

European Technical Approval ETA-13/0536

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung
Trade name

E-Jet Schrauben
E-Jet screws

Zulassungsinhaber
Holder of approval

Verbindungselemente Engel GmbH
Weltestraße 2+4
88250 Weingarten
DEUTSCHLAND

Zulassungsgegenstand
und Verwendungszweck
*Generic type and use
of construction product*

Selbstbohrende Schrauben als Holzverbindungsmittel
Self-tapping screws for use in timber constructions

Geltungsdauer:
Validity: vom
from
bis
to

27 June 2013
27 June 2018

Herstellwerk
Manufacturing plant

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

Diese Zulassung umfasst
This Approval contains

14 Seiten einschließlich 2 Anhänge
14 pages including 2 annexes

I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:
 - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products¹, modified by Council Directive 93/68/EEC² and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council³;
 - *Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998⁴, as amended by Article 2 of the law of 8 November 2011⁵;*
 - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC⁶.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- 3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.
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- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

¹ Official Journal of the European Communities L 40, 11 February 1989, p. 12
² Official Journal of the European Communities L 220, 30 August 1993, p. 1
³ Official Journal of the European Union L 284, 31 October 2003, p. 25
⁴ *Bundesgesetzblatt Teil I 1998*, p. 812
⁵ *Bundesgesetzblatt Teil I 2011*, p. 2178
⁶ Official Journal of the European Communities L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of the construction product

E-Jet screws are made from special carbon steel. The screws are hardened. The screws have a corrosion protection according to Annex A 1.6 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 2.

1.2 Intended use

The screws are intended to be used for connecting wood-based members, where requirements for mechanical resistance and stability and safety in use in the sense of the essential requirements N 1 and N 4 of Council Directive 89/106/EEC shall be fulfilled.

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) of strength classes C14 – C40 according to EN 338⁷/ EN 14081-1⁸,
- Glued laminated timber (softwood) of at least strength class GL24c according to EN 1194⁹/ EN 14080¹⁰,
- Laminated veneer lumber LVL according to EN 14374¹¹, arrangement of the screws only perpendicular to the plane of the veneers
- Glued laminated solid timber Duo- and Triobalken according to FprEN 14080¹² or national provisions that apply at the installation site
- Cross-laminated timber according to European technical approvals 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 636¹³ and EN 13986¹⁴,
- Oriented Strand Board, OSB according to EN 300¹⁵ and EN 13986,
- Particleboard according to EN 312¹⁶ and EN 13986,
- Fibreboards according to EN 622-2¹⁷, EN 622-3¹⁸ and EN 13986,

7	EN 338:2009	Timber structures - Strength classes
8	EN 14081-1:2005+A1:2011	Timber structures – Strength graded structural timber with rectangular cross section – Part 1: General requirements
9	EN 1194:1999	Timber structures – Glued laminated timber – Strength classes and determination of characteristic values
10	EN 14080:2005	Timber structures - Glued laminated timber - Requirements
11	EN 14374:2004	Timber structures - Structural laminated veneer lumber - Requirements
12	FprEN 14080:2013	Timber structures – Glued laminated timber and Glued laminated solid timber - Requirements
13	EN 636:2003	Plywood - Specifications
14	EN 13986:2004	Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking
15	EN 300:2006	Oriented strand boards (OSB) – Definition, classification and specifications
16	EN 312:2003	Particleboards - Specifications
17	EN 622-2:2004	Fibreboards – Specifications – Part 2: Requirements for hardboards
18	EN 622-3:2004	Fibreboards - Specifications - Part 3: Requirements for medium boards

- Cement-bonded particle boards according to national provisions that apply at the building site,
- Solid-wood panels according to national provisions that apply at the building site.

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

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. Annex 1.6 contains the corrosion protection for E-Jet screws.

The screws may be used for connections subject to static or quasi static loading.

The provisions made in this European technical approval are based on an assumed working life of the screws of 50 years, provided that the conditions laid down in section 4.2 for the installation are met. 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.

2 Characteristics of product

	Characteristic	Assessment of characteristic
2.1 Mechanical resistance and stability ^{*)}		
2.1.1	Dimensions	See Annex 2
2.1.2	Characteristic yield moment	See Annex 1
2.1.3	Characteristic withdrawal parameter	See Annex 1
2.1.4	Characteristic head pull-through parameter	See Annex 1
2.1.5	Characteristic tensile strength	See Annex 1
2.1.6	Characteristic yield strength	No performance determined
2.1.7	Characteristic torsional strength	See Annex 1
2.1.8	Insertion moment	See Annex 1
2.1.9	Spacing, end and edge distances of the screws and minimum thickness of the wood based material	See Annex 1
2.1.10	Slip modulus for mainly axially loaded screws	See Annex 1
2.2 Safety in case of fire		
2.2.1	Reaction to fire	Self-tapping screws are made of steel classified as Euroclass A1 in accordance with EC decision 96/603/EC, as amended by EC decision 2000/605/EC.

	Characteristic	Assessment of characteristic
2.3 Hygiene, health and the environment		
2.3.1	Content and/or release of dangerous substances	The product does not contain cadmium. There is no risk that chrome VI - contained in the chromated carbon steel screws - will be released by consideration of all possible release scenarios.**)
2.4 Safety in use		
2.4.1	Dimensions	See Annex 2
2.4.2	Characteristic yield moment	See Annex 1
2.4.3	Characteristic withdrawal parameter	See Annex 1
2.4.4	Characteristic head pull-through parameter	See Annex 1
2.4.5	Characteristic tensile strength	See Annex 1
2.4.6	Characteristic yield strength	No performance determined
2.4.7	Characteristic torsional strength	See Annex 1
2.4.8	Insertion moment	See Annex 1
2.4.9	Spacing, end and edge distances of the screws and minimum thickness of the wood based material	See Annex 1
2.4.10	Slip modulus for mainly axially loaded screws	See Annex 1
Protection against noise		Not relevant
Energy economy and heat retention		Not relevant
2.5 General aspects relating to fitness for use		
2.5.1	Durability against corrosion	See Annex 1
2.5.2	Serviceability	The assessment for mechanical resistance and stability as well as durability against corrosion covers this property.

**)
In accordance with <http://ec.europa.eu/enterprise/construction/cpd-ds/>. In addition to the specific clauses relating to dangerous substances contained in this European technical approval, 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 EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

2.1 Mechanical resistance and stability

Annex 1 contains the load-carrying capacities for E-Jet screws.

The design and construction shall be carried out according to national provisions that apply at the installation site in line with the partial safety factor format, e.g. in accordance with EN 1995-1-1.

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the decision 97/638/EC of the European Commission¹⁹ the system 2+ of attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 2+: Declaration of conformity of the product by the manufacturer on the basis of:

- (a) Tasks for the manufacturer:
 - (1) initial type-testing of the product;
 - (2) factory production control;
 - (3) testing of samples taken at the factory in accordance with a prescribed test plan.
- (b) Tasks for the approved body:
 - (4) certification of factory production control on the basis of:
 - initial inspection of factory and of factory production control;
 - continuous surveillance, assessment and approval of factory production control.

Note: Approved bodies are also referred to as "notified bodies".

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use raw materials stated in the technical documentation of this European technical approval supplied with the relevant inspection documents as laid down in the control plan.

The factory production control shall be in accordance with the "control plan relating to the European technical approval ETA-13/0536 issued on 27 June 2013" which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik.²⁰

The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of materials, such as steel rods or wire, shall include control of the inspection documents presented by suppliers (comparison with nominal values) by verifying dimension and determining material properties, e.g. chemical composition, mechanical properties and corrosion protection.

¹⁹ Official Journal of the European Communities L 268/36 of 19 September 1997

²⁰ The "control plan" is a confidential part of the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity. See section 3.2.2.

The manufactured components shall be checked visually and for dimensions. The control plan includes details of the extent, nature and frequency of testing and controls to be performed within the factory production control.

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan. The records shall include at least the following information:

- Designation of the product, basic material and components,
- Type of control or testing,
- Date of manufacture of the product and date of testing of the product or basic material and components,
- Result of control and testing and, if appropriate, comparison with requirements,
- Signature of person responsible for factory production control.

The records shall be presented to the approved body involved in the continuous surveillance and shall be presented to Deutsches Institut für Bautechnik on request.

3.2.1.2 Initial type testing

For initial type-testing the results of the tests performed as part of the assessment for the European technical approval may be used unless there are changes in the production line or plant. In such cases the necessary initial type-testing has to be agreed between Deutsches Institut für Bautechnik and the notified body.

3.2.1.3 Other tasks for the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of screws in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of the European technical approval ETA-13/0536 issued on 27 June 2013.

3.2.2 Tasks for the approved bodies

The approved body shall perform the

- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control, in accordance with the provisions laid down in the control plan.

3.2.2.1 Initial inspection of factory and factory production control

The approved body shall ascertain that, in accordance with the control plan, the factory, in particular the staff and equipment, and the factory production control, are suitable to ensure a continuous and orderly manufacturing of the screws with this European technical approval.

3.2.2.2 Continuous surveillance

The approved body shall control the documentation of the factory production control (FPC) twice a year including an annual visit of the factory for routine inspections. It shall be verified that the system of factory production control and the specified manufacturing processes are maintained, taking account of the control plan.

3.2.2.3 Other tasks of the approved body

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The results of certification and continuous surveillance shall be made available on demand by the certification body to Deutsches Institut für Bautechnik.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the factory production control stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

3.3 CE marking

The CE marking shall be affixed on each packaging of the self-tapping screws. The letters "CE" shall be followed by the identification number of the approved certification body and be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate for the factory production control,
- the number of the European technical approval,
- name of the product,
- outer thread diameter and length of the self-tapping screws,
- type and mean thickness of the corrosion protection, if relevant.

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

E-Jet screws shall be manufactured in accordance with the provisions of this European technical approval using the manufacturing processes as identified at the inspection of the plant by the notified inspection body and laid down in the technical documentation.

The European technical approval is issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, shall be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

4.2 Installation

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

A minimum of two screws shall be used for connections in load bearing timber structures.

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

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5 Indications to the manufacturer

5.1 Use, maintenance, repair

The assessment of the fitness for use is based on the assumption that no maintenance is required during the assumed intended working life.

Andreas Kummerow
p. p. Head of Department

beglaubigt:
Warns

ANNEX 1 – Characteristic values of the load-carrying capacities

Table 1.1 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.1.1 General

The minimum penetration length of screws in the load-bearing wood-based members shall be $4 \cdot d$.

The inner thread diameter d_1 of the screws shall be greater than the maximal width of the gaps in the layer of the cross-laminated timber.

A.1.2 Laterally loaded screws

The outer thread diameter d shall be used as effective diameter of the screw according to EN 1995-1-1.

A.1.3 Axially loaded screws

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

$$K_{ser} = 780 \cdot d^{0,2} \cdot l_{ef}^{0,4} \quad [\text{N/mm}] \quad (1.1)$$

where

d outer thread diameter of the screw [mm]

l_{ef} penetration length of the screw in the wood-based member [mm].

A.1.3.1 Axial withdrawal capacity

The characteristic withdrawal parameter at an angle of $30^\circ \leq \alpha \leq 90^\circ$ to the grain based on a characteristic density of the wood-based member of 350 kg/m^3 is

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

For screws penetrating more than one layer of cross-laminated timber the different layers may be taken into account proportionally.

E-Jet screws	Annex 1.1
Characteristic values of the load-carrying capacities	

A.1.3.2 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 board according to national provisions that apply at the building site
- solid wood panel according to national provisions that apply at the building site

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 shall be used in equation (8.40b) of EN 1995-1-1.

For wood based panels with a thickness between 12 mm and 20 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 the 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 1.2.

Table 1.2 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 1.2
Characteristic values of the load-carrying capacities	

A.1.4 Spacing, end and edge distances of the screws and minimum thickness of the wood based material

Minimum thickness for structural members is $t = 30$ mm.

A.1.4.1 Laterally and/or axially loaded screws

Screws in non pre-drilled holes

For E-Jet screws in non-predrilled holes the minimum spacing and distances are given in EN 1995-1-1:2004+A1:2008, 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.1.4.2 Only axially loaded screws

For E-Jet screws the minimum spacings, end and edge distances are given in EN 1995-1-1:2004+A1:2008, clause 8.7.2 and Table 8.6.

A.1.5 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.

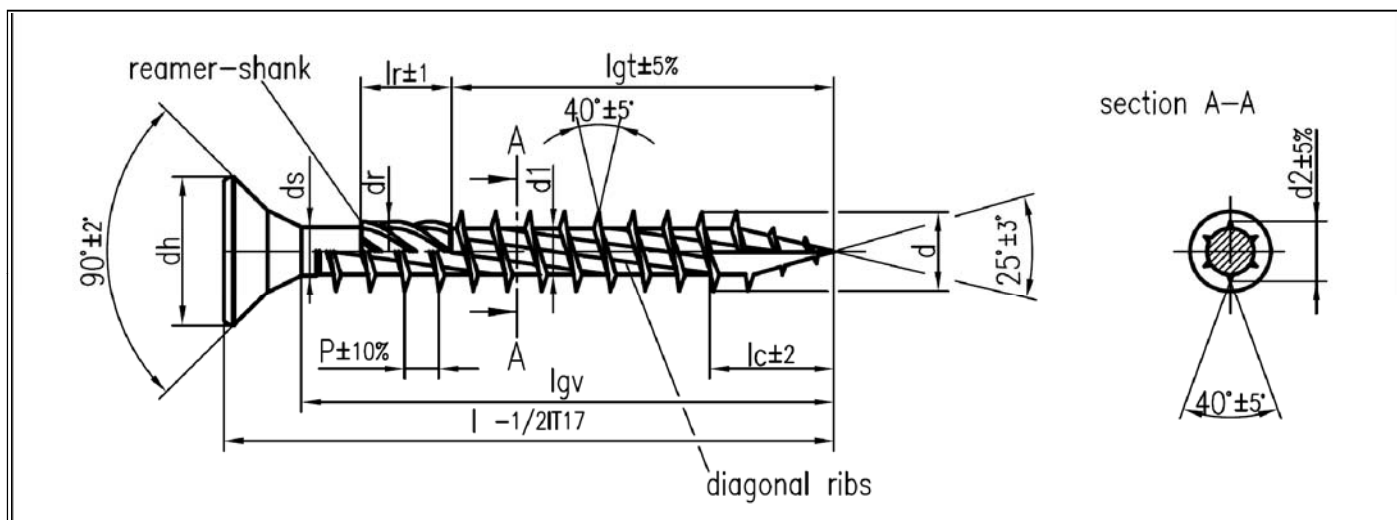
A.1.6 Durability against corrosion

Screws made from carbon steel may have the coatings according to Table 1.3

Table 1.3 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 1.3
Characteristic values of the load-carrying capacities	

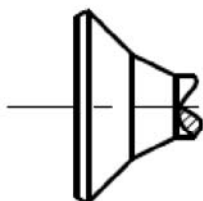


nominal size	Ø 3,0		Ø 3,5		Ø 4,0		Ø 4,5		Ø 5,0		Ø 6,0													
d	min.	2,80	3,30	3,75	4,25	4,70	5,70																	
	max	3,05	3,55	4,10	4,60	5,10	6,10																	
d1	min.	1,70	2,05	2,30	2,61	2,90	3,42																	
	max	1,90	2,21	2,52	2,84	3,15	3,78																	
d2	± 5%	2,27	2,63	2,85	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			6,5								
30	27	18	3	6	26,5	18	3	6	26	18	3,4	6,5	25,5			6,5								
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

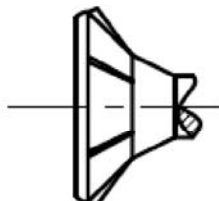
Other thread length lg in range $4 \times d \leq l_g \leq$ standard thread length as per table allowed .

E-Jet screws	Annex 2.1
Dimensions	

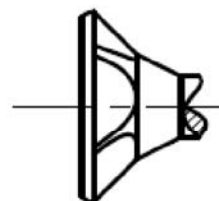
possible head versions:



countersunk head

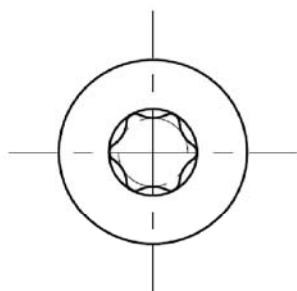


countersunk head with
under head ribs

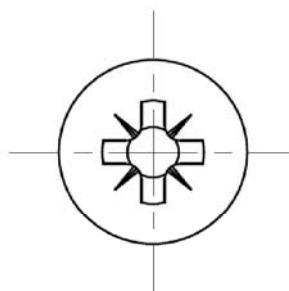


countersunk head with
milling grooves

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

E-Jet screws

Screw heads

Annex 2.2