

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

**ETA-13/0536
of 20 February 2018**

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

E-Jet screws

Product family
to which the construction product belongs

Self-tapping screws for use in timber constructions

Manufacturer

Verbindungselemente Engel GmbH
Weltestraße 2+4
88250 Weingarten
DEUTSCHLAND

Manufacturing plant

74437, 74437-01, 74437-02, 74437-03

This European Technical Assessment
contains

11 pages including 3 annexes which form an integral part
of this assessment

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

EAD 130118-00-0603

This version replaces

ETA-13/0536 issued on 27 June 2013

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Specific part

1 Technical description of the product

E-Jet screws are made from special carbon steel. The screws are hardened. The screws have a corrosion protection according to Annex A.2.6 and an antifriction coating. The outer thread diameter is not less than 3.0 mm and not greater than 6.0 mm. The overall length of the screws is ranging from 20 mm to 300 mm. Further dimensions are shown in Annex 3.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the E-Jet screws are used in compliance with the specifications and conditions given in Annex 1 and 2.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the E-Jet screws of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, 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

3.1 Mechanical resistance and stability (BWR 1)

| Essential characteristic | Performance |
|--|-------------------------|
| Dimensions | See Annex 3 |
| Characteristic yield moment | See Annex 2 |
| Characteristic withdrawal parameter | See Annex 2 |
| Characteristic head pull-through parameter | See Annex 2 |
| Characteristic tensile strength | See Annex 2 |
| Characteristic yield strength | No performance assessed |
| Characteristic torsional strength | See Annex 2 |
| Insertion moment | See Annex 2 |
| Spacing, end and edge distances of the screws and minimum thickness of the wood based material | See Annex 2 |
| Slip modulus for mainly axially loaded screws | See Annex 2 |

English translation prepared by DIBt

3.2 Safety in case of fire (BWR 2)

| Essential characteristic | Performance |
|--------------------------|--------------|
| Reaction to fire | Euroclass A1 |

3.3 Safety and accessibility in use (BWR 4)

Same as BWR 1

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No. 130118-00-0603, the applicable European legal act is: 97/176/EC.
The system to be applied is: 3

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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 20 February 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Dewitt

Annex 1 Specifications of intended use

A.1.1 Use of the E-Jet screws only for:

- Static and quasi-static loads

A.1.2 Base materials

The screws are used for connections in load bearing timber structures between wood-based members or between those members and steel members:

- Solid timber (softwood) according to EN 14081-1¹,
- Glued laminated timber (softwood) according to EN 14080²,
- Laminated veneer lumber LVL of softwood according to EN 14374³, arrangement of the screws only perpendicular to the plane of the veneers,
- Glued solid timber (softwood) according to EN 14080 or national provisions that apply at the installation site,
- Cross-laminated timber (softwood) according to European Technical Approvals/Assessments or national provisions that apply at the installation site.

The screws may be used for connecting the following wood-based panels to the timber members mentioned above:

- Plywood according to EN 636⁴ and EN 13986⁵,
- Oriented Strand Board, OSB according to EN 300⁶ and EN 13986,
- Particleboard according to EN 312⁷ and EN 13986,
- Fibreboards according to EN 622-2⁸, EN 622-3⁹ and EN 13986,
- Cement-bonded particle boards according to EN 634-2¹⁰ and EN 13986,
- Solid-wood panels according to EN 13353¹¹ and EN 13986.

Wood-based panels shall only be arranged on the side of the screw head.

electronic copy of the eta by dibt: eta-13/0536

| | | |
|----|-------------------------|--|
| 1 | EN 14081-1:2005+A1:2011 | Timber structures – Strength graded structural timber with rectangular cross section – Part 1: General requirements |
| 2 | EN 14080:2013 | Timber structures - Glued laminated timber and glued solid timber - Requirements |
| 3 | EN 14374:2004 | Timber structures - Structural laminated veneer lumber - Requirements |
| 4 | EN 636:2012+A1:2015 | Plywood - Specifications |
| 5 | EN 13986:2004+A1:2015 | Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking |
| 6 | EN 300:2006 | Oriented strand boards (OSB) – Definition, classification and specifications |
| 7 | EN 312:2010 | Particleboards - Specifications |
| 8 | EN 622-2:2004 | Fibreboards – Specifications – Part 2: Requirements for hardboards |
| 9 | EN 622-3:2004 | Fibreboards - Specifications - Part 3: Requirements for medium boards |
| 10 | EN 634-2:2007 | Cement-bonded particleboards – Specifications – Part 2: Requirements for OPC bonded particleboards for use in dry, humid and external conditions |
| 11 | EN 13353:2008+A1:2011 | Solid wood panels (SWP) – Requirements |

| | |
|--------------------------------|---------|
| E-Jet screws | Annex 1 |
| Specifications of intended use | |

A.1.3 Use Conditions (environmental conditions)

The corrosion protection of the E-Jet screws is specified in Annex A.2.6. With regards to the use and the environmental conditions, the national provisions of the place of installation apply.

A.1.4 Installation provisions

EN 1995-1-1¹² in conjunction with the respective national annex applies for the installation.

A minimum of two screws shall be used for connections in load bearing timber structures. This does not apply for special situations specified in National Annexes to EN 1995-1-1.

The screws are driven into the wood-based member made of softwood without pre-drilling. The screw holes in steel members shall be pre-drilled with an adequate diameter greater than the outer thread diameter.

By fastening screws in wood-based members the head of the screws shall be flush with the surface of the wood-based member.

¹² EN 1995-1-1: 2004+AC:2006+A1:2008+A2:2014 Eurocode 5: Design of timber structures – Part 1-1: General - Common rules and rules for buildings

| | |
|-------------------------|---------|
| E-Jet screws | Annex 1 |
| Installation provisions | |

ANNEX 2 – Characteristic values of the load-carrying capacities

Table A.2.1 Characteristic load-carrying capacities of E-Jet screws

| Outer thread diameter [mm] | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 6.0 |
|---|-----|-----|-----|-----|-----|-----|
| Characteristic yield moment $M_{y,k}$ [Nm] | 1.4 | 2.2 | 2.8 | 3.8 | 5.4 | 7.2 |
| Characteristic tensile strength $f_{tens,k}$ [kN] | 3.5 | 4.5 | 6.0 | 7.0 | 8.0 | 9.0 |
| Characteristic torsional strength $f_{tor,k}$ [Nm] | 1.5 | 2.5 | 3.5 | 4.5 | 5.7 | 8.5 |

A.2.1 General

The minimum penetration length of the threaded part of the screw in the wood-based members l_{ef} shall be

$$l_{ef} = \frac{4 \cdot d}{\sin \alpha} \quad (2.1)$$

where

- α angle between screw axis and grain direction
- d outer thread diameter of the screw.

The outer thread diameter of screws inserted in cross-laminated timber shall be at least 6 mm. The inner thread diameter d_1 of the screws shall be greater than the maximal width of the gaps in the layer of cross laminated timber.

A.2.2 Laterally loaded screws

A.2.2.1 General

The outer thread diameter d shall be used as effective diameter of the screw according to EN 1995-1-1. The embedding strength for the screws in wood-based members or in wood-based panels shall be taken from EN 1995-1-1 or from national provisions that apply at the installation site unless otherwise specified in the following.

A.2.3 Axially loaded screws

A.2.3.1 Slip modulus

The axial slip modulus K_{ser} of the threaded part of a screw for the serviceability limit state shall be taken independent of angle α to the grain as:

$$K_{ser} = 780 \cdot d^{0.2} \cdot l_{ef}^{0.4} \quad [\text{N/mm}] \quad (2.2)$$

Where

- d outer thread diameter of the screw [mm]
- l_{ef} penetration length of the of the threaded part of the screw in the wood-based member [mm].

A.2.3.2 Axial withdrawal capacity

The characteristic withdrawal parameter at an angle $\alpha = 90^\circ$ to the grain based on a characteristic density of the wood-based member of 350 kg/m^3 is

$$f_{ax,k} = 11.5 \text{ N/mm}^2 \text{ for E-Jet screws.}$$

For LVL a maximum characteristic density of 500 kg/m^3 shall be used in equation (8.40a) of EN 1995-1-1.

| | |
|---|---------|
| E-Jet screws | Annex 2 |
| Characteristic values of the load-carrying capacities | |

A.2.3.3 Head pull-through capacity

The characteristic value of the head pull-through parameter for E-Jet screws for a characteristic density of 350 kg/m³ of the timber and for wood-based panels like

- Plywood according to EN 636 and EN 13986
- Oriented Strand Board, OSB according to EN 300 and EN 13986
- Particleboard according to EN 312 and EN 13986
- Fibreboards according to EN 622-2, EN 622-3 and EN 13986
- Cement-bonded particle boards according to EN 634-2 and EN 13986,
- Solid-wood panels according to EN 13353 and EN 13986

with a thickness of more than 20 mm is

$$f_{\text{head,k}} = 9.4 \text{ N/mm}^2.$$

For wood-based panels a maximum characteristic density of 380 kg/m³ and for LVL a maximum characteristic density of 500 kg/m³ shall be used in equation (8.40b) of EN 1995-1-1.

For wood based panels with a thickness $12 \text{ mm} \leq t \leq 20 \text{ mm}$ the characteristic value of the head pull-through parameter for the screws is:

$$f_{\text{head,k}} = 8 \text{ N/mm}^2$$

For wood based panels with a thickness of less than 12 mm the characteristic head pull-through capacity for screws shall be based on a characteristic value of the head pull-through parameter of 8 N/mm², and limited to 400 N complying with the minimum thickness of the wood based panels of 1.2·d, with d as outer thread diameter and the values in Table A.2.2.

Table A.2.2 Minimum thickness of wood based panels

| Wood based panel | Minimum thickness [mm] |
|--|------------------------|
| Plywood | 6 |
| Fibreboards (hardboards and medium boards) | 6 |
| Oriented Strand Boards, OSB | 8 |
| Particleboards | 8 |
| Cement-bonded particle board | 8 |
| Solid wood Panels | 12 |

In steel-to-timber connections the head pull-through capacity is not governing.

| | |
|---|---------|
| E-Jet screws | Annex 2 |
| Characteristic values of the load-carrying capacities | |

A.2.4 Spacing, end and edge distances of the screws and minimum thickness of the wood based material

A.2.4.1 General

Minimum thickness for structural members made from solid timber, glued laminated timber, glued solid timber, laminated veneer lumber and cross laminated timber is $t = 30$ mm.

A.2.4.2 Laterally and/or axially loaded screws

Screws in non pre-drilled holes

For E-Jet screws minimum spacing and distances are given in EN 1995-1-1, clause 8.3.1.2 and Table 8.2 as for nails in non-predrilled holes. Here, the outer thread diameter d shall be considered.

For Douglas fir members minimum spacing and distances parallel to the grain shall be increased by 50%.

A.2.4.3 Only axially loaded screws

For E-Jet screws the minimum spacings, end and edge distances are given in EN 1995-1-1, clause 8.3.1.2 and Table 8.2 as for nails in non-predrilled holes and clause 8.7.2, Table 8.6.

A.2.5 Insertion moment

The ratio between the characteristic torsional strength $f_{tor,k}$ and the mean value of insertion moment $R_{tor,mean}$ fulfills the requirement for all screws.

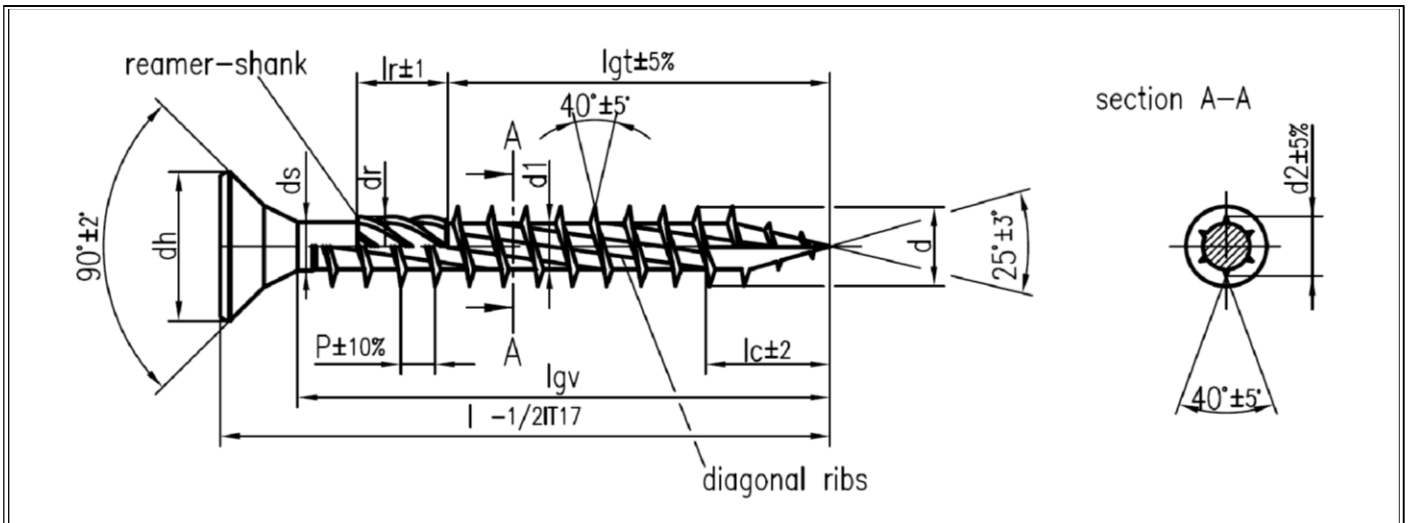
A.2.6 Durability against corrosion

E-Jet screws may have the coatings according to Table A.2.3

Table A.2.3 Coatings of the E-Jet screws

| Coating | | Minimum thickness of the coating [μm] |
|-----------------------------|------------------------|---|
| electrolytically galvanised | blue chromated | 3 |
| | yellow chromated | |
| | thick layer passivated | |

| | |
|---|---------|
| E-Jet screws | Annex 2 |
| Spacings, insertion moment and durability against corrosion | |

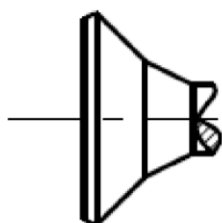


| nominal size | Ø 3,0 | | Ø 3,5 | | Ø 4,0 | | Ø 4,5 | | Ø 5,0 | | Ø 6,0 | | | | | | | | | | | | | |
|--------------|--------------------|------|-------|------|-------|-------|-------|----|-------|-----|-------|-----|------|-----|-----|------|------|-----|-----|------|-----|-----|------|------|
| d | min. | 2,80 | 3,30 | 3,75 | 4,25 | 4,70 | 5,70 | | | | | | | | | | | | | | | | | |
| | max | 3,05 | 3,55 | 4,10 | 4,60 | 5,10 | 6,10 | | | | | | | | | | | | | | | | | |
| d1 | min. | 1,70 | 2,05 | 2,30 | 2,61 | 2,90 | 3,42 | | | | | | | | | | | | | | | | | |
| | max | 1,90 | 2,21 | 2,52 | 2,84 | 3,15 | 3,78 | | | | | | | | | | | | | | | | | |
| d2 ± 5% | | 2,27 | 2,63 | 2,85 | 3,00 | 3,36 | 4,46 | | | | | | | | | | | | | | | | | |
| ds | min. | 2,25 | 2,60 | 2,85 | 3,15 | 3,50 | 4,20 | | | | | | | | | | | | | | | | | |
| | max | 2,30 | 2,65 | 2,90 | 3,20 | 3,60 | 4,30 | | | | | | | | | | | | | | | | | |
| dh | min. | 5,70 | 6,70 | 7,60 | 8,60 | 9,50 | 11,50 | | | | | | | | | | | | | | | | | |
| | max | 6,00 | 7,00 | 8,00 | 9,00 | 10,00 | 12,00 | | | | | | | | | | | | | | | | | |
| dr | min. | 2,00 | 2,30 | 2,90 | 3,20 | 3,60 | 4,50 | | | | | | | | | | | | | | | | | |
| | max | 2,60 | 2,90 | 3,50 | 3,80 | 4,20 | 5,10 | | | | | | | | | | | | | | | | | |
| P ± 10% | | 1,35 | 1,60 | 1,80 | 2,00 | 2,20 | 2,60 | | | | | | | | | | | | | | | | | |
| l | lgv | lgt | lr | lc | lgv | lgt | lr | lc | lgv | lgt | lr | lc | lgv | lgt | lr | lc | lgv | lgt | lr | lc | lgv | lgt | lr | lc |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | 17 | | | 6 | 16,5 | | | 6 | | | | | | | | | | | | | | | | |
| 25 | 22 | | | 6 | 21,5 | | | 6 | 21 | | | 6,5 | 20,5 | | | | | | | | | | | |
| 30 | 27 | 18 | 3 | 6 | 26,5 | 18 | 3 | 6 | 26 | 18 | 3,4 | 6,5 | 25,5 | | | | | | | | | | | |
| 35 | 32 | 21 | 3 | 6 | 31,5 | 21 | 3 | 6 | 31 | 21 | 3,4 | 6,5 | 30,5 | 21 | 3,8 | 8 | | 21 | 4,2 | 8,5 | | | | |
| 40 | 37 | 24 | 3 | 7 | 36,5 | 24 | 3 | 7 | 36 | 24 | 3,4 | 7,5 | 35,5 | 24 | 3,8 | 8 | 35,5 | 24 | 4,2 | 9,5 | 34 | 24 | 5 | 9,5 |
| 45 | | 24 | 3 | 7 | 41,5 | 24 | 3 | 7 | 41 | 24 | 6,2 | 9 | 40,5 | 24 | 3,8 | 8 | 40,5 | 27 | 4,2 | 10,5 | 39 | 27 | 5 | 9,5 |
| 50 | | 30 | 3 | 8 | 46,5 | 30 | 3 | 8 | 46 | 30 | 6,2 | 9 | 45,5 | 30 | 8,2 | 8,5 | 45,5 | 27 | 4,2 | 10,5 | 44 | 30 | 5 | 10,5 |
| 55 | | | | | | | | | | 30 | 6,2 | 9 | | 36 | 8,2 | 9,5 | | 36 | 8,2 | 10,5 | | 36 | 5 | 11,5 |
| 60 | | | | | | | | | | 36 | 6,2 | 9 | | 36 | 8,2 | 9,5 | | 36 | 8,2 | 10,5 | | 36 | 5 | 11,5 |
| 70 | | | | | | | | | | 42 | 6,2 | 9 | | 42 | 8,2 | 9,5 | | 42 | 8,2 | 10,5 | | 42 | 10,2 | 11,5 |
| 80 | | | | | | | | | | 48 | 6,2 | 10 | | 48 | 8,2 | 10,5 | | 48 | 8,2 | 11 | | 48 | 10,2 | 12,5 |
| 90 | | | | | | | | | | | | | | | | | | 48 | 8,2 | 11 | | 48 | 10,2 | 12,5 |
| 100 | | | | | | | | | | | | | | | | | | 54 | 8,2 | 12 | | 54 | 10,2 | 12,5 |
| 110 | | | | | | | | | | | | | | | | | | 60 | 8,2 | 12 | | 60 | 10,2 | 13,5 |
| 120 | | | | | | | | | | | | | | | | | | 60 | 8,2 | 12 | | 60 | 10,2 | 13,5 |
| 130 | | | | | | | | | | | | | | | | | | | | | | 60 | 10,2 | 13,5 |
| 140-150 | in 10mm graduation | | | | | | | | | | | | | | | | | | | | | 70 | 10,2 | 15 |
| 160-300 | in 20mm graduation | | | | | | | | | | | | | | | | | | | | | 70 | 10,2 | 15 |

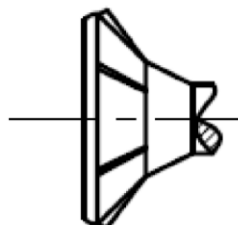
Other thread length lg in range $4 \times d \leq lg \leq$ standard thread length as per table allowed .

| | |
|--------------|-----------|
| E-Jet screws | Annex 3.1 |
| Dimensions | |

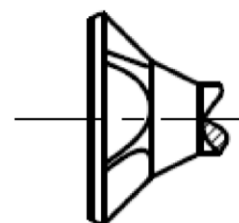
possible head versions:



countersunk head

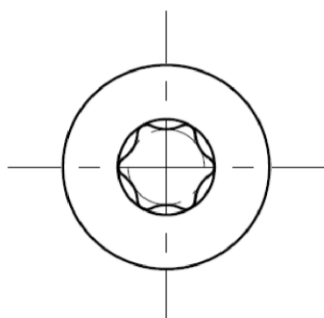


countersunk head with
under head ribs

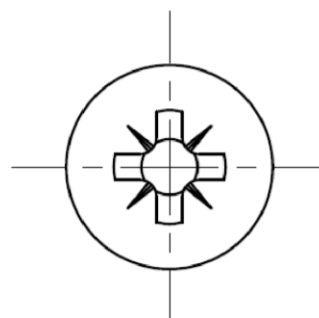


countersunk head with
milling grooves

possible recess versions:



Tor-recess^a



Pozi drive Z^b

| nominal size | recess size | |
|--------------|-------------------------|-------------------------|
| | Tor-recess ^a | Pozi drive ^b |
| Ø 3,0 | 10 | Z1 |
| Ø 3,5 | 10 / 15 / 20 | Z2 |
| Ø 4,0 | 10 / 15 / 20 | Z2 |
| Ø 4,5 | 15 / 20 / 25 | Z2 |
| Ø 5,0 | 15 / 20 / 25 | Z2 |
| Ø 6,0 | 20 / 25 / 30 | Z3 |

^a e.g. acc. ISO 10664, TORX[®] TTAP[®] or similar
^b e.g. acc. ISO 4757 or similar

E-Jet screws

Screw heads

Annex 3.2