

## European Technical Approval ETA-13/0243

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung  
*Trade name*

IHF-Stretch-System

Zulassungsinhaber  
*Holder of approval*

IHF-GmbH  
Auf'm Brinke 18  
59872 Meschede  
DEUTSCHLAND

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

IHF-Stretch Bolt Schraubengarnituren  
*IHF-Stretch Bolt bolting assemblies*

Geltungsdauer:  
*Validity:* vom  
*from*  
bis  
*to*

28 May 2013  
28 May 2018

Herstellwerk  
*Manufacturing plant*

Werk 1  
Werk 2  
Plant 1  
Plant 2

Diese Zulassung umfasst  
*This Approval contains*

10 Seiten einschließlich 2 Anhänge  
*10 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 products<sup>1</sup>, modified by Council Directive 93/68/EEC<sup>2</sup> and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council<sup>3</sup>;
  - *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 1998<sup>4</sup>, as amended by Article 2 of the law of 8 November 2011<sup>5</sup>;*
  - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>.
- 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.
- 4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
- 5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.
- 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.

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

## II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

### 1 Definition of the product and intended use

#### 1.1 Definition of the construction product

The IHF-Stretch Bolt bolting assemblies are special high-strength structural bolting assemblies of the sizes M30 to M64 used for torsion and friction free tightening of structural metallic components predominantly made of steel. IHF-Stretch Bolt bolting assemblies consist of a sc. stretch-bolt, strength class 10.9 and a flange-nut, strength class 10. Due to the geometry of the contact faces of bolt and nut any washers are not necessary. The required tension load will be applied by means of a hydraulic bolt tensioning cylinder. The tensioner preloads the bolt free of torsion and friction.

The bolt and nut materials are chosen according to ISO 898. The surface protection can be either zinc flake coating or alternatively hot deep galvanizing. A sample for a IHF-Stretch Bolt bolting assembly is shown in Annex 1 and a principle sketch of the stretch tightening method is shown in Annex 2.

#### 1.2 Intended use of the construction product

IHF-Stretch Bolt bolting assemblies are used in applications where a precise preload is required. The required minimum clamping length ratio is 1:2.5. The IHF-Stretch Bolt bolting assemblies provide a precise preload in the bolted joint and guarantee the required preload according to the relevant standards (for instance 70 % of  $f_{u,B} \cdot A_s$  in accordance with EN 1993-1-8). The precise preload method can result in less required maintenance of the bolted connection. In most cases the bolted joint is a maintenance free connection and leads to a higher availability for instance of a wind turbine and thus lower costs. Annex 1 shows the possibly application for a bolted flange connection in a tower for a wind turbine. By using the IHF-Stretch Bolt bolting assemblies for instance the flange thickness in towers for wind turbines can be reduced and the number of bolts can be increased using the same bolt circle diameter as before for standard fasteners. This is achieved by moving the bolt holes closer together as the required tooling diameter for tensioning tools is smaller in comparison to traditional torque tools.

The stretch-bolts and flanged-nuts can also be used for other applications requiring a precise and repeatable preload. Bolts that are pre-stressed acc. to the IHF-stretch method, achieve very high remaining preloads that are reproducible and free of bending and torsional loads. Costs can be saved due to the faster tensioning process compared to the traditional torque process. The tightening method of hydraulic tensioning in combination with stretch-bolts and flanged-nuts can utilize the material properties closer to their limits. A better fatigue strength of the structure can be achieved. In the design phase of the wind turbine, this process allows savings in regards to the flange thickness  $t_2$  according to Annex 2.

The provisions made in this European technical approval are based on an assumed working life of the IHF-Stretch Bolt bolting assemblies of 25 years when installed in the works or as long as the assumed working life of the structure where the bolting assembly is installed, a sufficient protected against corrosion provided.. 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 and methods of verification

### 2.1 Characteristics of product

The IHF-Stretch Bolt bolting assemblies shall correspond to the drawing given in Annex 1.

The characteristic material values, dimensions and tolerances of the IHF-Stretch Bolt bolting assemblies neither indicated in this section nor in Annex 1 shall correspond to the respective values laid down in the technical documentation<sup>7</sup> to this European technical approval.

The values of preload forces of the connections made with the IHF-Stretch Bolt bolting assemblies are given in section 4.2.

The IHF-Stretch Bolt bolting assemblies are considered to satisfy the requirements of performance class A1 of the characteristic reaction to fire.

### 2.2 Methods of verification

The assessment of the fitness of the IHF-Stretch Bolt bolting assemblies for the intended use in relation to the Essential Requirements ER 1 (Mechanical resistance and stability), ER 2 (Safety in case of fire), ER 3 (Hygiene, health and environment) and additional aspects of durability has been made in accordance with section 3.2 of the Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>.

The assessment of the resistance to fire performance is only relevant to the assembled system (IHF-Stretch Bolt bolting assemblies, steel structure) which is not part of the ETA.

The IHF-Stretch Bolt bolting assemblies are considered to satisfy the requirements of performance class A 1 of the characteristic reaction to fire, in accordance with the provisions of the EC Decision 96/603/EC (as amended) without the need for testing on the basis of its listing in that decision.

Concerning Essential Requirements No. 1 (Mechanical resistance and stability) the following applies:

The values of preload forces given in Table 1 were determined by tests and confirmed by measuring results from practical applications.

Concerning Essential Requirement No. 3 (Hygiene, health and environment) the following applies:

The IHF-Stretch Bolt bolting assemblies do not contain dangerous substances or radiation.

Note: 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 Construction Products Directive, these requirements need also to be complied with, when and where they apply.

<sup>7</sup> The technical documentation to this European technical approval is deposited at Deutsches Institut für Bautechnik and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure is handed over to the approved bodies.

### 3 Evaluation and attestation of conformity and CE marking

#### 3.1 System of attestation of conformity

According to the Decision 99/92/EC of the European Commission<sup>8</sup> system 2+ of the attestation of conformity applies.

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 factory production control shall be in accordance with the control plan 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.<sup>9</sup>

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

###### 3.2.1.2 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 mechanical connections 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 this European technical approval.

<sup>8</sup> Official Journal of the European Communities L 80 of 18.03.1998

<sup>9</sup> The control plan is a confidential part of the European technical approval and only handed over to the approved bodies involved in the procedure of attestation of conformity. See section 3.2.2.

### 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.

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

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 the accompanying commercial documents. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, 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,
- the name of the product.

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

### 4.1 Manufacturing

The IHF-Stretch Bolt bolting assemblies are manufactured in accordance with the provisions of the European technical approval using the manufacturing process as 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, should 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 Design

### 4.2.1 General

IHF-Stretch Bolt bolting assemblies completely or partly exposed to external weather or similar conditions are protected sufficiently against corrosion. For the corrosion protection the rules given in EN 1090-2:2008 + A1:2011 are taken into account.

Bolted connections in steel structure with IHF-Stretch Bolt bolting assemblies are designed according to EN 1993-1-8:2005 + AC:2009 as far as no other provisions are made in the following.

### 4.2.2 Specific

The minimum clamping length ratio is 1: 3 or 1: 2.5 if the increased preload force according to Table 1, column 3 shall be applied and the designer has informed the executer in written form about this (e.g. on the shop drawing).

**Table 1 Preload force to be applied to achieve the design preload force**

1	2		3	4
Nominal size	Preload force to be applied		Design preload force $F_{p,Cd}$ [kN]	
	Normal preload force [kN]	Increased preload force [kN]		
M 30	500	520	357	
M 36	740	760	520	
M 39	880	910	621	
M 42	1.010	1.040	713	
M 45	1.180	1.210	828	
M 48	1.330	1.370	937	
M 56	1.830	1.890	1.290	
M 64	2.410	2.490	1.700	

## 4.3 Installation

### 4.3.1 General

Bolted connections in steel structure with IHF-Stretch Bolt bolting assemblies are executed according to EN 1090-2:2008+A1:2011 as far as no other provisions are made in the following.

### 4.3.2 Specific

The installation of the IHF-Stretch Bolt bolting assemblies is only carried out according to the provisions of the manufacturer with the appropriate hydraulic bolt tensioning cylinder. The manufacturer hands over the assembly instruction to the executing company.

The preload force to be applied for every nominal size according to Table 1 or the corresponding oil pressure at the hydraulic bolt tensioning cylinder is kept. The manufacturer hands over the assembly instruction to the executing company.

Connections with IHF-Stretch Bolt bolting assemblies are only executed by companies with the necessary experience unless the instruction of the assembly personnel is arranged by specialists experienced in this field.

The structural parts to be connected have direct contact. The bolt axis is rectangular to the surface of the structural part. The measures for possible inclination of the faces are agreed with the manufacturer in written form for the single case (e. g. wedge washers).

## 5 Indications to the manufacturer

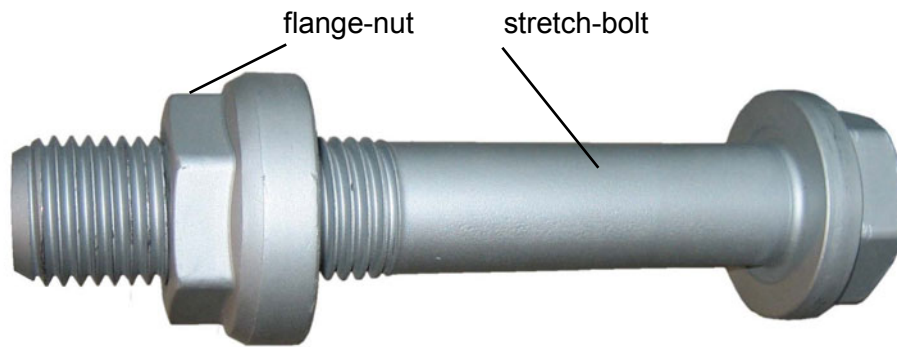
It is in the responsibility of the manufacturer to ensure that the information on the specific conditions according to 1, 2, 4.2 and 4.3 (including Annexes if referred to) is given to those who are concerned. This information may be given by reproduction of the respective parts of the European technical approval.

In addition all installation data (e. g. preload force) shall be shown clearly on the package and/or on an enclosed instruction sheet, preferably using illustration(s).

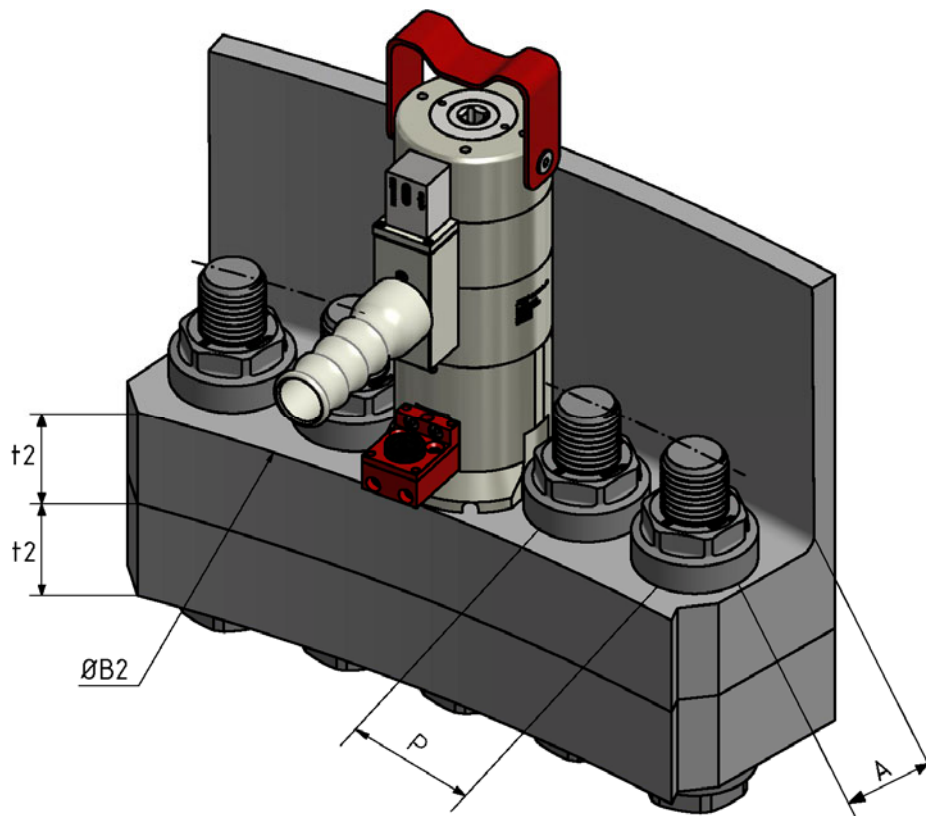
Uwe Bender  
Head of Department

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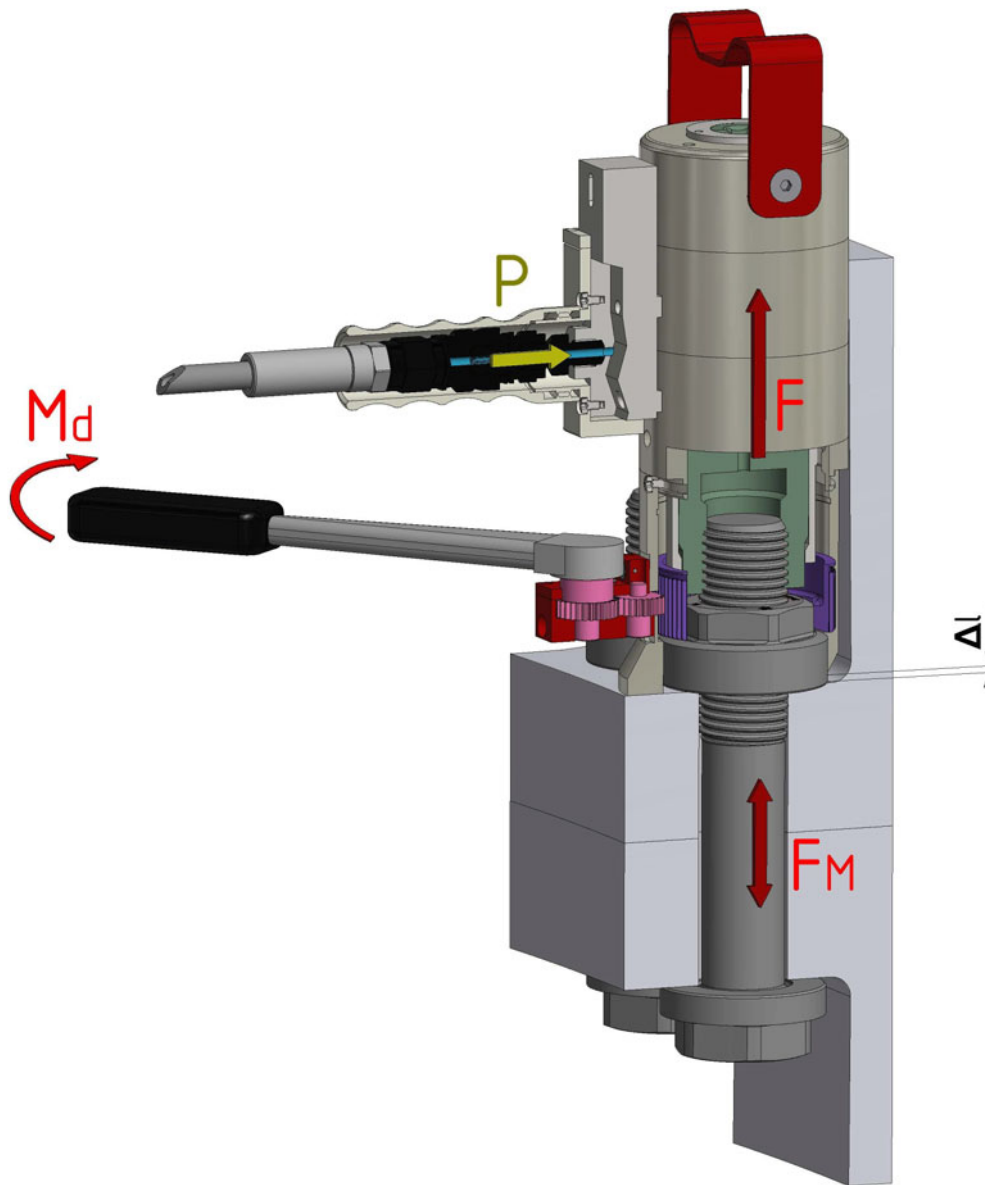




Sample of an IHF-Stretch Bolt bolting assembly



Application for a bolted connection in towers for wind turbines



1. Step: Applying the force  $F$  by means of the hydraulic bolt tensing cylinder and lengthening the bolt by  $\Delta l$
2. Step: Tightening the nut by means of the hand torque wrench or motor-powered with the relative low torque moment  $M_d$
3. Step: Release the hydraulic bolt tensing cylinder, the preload force  $F_M$  will remain in the bolting assembly

IHF-Stretch-System

Principle sketch of the stretch tightening method

Annex 2