|----|---------------|
| \emptyset | | L | Tol. |
| 5,0 | x | 25 | +2,0/ -1,0 |
| 5,0 | x | 35 | |
| 5,0 | x | 40 | |
| 5,0 | x | 50 | |
| 5,0 | x | 60 | |
| 5,0 | x | 70 | |



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GH Schraube
 \emptyset 5,0 mm

Annex B

Characteristic capacities for GH Connector nails and GH Connector screws

Table B.1 Characteristic capacities for GH Connector nails

Characteristic capacities for a characteristic density of the timber members as indicated in Table B.1. The nail shall be driven completely into the wood or wood based material, which shall have a thickness of at least the length of the nail. The values given in Table B.1 presuppose that the threaded part of the nail is completely embedded in the wood or wood based material.

| Nail non predrilled | C18 $\rho_k = 320 \text{ kg/m}^3$ | | | C24/GL24c $\rho_k = 350 \text{ kg/m}^3$ | | | C30/GL24h/GL28c $\rho_k = 380 \text{ kg/m}^3$ | | | GL28h/GL32c $\rho_k = 410 \text{ kg/m}^3$ | | | Kerto LVL $\rho_k = 480 \text{ kg/m}^3$ | | |
|--------------------------|--|------------------------------|------|--|------------------------------|------|--|------------------------------|------|--|------------------------------|------|--|------------------------------|------|
| | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] thin thick | | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] thin thick | | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] thin thick | | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] thin thick | | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] thin thick | |
| 4,0 x 35 | 698 | 945 | 1574 | 750 | 1033 | 1691 | 801 | 1122 | 1807 | 851 | 1210 | 1923 | 966 | 1417 | 2191 |
| 4,0 x 40 | 838 | 1083 | 1755 | 900 | 1185 | 1890 | 961 | 1286 | 2025 | 1021 | 1388 | 2159 | 1159 | 1625 | 2469 |
| 4,0 x 50 | 1117 | 1360 | 2102 | 1200 | 1488 | 2214 | 1282 | 1615 | 2322 | 1362 | 1743 | 2428 | 1545 | 2040 | 2662 |
| 4,0 x 60 | 1396 | 1637 | 2241 | 1500 | 1790 | 2364 | 1602 | 1944 | 2483 | 1702 | 2086 | 2598 | 1931 | 2302 | 2855 |
| 4,0 x 75 | 1675 | 1929 | 2381 | 1800 | 2041 | 2514 | 1922 | 2150 | 2643 | 2043 | 2257 | 2768 | 2317 | 2495 | 3049 |
| 4,0 x 100 | 2234 | 2208 | 2660 | 2400 | 2341 | 2814 | 2563 | 2471 | 2963 | 2724 | 2597 | 3109 | 3090 | 2881 | 3435 |
| 6,0 x 60 | 2094 | 2134 | 3722 | 2250 | 2334 | 4010 | 2403 | 2534 | 4296 | 2554 | 2734 | 4581 | 2897 | 3201 | 5172 |
| 6,0 x 80 | 2932 | 2870 | 4507 | 3150 | 3139 | 4755 | 3364 | 3408 | 4995 | 3575 | 3677 | 5229 | 4056 | 4304 | 5752 |
| 6,0 x 100 | 3351 | 3605 | 4716 | 3600 | 3943 | 4980 | 3845 | 4265 | 5236 | 4086 | 4476 | 5484 | 4635 | 4951 | 6041 |
| Nail in Beech LVL or FST | $\rho_k = 730 \text{ kg/m}^3$ Non-predrilled Wide face | | | $\rho_k = 730 \text{ kg/m}^3$ Non-predrilled Edge face | | | $\rho_k = 730 \text{ kg/m}^3$ Predrilled Wide face | | | $\rho_k = 730 \text{ kg/m}^3$ Predrilled Edge face | | | | | |
| | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] 0° 90° | | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] 0° 90° | | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] 0° 90° | | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] 0° 90° | | | | |
| 4,0 x 35 | 2500 | 3521 | 4475 | 2500 | 3323 | 4140 | 1700 | 3121 | 4275 | 1700 | 2923 | 3940 | | | |
| 4,0 x 40 | - | - | - | - | - | - | 2040 | 3291 | 4360 | 2040 | 3093 | 4025 | | | |
| 4,0 x 50 | - | - | - | - | - | - | 2720 | 3631 | 4530 | 2720 | 3433 | 4195 | | | |
| 4,0 x 60 | - | - | - | - | - | - | 2812 | 3677 | 4553 | 3168 | 3657 | 4307 | | | |
| 4,0 x 75 | - | - | - | - | - | - | 2812 | 3677 | 4553 | 3168 | 3657 | 4307 | | | |
| 4,0 x 100 | - | - | - | - | - | - | 2812 | 3677 | 4553 | 3168 | 3657 | 4307 | | | |

$F_{ax,Rk}$ Characteristic withdrawal (axial) capacity per nail
Values for other densities (ρ_k) up to 480 kg/m^3 may be calculated by multiplying the values for C24 with $(\rho_k/350)^{0,8}$

$F_{v,Rk}$ Characteristic load-carrying capacity per shear plane per nail
Thin refers to a plate thickness = 0,9 mm for $d = 4,0 \text{ mm}$ and a plate thickness = 2,0 mm for $d = 6,0 \text{ mm}$
Thick refers to a plate thickness = 1,5 mm for $d = 4,0 \text{ mm}$ and a plate thickness = 3,0 mm for $d = 6,0 \text{ mm}$
0° or 90°, respectively, refer to the load-grain angle

In non-predrilled Beech LVL or FST according to ETA-14/0354 the characteristic load-carrying capacities for nails 4,0 x 35 may be used for longer nails if the penetration length does not exceed 34 mm.

Table B.2 Characteristic yield moments for GH Connector nails

| Nail diameter [mm] | $M_{y,Rk}$ [Nmm] |
|--------------------|------------------|
| 4,0 | 6500 |
| 6,0 | 19000 |

Table B.3 Characteristic capacities for GH Connector screws

Characteristic capacities for a characteristic density of the timber members as indicated in Table B.1. The screw shall be driven completely into the wood or wood based material, which shall have a thickness of at least the length of the screw. The values given in Table B.1 presuppose that the threaded part of the screw is completely embedded in the wood or wood based material.

| Screw non-predrilled | C18 $\rho_k = 320 \text{ kg/m}^3$ | | | C24/GL24c $\rho_k = 350 \text{ kg/m}^3$ | | | C30/GL24h/GL28c $\rho_k = 380 \text{ kg/m}^3$ | | |
|--|--|----------------|-------|--|----------------|-------|--|----------------|-------|
| | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] | | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] | | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] | |
| | | thin | thick | | thin | thick | | thin | thick |
| 5,0 x 25 | 1026 | 761 | 1319 | 1103 | 832 | 1412 | 1177 | 904 | 1504 |
| 5,0 x 35 | 1515 | 1085 | 1694 | 1628 | 1186 | 1826 | 1738 | 1288 | 1958 |
| 5,0 x 40 | 1759 | 1247 | 1896 | 1890 | 1364 | 2003 | 2019 | 1480 | 2099 |
| 5,0 x 50 | 2248 | 1571 | 2025 | 2415 | 1686 | 2134 | 2579 | 1772 | 2239 |
| 5,0 x 60 | 2737 | 1719 | 2147 | 2940 | 1817 | 2265 | 3140 | 1913 | 2380 |
| 5,0 x 70 | 3225 | 1841 | 2270 | 3465 | 1948 | 2397 | 3701 | 2053 | 2520 |
| Screw non-predrilled | GL28h/GL32c $\rho_k = 410 \text{ kg/m}^3$ | | | Kerto LVL $\rho_k = 480 \text{ kg/m}^3$ | | | Micro=Lam LVL $\rho_k = 600 \text{ kg/m}^3$ | | |
| | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] | | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] | | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] | |
| | | thin | thick | | thin | thick | | thin | thick |
| 5,0 x 25 | 1251 | 975 | 1596 | 1419 | 1141 | 1808 | 1697 | 1427 | 2169 |
| 5,0 x 35 | 1847 | 1390 | 2089 | 2095 | 1627 | 2316 | 2505 | 2034 | 2630 |
| 5,0 x 40 | 2145 | 1597 | 2193 | 2433 | 1870 | 2401 | 2909 | 2144 | 2731 |
| 5,0 x 50 | 2741 | 1856 | 2342 | 3109 | 2045 | 2569 | 3717 | 2346 | 2933 |
| 5,0 x 60 | 3337 | 2005 | 2491 | 3785 | 2214 | 2738 | 4525 | 2548 | 3135 |
| 5,0 x 70 | 3933 | 2154 | 2639 | 4461 | 2383 | 2907 | 5333 | 2750 | 3337 |
| Screw predrilled Beech LVL or FST | $\rho_k = 730 \text{ kg/m}^3$ Wide face | | | $\rho_k = 730 \text{ kg/m}^3$ Edge face | | | | | |
| | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] | | $F_{ax,Rk}$ [N] | $F_{v,Rk}$ [N] | | | | |
| | | 0° | 90° | | 0° | 90° | | | |
| 5,0 x 25 | 3675 | 2162 | 3026 | 2450 | 1802 | 2536 | | | |
| 5,0 x 35 | 5425 | 3102 | 3463 | 3617 | 2513 | 2828 | | | |
| 5,0 x 40 | 5845 | 3224 | 3568 | 4200 | 2659 | 2973 | | | |
| 5,0 x 50 | 5845 | 3224 | 3568 | 5367 | 2951 | 3265 | | | |
| 5,0 x 60 | 5845 | 3224 | 3568 | 6076 | 3128 | 3443 | | | |
| 5,0 x 70 | 5845 | 3224 | 3568 | 6076 | 3128 | 3443 | | | |

$F_{ax,Rk}$ Characteristic withdrawal (axial) capacity per screw
Values for other densities (ρ_k) up to 600 kg/m³ may be calculated by multiplying the values for C24 with $(\rho_k/350)^{0,8}$

$F_{v,Rk}$ Characteristic load-carrying capacity per shear plane per screw
Thin refers to a plate thickness = 1,5 mm
Thick refers to a plate thickness = 2,0 mm
0° or 90°, respectively, refer to the load-grain angle