STRUCTURAL BOLTING ASSEMBLIES

EN 14399 PRELOADED ASSEMBLIES

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

After about 10 years from its first publication, in 2015 a new revision of several parts of EN 14399 were issued; other parts are now under approval for the next publication.

Since the beginning, this set of standard references had a strong impact both on manufacturers, called to meet much higher quality standards, and on the end users who have been required to substantially review the purchasing and assembly method of structural bolting.

The current standard revision (carried out by CEN/TC185/WG6 in response to the M/120 mandate - Structural metallic products and ancillaries - under the supervision of a CEN consultant) modifies some of the rules that have deeply changed the regulation for fastener assemblies in the European countries, and it is of particular importance considering the publication of Regulation n. 305/2011 and its subsequent amendments which set the harmonized conditions for the marketing of construction products in the European Union (Construction Product Regulation - CPR).

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

Construction Products Regulation (CPR) replaces the previous Directive 89/106/EEC - Construction Product Directive (CPD), the first document which introduced the obligation of the CE marking for the production and marketing of construction products in Europe. After the approval of the new CPR Regulation, the CE marking changed its meaning in comparison with CPD. It is now supported by the "Declaration of Performance - DoP" (which replaced the Declaration of Conformity), a statement that represents a sort of identity card of the screw, nut and washers assembly.

The DoP must be issued when the construction product is placed on the market and should be made available whenever the product is made available on the market. The DoP is drawn up on the basis of the CPR Annex III model in the language(s) requested by the Member State in which the product is made available. It contains information about the intended use and the performance of the product in relation to its essential characteristics as defined in the applicable Harmonized Product Standard (EN 14399-1).

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

Essential Characteristics
(to be declared in DoP)

- Type
- Property class
- Product grade
- *k*-class and *k*-factor

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

Essential Characteristics

❖ Type (bolting assemblies)

Type covers the axial load expected from design and margin against overtightening. The type is relevant for the ability of the bolting assembly to be tightened by different tightening methods, given in EN 1090-2, in order to provide the declared performances of the bolting assemblies.

Characteristics to be assessed: angle to failure during tightening, axial load, compression load for bolting assemblies with direct tension indicators, calibrated preload for bolting assemblies with calibrated preload.

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

Essential Characteristics

There are two types of bolting assemblies:

- **Type HR (HRC)**: designed to obtain ductility predominantly by plastic elongation of the bolt (minimum nut height ≥ 0,8 D and thread length of the bolt according to ISO 888)
- **Type HV**: designed to obtain ductility predominantly by plastic deformation of the engaged threads (nut height at approximately 0,8 D with short thread length)

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

Essential Characteristics

❖ Property class (bolting assemblies)

Property class expresses in a concise way a set of mechanical characteristics of the components. It is relevant for the ability of components to be matched together in order to obtain the declared performances of the bolting assemblies.

Characteristics to be assessed: elongation (bolts), tensile strength (bolts), strength under wedge loading (bolts), tensile yield strength (bolts), proof load (nuts and bolts), impact strength (bolts), hardness (bolts, nuts, washers and, if provided, direct tension indicators), compression load for direct tension indicators.

Reference standards: ISO 898-1 (bolts); ISO 898-2 (nuts); EN 14399-6 (washers).

STRUCTURAL BOLTING ASSEMBLIES

Essential Characteristics

Preloaded assemblies

- **Product grade (bolts, nuts, washers and, if provided, direct tension indicators)**

Product grade covers tolerances on dimensions and shape for bolts, nuts and washers. Product grade covers three critical features for direct tension indicators. It is relevant for the ability of components to be matched together in order to provide for the declared performances of the bolting assemblies.

Characteristics to be assessed:

Bolts and nuts: tolerances on dimensions and shape in accordance with ISO 4759-1. Thread tolerance (ISO 6g, 6H, 6AZ)

Washers: tolerances on dimensions and shape in accordance with ISO 4759-3

Direct tension indicators: features and tolerances in accordance with EN 14399-9

STRUCTURAL BOLTING ASSEMBLIES

Essential Characteristics

❖ *k*-class and *k*-factor (bolting assemblies)

k-class expresses in a concise way the ability of the bolting assemblies to be tightened by the torque method or the combined method by means of the *k*-factor.

k-class	*k*-factor
K0	-
K1	$0{,}10 \le k_i \le 0{,}16$
K2	$0{,}10 \le k_i \le 0{,}23$ $\quad V_k \le 0{,}06$ (*)

(*) In the previous edition it was 0,10. Studies have been conducted to demonstrate that a reduced scattering of k factor enables achieving the nominal preload $F_{p,C}$ with a confidence interval of 95% as required by the design code, a condition that could not always be satisfied before

SBE VARVIT

STRUCTURAL BOLTING ASSEMBLIES

EN 14399-3 HR System (DoP K1)

50 YEARS OF PASSION

Preloaded assemblies

SBE VARVIT — VESCOVINI GROUP

DICHIARAZIONE DI PRESTAZIONE / DECLARATION OF PERFORMANCE / DÉCLARATION DES PERFORMANCES / LEISTUNGSERKLÄRUNG

n. 01HRK12015

IT	EN	FR	DE
1. Codice di identificazione unico del prodotto-tipo:	1. Unique identification code of the product-type:	1. Code d'identification unique du produit type:	1. Eindeutiger Kenncode des Produkttyps:
Elementi di collegamento strutturali ad alta resistenza adatti al precarico. Sistema HR, K-class K1.	High-strength structural bolting assemblies for preloading. HR system, K-class K1.	Boulonnerie de construction métallique à haute résistance apte à la précontrainte. Système HR, K-classe K1.	Garnituren für hochfeste planmäßig Vorspannbare Schraubenverbindungen für den Metallbau. System HR, K-klasse K1.
2. Numero di tipo, lotto, serie o qualsiasi altro elemento che consenta l'identificazione del prodotto da costruzione ai sensi dell'articolo 11, paragrafo 4:	2. Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11 (4):	2. Numéro de type, de loto u de série ou tout autre élément permettant l'identification du produit de construction, conformément à l'article 11, paragraphe 4:	2. Typen-, Chargen- oder Seriennummer oder ein anderes Kennzeichen zur Identifikation des Bauprodukts gemäß Artikel 11 Absatz 4:
Elementi di collegamento strutturali ad alta resistenza adatti al precarico. Sistema HR, K-class K1.	High-strength structural bolting assemblies for preloading. HR system, K-class K1.	Boulonnerie de construction métallique à haute résistance apte à la précontrainte. Système HR, K-class K1.	Garnituren für hochfeste planmäßig Vorspannbare Schraubenverbindungen für den Metallbau. System HR, K-class K1.
3. Uso previsto del prodotto da costruzione, conformemente alla relativa specifica tecnica armonizzata, come previsto dal fabbricante:	3. Intended use of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer:	3. Usage prévus du produit de construction, conformément à la spécification technique harmonisée applicable, comme prévu par le fabricant:	3. Vom Hersteller vorgesehener Verwendungszweck des Bauprodukts gemäß der anwendbaren harmonisierten technischen Spezifikation:
Opere metalliche strutturali	Structural metallic works.	Travaux de construction métalliques.	Metallbau Werke.
4. Nome, denominazione commerciale registrata o marchio registrato e indirizzo del fabbricante ai sensi dell'articolo 11, paragrafo 5:	4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required under Article 11 (5):	4. Nom, raison sociale ou marque déposée et adresse de contact du fabricant, conformément à l'article 11, paragraphe 5:	4. Name, eingetragener Handelsname oder eingetragene Marke und Kontaktanschrift des Herstellers gemäß Artikel 11 Absatz 5:

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Fax (+39) 0481 714714
e-mail: info@vescovinigroup.com

IT	EN	FR	DE
5. Se opportuno, nome e indirizzo del mandatario il cui mandato copre i compiti cui all'articolo 12, paragrafo 2:	5. Where applicable, name and contact address of the authorised representative whose mandate covers the tasks specified in Article 12 (2):	5. Le cas échéant, nom et adresse de contact du mandataire dont le mandat couvre les tâches visées à l'article 12, paragraphe 2:	5. Gegebenenfalls Name und Kontaktanschrift des Bevollmächtigten, der mit den Aufgaben gemäß Artikel 12 Absatz 2 beauftragt ist:
Non applicabile	Not applicable	Non applicable	Nicht anwendbar
6. Sistema di valutazione e verifica della costanza della prestazione del prodotto da costruzione di cui all'allegato V:	6. System of assessment and verification of constancy of performance of the construction product as set out in CPR, Annex V:	6. Le système d'évaluation et de vérification de la constance des performances du produit de construction, conformément à CPR, annexe V:	6. System zur Bewertung und Überprüfung der Leistungsbeständigkeit des Bauprodukts gemäß in CPR, Anhang V:
Sistema 2+	System 2+	Système 2+	System 2+

DICHIARAZIONE DI PRESTAZIONE / DECLARATION OF PERFORMANCE /DÉCLARATION DES PERFORMANCES / LEISTUNGSERKLÄRUNG n. 01HRK12015 PAG. 1/2

SBE VARVIT — VESCOVINI GROUP

IT	EN	FR	DE
7. Nel caso di una dichiarazione di prestazione relativa ad un prodotto da costruzione che rientra nell'ambito di applicazione di una norma armonizzata:	7. In case of declaration of performance concerning a construction product covered by a harmonised standard:	7. Dans le cas de la déclaration des performances concernant un produit de construction couvert par une norme harmonisée:	7. Im Falle der Leistungserklärung, die ein Bauprodukt betrifft, das von einer harmonisierten Norm erfasst wird:
TÜV Italia S.r.l., organismo notificato di certificazione del controllo della produzione n. 0948, ha effettuato l'ispezione iniziale dello Stabilimento di produzione e del controllo di produzione in fabbrica, la sorveglianza continua, la verifica e la valutazione del controllo di produzione e ha rilasciato il certificato di conformità del controllo di produzione in fabbrica N. 0948-CPR-0104 rev. 4.	TÜV Italia S.r.l., notified body for factory production control certification n. 0948, performed the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control and issued the certificate of conformity of the factory production control N. 0948-CPR-0104 rev. 4.	TÜV Italia S.r.l., organisme notifié pour le certification du contrôle de la production en usine n. 0948, a effectué l' inspection initiale de l'établissement de fabrication, le contrôle de la production en usine, la surveillance continue, l'évaluation et l'appréciation permanentes du contrôle de la production en usine et a délivré le certificat de conformité du contrôle de la production en usine N. 0948-CPR-0104 rev. 4.	TÜV Italia S.r.l., zustellender Organismus für die Zertifizierung der Produktionskontrolle n. 0948, hat die Erstinspektion des Werks und die Produktionskontrolle beim Werk, die ununterbrochene Überwachung, die Prüfung und Bewertung der Produktionskontrolle im Werk durchgeführt und hat die Konformitätsbescheinigung für die Produktionskontrolle im Werk N. 0948-CPR-0104 rev. 4 erteilt.

8. Prestazione dichiarata / Declared performance / Performances déclarée / Erklärte Leistung

Caratteristiche essenziali / Essential characteristics / Caractéristique essentielles / Wesentliche Merkmale	Prestazione / Performance / Performances / Leistung		Specifica tecnica armonizzata / Harmonised technical specification/ Spécifications techniques harmonisées Harmonisierte technische Spezifikation
Tipo / Type / Type / Art	HR		EN 14399-1:2015
Classe di resistenza / Property class / Class de résistance / Festigkeitsklasse	8.8 / 8 o/or/ou/oder 10 10.9 / 10		
Prodotto di grado / Product grade / Produit de qualité / Produktklasse	Viti: C eccetto per le dimensioni c ed r Screw: C except for dimensions c and r Vis: C sauf pour les dimensions c et r Schrauben: C mit Ausnahme der Abmessungen c und r Tol. l ≥ 155 mm + 4,0 mm		
	Dadi / Nuts / Écrous / Muttern:	B	
	Rondelle / Washers / Rondelles / Scheiben:	A	
k-class and k-Factor	K1: $0{,}10 \le k_i \le 0{,}16$		

IT	EN	FR	DE
9. La prestazione del prodotto di cui ai punti 1 e 2 è conforme alla prestazione dichiarata di cui al punto 8.	9. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 8.	9. Les performances du produit identifié aux point 1 et 2 sont conformes aux performances déclarées indiquées au point 8.	9. Die Leistung des Produkts gemäß den Nummern 1 und 2 entspricht der erklärten Leistung nach Nummer 8.
Si rilascia la presente dichiarazione di prestazione sotto la responsabilità esclusiva del fabbricante di cui al punto 4.	This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.	La présent déclaration des performances est établie sous la seule responsabilité du fabricant identifié au point 4.	Verantwortlich für die Erstellung dieser Leistungserklärung ist allein der Hersteller gemäß Nummer 4.
Firmato a nome e per conto di:	Signed for and on behalf of the manufacturer by:	Signé pour le fabricant et en son nom par:	Unterzeichnet für den Hersteller und im Namen des Herstellers von:

Alessandro Vescovini

SBE-VARVIT S.p.A. Presidente / Chairman / President / Präsident

Monfalcone, 31/07/2015

DICHIARAZIONE DI PRESTAZIONE / DECLARATION OF PERFORMANCE /DÉCLARATION DES PERFORMANCES / LEISTUNGSERKLÄRUNG n. 01HRK12015 PAG. 2/2

STRUCTURAL BOLTING ASSEMBLIES

EN 14399-3 HR System (DoP K2)

Preloaded assemblies

VESCOVINI GROUP

DICHIARAZIONE DI PRESTAZIONE / DECLARATION OF PERFORMANCE / DÉCLARATION DES PERFORMANCES / LEISTUNGSERKLÄRUNG

n. 01HRK22015

IT

1. Codice di identificazione unico del prodotto-tipo:

Elementi di collegamento strutturali ad alta resistenza adatti al precarico. Sistema HR, K-class K2.

2. Numero di tipo, lotto, serie o qualsiasi altro elemento che consenta l'identificazione del prodotto da costruzione ai sensi dell'articolo 11, paragrafo 4:

Elementi di collegamento strutturali ad alta resistenza adatti al precarico. Sistema HR, K-class K2.

3. Uso previsto del prodotto da costruzione, conformemente alla relativa specifica tecnica armonizzata, come previsto dal fabbricante:

Opere metalliche strutturali

4. Nome, denominazione commerciale registrata o marchio registrato e indirizzo del fabbricante ai sensi dell'articolo 11, paragrafo 5:

EN

1. Unique identification code of the product-type:

High-strength structural bolting assemblies for preloading. HR system, K-class K2.

2. Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11 (4):

High-strength structural bolting assemblies for preloading. HR system, K-class K2.

3. Intended use of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer:

Structural metallic works.

4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required under Article 11 (5):

FR

1. Code d'identification unique du produit type:

Boulonnerie de construction métallique à haute résistance apte à la précontrainte. Système HR, K-classe K2.

2. Numéro de type, de loto u de série ou tout autre élément permettant l'identification du produit de construction, conformément à l'article 11, paragraphe 4:

Boulonnerie de construction métallique à haute résistance apte à la précontrainte. Système HR, K-class K2.

3. Usage prévus du produit de construction, conformément à la spécification technique harmonisée applicable, comme prévu par le fabricant:

Travaux de construction métalliques.

4. Nom, raison sociale ou marque déposée et adresse de contact du fabricant, conformément à l'article 11, paragraphe 5:

DE

1. Eindeutiger Kenncode des Produkttyps:

Garnituren für hochfeste planmäßig Vorspannbare Schraubenverbindungen für den Metallbau. System HR, K-klasse K2.

2. Typen-, Chargen- oder Seriennummer oder ein anderes Kennzeichen zur Identifikation des Bauprodukts gemäß Artikel 11 Absatz 4:

Garnituren für hochfeste planmäßig Vorspannbare Schraubenverbindungen für den Metallbau. System HR, K-class K2.

3. Vom Hersteller vorgesehener Verwendungszweck des Bauprodukts gemäß der anwendbaren harmonisierten technischen Spezifikation:

Metallbau Werke.

4. Name, eingetragener Handelsname oder eingetragene Marke und Kontaktanschrift des Herstellers gemäß Artikel 11 Absatz 5:

SBE-VARVIT S.p.A.
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34074 Monfalcone (GO) – Italy
Tel. (+39) 0481 7146
Fax (+39) 0481 714714
e-mail: info@vescovinigroup.com

5. Se opportuno, nome e indirizzo del mandatario il cui mandato copre i compiti cui all'articolo 12, paragrafo 2:

Non applicabile

5. Where applicable, name and contact address of the authorised representative whose mandate covers the tasks specified in Article 12 (2):

Not applicable

5. Le cas échéant, nom et adresse de contact du mandataire dont le mandat couvre les tâches visées à l'article 12, paragraphe 2:

Non applicable

5. Gegebenenfalls Name und Kontaktanschrift des Bevollmächtigten, der mit den Aufgaben gemäß Artikel 12 Absatz 2 beauftragt ist:

Nicht anwendbar

6. Sistema di valutazione e verifica della costanza della prestazione del prodotto da costruzione di cui all'allegato V:

Sistema 2+

6. System of assessment and verification of constancy of performance of the construction product as set out in CPR, Annex V:

System 2+

6. Le système d'évaluation et de vérification de la constance des performances du produit de construction, conformément à CPR, annexe V:

Système 2+

6. System zur Bewertung und Überprüfung der Leistungsbeständigkeit des Bauprodukts gemäß in CPR, Anhang V:

System 2+

DICHIARAZIONE DI PRESTAZIONE / DECLARATION OF PERFORMANCE /DÉCLARATION DES PERFORMANCES / LEISTUNGSERKLÄRUNG n. 01HRK22015 PAG. 1/2

VESCOVINI GROUP

7. Nel caso di una dichiarazione di prestazione relativa ad un prodotto da costruzione che rientra nell'ambito di applicazione di una norma armonizzata:

TÜV Italia S.r.l., organismo notificato di certificazione del controllo della produzione n. 0948, ha effettuato l'ispezione iniziale dello Stabilimento di produzione e del controllo di produzione in fabbrica, la sorveglianza continua, la verifica e la valutazione del controllo di produzione e ha rilasciato il certificato di conformità del controllo di produzione in fabbrica N. 0948-CPR-0104 rev. 4.

7. In case of declaration of performance concerning a construction product covered by a harmonised standard:

TÜV Italia S.r.l., notified body for factory production control certification n. 0948, performed the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control and issued the certificate of conformity of the factory production control N. 0948-CPR-0104 rev. 4.

7. Dans le cas de la déclaration des performances concernant un produit de construction couvert par une norme harmonisée:

TÜV Italia S.r.l., organisme notifié pour le certification du contrôle de la production en usine n. 0948, a effectué l' inspection initiale de l'établissement de fabrication, le contrôle de la production en usine, la surveillance continue, l'évaluation et l'appréciation permanentes du contrôle de la production en usine et a délivré le certificat de conformité du contrôle de la production en usine N. 0948-CPR-0104 rev. 4.

7. Im Falle der Leistungserklärung, die ein Bauprodukt betriff, das von einer harmonisierten Norm erfasst wird:

TÜV Italia S.r.l., zustellender Organismus für die Zertifizierung der Produktionskontrolle n. 0948, hat die Erstinspektion des Werks und die Produktionskontrolle beim Werk, die ununterbrochene Überwachung, die Prüfung und Bewertung der Produktionskontrolle im Werk durchgeführt und hat die Konformitätsbescheinigung für die Produktionskontrolle im Werk N. 0948-CPR-0104 rev. 4 erteilt.

8. Prestazione dichiarata / Declared performance / Performances déclarée / Erklärte Leistung

Caratteristiche essenziali / Essential characteristics / Caractéristique essentielles / Wesentliche Merkmale	Prestazione / Performance / Performances / Leistung	Specifica tecnica armonizzata / Harmonised technical specification/ Spécifications techniques harmonisées Harmonisierte technische Spezifikation
Tipo / Type / Type / Art	HR	EN 14399-1:2015
Classe di resistenza / Property class / Class de résistance / Festigkeitsklasse	8.8 / 8 o/or/ou/oder 10 10.9 / 10	
Prodotto di grado / Product grade / Produit de qualité / Produktklasse	Viti: C eccetto per le dimensioni c ed r Screw: C except for dimensions c and r Vis: C sauf pour les dimensions c et r Schrauben: C mit Ausnahme der Abmessungen c und r Tol. l ≥ 155 mm + 4,0 mm	
	Dadi / Nuts / Écrous / Muttern: B	
	Rondelle / Washers / Rondelles / Scheiben: A	
k-class and k-Factor	K2: $0,10 \le k_m \le 0,23$ $V_k \le 0,06$	

9. La prestazione del prodotto di cui ai punti 1 e 2 è conforme alla prestazione dichiarata di cui al punto 8.

Si rilascia la presente dichiarazione di prestazione sotto la responsabilità esclusiva del fabbricante di cui al punto 4.

Firmato a nome e per conto di:

9. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 8.

This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Signed for and on behalf of the manufacturer by:

9. Les performances du produit identifié aux point 1 et 2 sont conformes aux performances déclarées indiquées au point 8.

La présent déclaration des performances est établie sous la seule responsabilité du fabricant identifié au point 4.

Signé pour le fabricant et en son nom par:

9. Die Leistung des Produkts gemäß den Nummern 1 und 2 entspricht der erklärten Leistung nach Nummer 8.

Verantwortlich für die Erstellung dieser Leistungserklärung ist allein der Hersteller gemäß Nummer 4.

Unterzeichnet für den Hersteller und im Namen des Herstellers von:

Alessandro Vescovini

SBE-VARVIT S.p.A. Presidente / Chairman / President / Präsident

Monfalcone, 31/07/2015

DICHIARAZIONE DI PRESTAZIONE / DECLARATION OF PERFORMANCE /DÉCLARATION DES PERFORMANCES / LEISTUNGSERKLÄRUNG n. 01HRK22015 PAG. 2/2

SBE VARVIT

STRUCTURAL BOLTING ASSEMBLIES

50 YEARS OF PASSION

EN 14399-4 HV System (DoP K1)

Preloaded assemblies

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REA di RE 228950
CAP. SOC. Euro 3.096.000,00 i.v.

VESCOVINI GROUP

DICHIARAZIONE DI PRESTAZIONE / DECLARATION OF PERFORMANCE / DÉCLARATION DES PERFORMANCES / LEISTUNGSERKLÄRUNG

n. 01HVK12015

IT / EN / FR / DE

1. Codice di identificazione unico del prodotto-tipo:

Elementi di collegamento strutturali ad alta resistenza adatti al precarico. Sistema HV, K-class K1.

1. Unique identification code of the product-type:

High-strength structural bolting assemblies for preloading. HV system, K-class K1.

1. Code d'identification unique du produit type:

Boulonnerie de construction métallique à haute résistance apte à la précontrainte. Système HV, K-classe K1.

1. Eindeutiger Kenncode des Produkttyps:

Garnituren für hochfeste planmäßig Vorspannbare Schraubenverbindungen für den Metallbau. System HV, K-klasse K1.

2. Numero di tipo, lotto, serie o qualsiasi altro elemento che consenta l'identificazione del prodotto da costruzione ai sensi dell'articolo 11, paragrafo 4:

Elementi di collegamento strutturali ad alta resistenza adatti al precarico. Sistema HV, K-class K1.

2. Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11 (4):

High-strength structural bolting assemblies for preloading. HV system, K-class K1.

2. Numéro de type, de loto u de série ou tout autre élément permettant l'identification du produit de construction, conformément à l'article 11, paragraphe 4:

Boulonnerie de construction métallique à haute résistance apte à la précontrainte. Système HV, K-class K1.

2. Typen-, Chargen- oder Seriennummer oder ein anderes Kennzeichen zur Identifikation des Bauprodukts gemäß Artikel 11 Absatz 4:

Garnituren für hochfeste planmäßig Vorspannbare Schraubenverbindungen für den Metallbau. System HV, K-class K1.

3. Uso previsto del prodotto da costruzione, conformemente alla relativa specifica tecnica armonizzata, come previsto dal fabbricante:

Opere metalliche strutturali

3. Intended use of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer:

Structural metallic works.

3. Usage prévus du produit de construction, conformément à la spécification technique harmonisée applicable, comme prévu par le fabricant:

Travaux de construction métalliques.

3. Vom Hersteller vorgesehener Verwendungszweck des Bauprodukts gemäß der anwendbaren harmonisierten technischen Spezifikation:

Metallbau Werke.

4. Nome, denominazione commerciale registrata o marchio registrato e indirizzo del fabbricante ai sensi dell'articolo 11, paragrafo 5:

4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required under Article 11 (5):

4. Nom, raison sociale ou marque déposée et adresse de contact du fabricant, conformément à l'article 11, paragraphe 5:

4. Name, eingetragener Handelsname oder eingetragene Marke und Kontaktanschrift des Herstellers gemäß Artikel 11 Absatz 5:

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34074 Monfalcone (GO) – Italy
Tel. (+39) 0481 7146
Fax (+39) 0481 714714
e-mail: info@vescovinigroup.com

5. Se opportuno, nome e indirizzo del mandatario il cui mandato copre i compiti cui all'articolo 12, paragrafo 2:

Non applicabile

5. Where applicable, name and contact address of the authorised representative whose mandate covers the tasks specified in Article 12 (2):

Not applicable

5. Le cas échéant, nom et adresse de contact du mandataire dont le mandat couvre les tâches visées à l'article 12, paragraphe 2:

Non applicable

5. Gegebenenfalls Name und Kontaktanschrift des Bevollmächtigten, der mit den Aufgaben gemäß Artikel 12 Absatz 2 beauftragt ist:

Nicht anwendbar

6. Sistema di valutazione e verifica della costanza della prestazione del prodotto da costruzione di cui all'allegato V:

Sistema 2+

6. System of assessment and verification of constancy of performance of the construction product as set out in CPR, Annex V:

System 2+

6. Le système d'évaluation et de vérification de la constance des performances du produit de construction, conformément à CPR, annexe V:

Système 2+

6. System zur Bewertung und Überprüfung der Leistungsbeständigkeit des Bauprodukts gemäß in CPR, Anhang V:

System 2+

VESCOVINI GROUP

7. Nel caso di una dichiarazione di prestazione relativa ad un prodotto da costruzione che rientra nell'ambito di applicazione di una norma armonizzata:

TÜV Italia S.r.l., organismo notificato di certificazione del controllo della produzione n. 0948, ha effettuato l'ispezione iniziale dello Stabilimento di produzione e del controllo di produzione in fabbrica, la sorveglianza continua, la verifica e la valutazione del controllo di produzione e ha rilasciato il certificato di conformità del controllo di produzione in fabbrica N. 0948-CPR-0104 rev. 4.

7. In case of declaration of performance concerning a construction product covered by a harmonised standard:

TÜV Italia S.r.l., notified body for factory production control certification n. 0948, performed the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control and issued the certificate of conformity of the factory production control N. 0948-CPR-0104 rev. 4.

7. Dans le cas de la déclaration des performances concernant un produit de construction couvert par une norme harmonisée:

TÜV Italia S.r.l., organisme notifié pour le certification du contrôle de la production en usine n. 0948, a effectué l' inspection initiale de l'établissement de fabrication, le contrôle de la production en usine, la surveillance continue, l'évaluation et l'appréciation permanentes du contrôle de la production en usine et a délivré le certificat de conformité du contrôle de la production en usine N. 0948-CPR-0104 rev. 4.

7. Im Falle der Leistungserklärung, die ein Bauprodukt betriff, das von einer harmonisierten Norm erfasst wird:

TÜV Italia S.r.l., zustellender Organismus für die Zertifizierung der Produktionskontrolle n. 0948, hat die Erstinspektion des Werks und die Produktionskontrolle beim Werk, die ununterbrochene Überwachung, die Prüfung und Bewertung der Produktionskontrolle im Werk durchgeführt und hat die Konformitätsbescheinigung für die Produktionskontrolle im Werk N. 0948-CPR-0104 rev. 4 erteilt.

8. Prestazione dichiarata / Declared performance / Performances déclarée / Erklärte Leistung

Caratteristiche essenziali / Essential characteristics / Caractéristique essentielles / Wesentliche Merkmale	Prestazione / Performance / Performances / Leistung		Specifica tecnica armonizzata / Harmonised technical specification/ Spécifications techniques harmonisées Harmonisierte technische Spezifikation
Tipo / Type / Type / Art	HV		EN 14399-1:2015
Classe di resistenza / Property class / Class de résistance / Festigkeitsklasse	10.9 / 10		
Prodotto di grado / Product grade / Produit de qualité / Produktklasse	Viti: C eccetto per le dimensioni c ed r Screw: C except for dimensions c and r Vis: C sauf pour les dimensions c et r Schrauben: C mit Ausnahme der Abmessungen c und r Tol. l ≥ 155 mm $^{+IT17}_{-1/2IT17}$		
	Dadi / Nuts / Écrous / Muttern:	B	
	Rondelle / Washers / Rondelles / Scheiben:	A	
k-class and k-Factor	K1: $0,10 \le k_i \le 0,16$		

9. La prestazione del prodotto di cui ai punti 1 e 2 è conforme alla prestazione dichiarata di cui al punto 8.

Si rilascia la presente dichiarazione di prestazione sotto la responsabilità esclusiva del fabbricante di cui al punto 4.

Firmato a nome e per conto di:

9. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 8.

This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Signed for and on behalf of the manufacturer by:

9. Les performances du produit identifié aux point 1 et 2 sont conformes aux performances déclarées indiquées au point 8.

La présent déclaration des performances est établie sous la seule responsabilité du fabricant identifié au point 4.

Signé pour le fabricant et en son nom par:

9. Die Leistung des Produkts gemäß den Nummern 1 und 2 entspricht der erklärten Leistung nach Nummer 8.

Verantwortlich für die Erstellung dieser Leistungserklärung ist allein der Hersteller gemäß Nummer 4.

Unterzeichnet für den Hersteller und im Namen des Herstellers von:

Alessandro Vescovini

SBE-VARVIT S.p.A. Presidente / Chairman / President / Präsident

Monfalcone, 31/07/2015

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

EN 14399-4 HV System (DoP K2)

SBE VARVIT

SBE – VARVIT SpA
HEAD AND REGISTERED OFFICE, SALES TO DISTRIBUTORS
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PURCHASING OFFICE AND MANUFACTURING PLANT
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MANUFACTURING PLANT
VIA DELL'INDUSTRIA, 41
33028 TOLMEZZO (UD) - ITALIA

OEM SALES AND MANUFACTURING PLANT
VIA CUMIANA, 9-11
10095 GRUGLIASCO (TO) - ITALIA
TEL. (39) 011-4704770 FAX (39) 011-4702238
FISCAL DATA
CF – PI – CC CEE IT00052160314
REA di RE 225950
CAP. SOC. Euro 3.096.000,00 i.v.

50 YEARS OF PASSION

VESCOVINI GROUP

DICHIARAZIONE DI PRESTAZIONE / DECLARATION OF PERFORMANCE / DÉCLARATION DES PERFORMANCES / LEISTUNGSERKLÄRUNG

n. 01HVK22015

IT	EN	FR	DE
1. Codice di identificazione unico del prodotto-tipo:	1. Unique identification code of the product-type:	1. Code d'identification unique du produit type:	1. Eindeutiger Kenncode des Produkttyps:
Elementi di collegamento strutturali ad alta resistenza adatti al precarico. Sistema HV, K-class K2.	High-strength structural bolting assemblies for preloading. HV system, K-class K2.	Boulonnerie de construction métallique à haute résistance apte à la précontrainte. Système HV, K-classe K2.	Garnituren für hochfeste planmäßig Vorspannbare Schraubenverbindungen für den Metallbau. System HV, K-klasse K2.
2. Numero di tipo, lotto, serie o qualsiasi altro elemento che consenta l'identificazione del prodotto da costruzione ai sensi dell'articolo 11, paragrafo 4:	2. Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11 (4):	2. Numéro de type, de loto u de série ou tout autre élément permettant l'identification du produit de construction, conformément à l'article 11, paragraphe 4:	2. Typen-, Chargen- oder Seriennummer oder ein anderes Kennzeichen zur Identifikation des Bauprodukts gemäß Artikel 11 Absatz 4:
Elementi di collegamento strutturali ad alta resistenza adatti al precarico. Sistema HV, K-class K2.	High-strength structural bolting assemblies for preloading. HV system, K-class K2.	Boulonnerie de construction métallique à haute résistance apte à la précontrainte. Système HV, K-class K2.	Garnituren für hochfeste planmäßig Vorspannbare Schraubenverbindungen für den Metallbau. System HV, K-class K2.
3. Uso previsto del prodotto da costruzione, conformemente alla relativa specifica tecnica armonizzata, come previsto dal fabbricante:	3. Intended use of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer:	3. Usage prévus du produit de construction, conformément à la spécification technique harmonisée applicable, comme prévu par le fabricant:	3. Vom Hersteller vorgesehener Verwendungszweck des Bauprodukts gemäß der anwendbaren harmonisierten technischen Spezifikation:
Opere metalliche strutturali	Structural metallic works.	Travaux de construction métalliques.	Metallbau Werke.
4. Nome, denominazione commerciale registrata o marchio registrato e indirizzo del fabbricante ai sensi dell'articolo 11, paragrafo 5:	4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required under Article 11 (5):	4. Nom, raison sociale ou marque déposée et adresse de contact du fabricant, conformément à l'article 11, paragraphe 5:	4. Name, eingetragener Handelsname oder eingetragene Marke und Kontaktanschrift des Herstellers gemäß Artikel 11 Absatz 5:

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e-mail: info@vescovinigroup.com

IT	EN	FR	DE
5. Se opportuno, nome e indirizzo del mandatario il cui mandato copre i compiti cui all'articolo 12, paragrafo 2:	5. Where applicable, name and contact address of the authorised representative whose mandate covers the tasks specified in Article 12 (2):	5. Le cas échéant, nom et adresse de contact du mandataire dont le mandat couvre les tâches visées à l'article 12, paragraphe 2:	5. Gegebenenfalls Name und Kontaktanschrift des Bevollmächtigten, der mit den Aufgaben gemäß Artikel 12 Absatz 2 beauftragt ist:
Non applicabile	Not applicable	Non applicable	Nicht anwendbar
6. Sistema di valutazione e verifica della costanza della prestazione del prodotto da costruzione di cui all'allegato V:	6. System of assessment and verification of constancy of performance of the construction product as set out in CPR, Annex V:	6. Le système d'évaluation et de vérification de la constance des performances du produit de construction, conformément à CPR, annexe V:	6. System zur Bewertung und Überprüfung der Leistungsbeständigkeit des Bauprodukts gemäß in CPR, Anhang V:
Sistema 2+	System 2+	Système 2+	System 2+

DICHIARAZIONE DI PRESTAZIONE / DECLARATION OF PERFORMANCE /DÉCLARATION DES PERFORMANCES / LEISTUNGSERKLÄRUNG n. 01HVK22015 PAG. 1/2

SBE VARVIT

VESCOVINI GROUP

IT	EN	FR	DE
7. Nel caso di una dichiarazione di prestazione relativa ad un prodotto da costruzione che rientra nell'ambito di applicazione di una norma armonizzata:	7. In case of declaration of performance concerning a construction product covered by a harmonised standard:	7. Dans le cas de la déclaration des performances concernant un produit de construction couvert par une norme harmonisée:	7. Im Falle der Leistungserklärung, die ein Bauprodukt betriff, das von einer harmonisierten Norm erfasst wird:
TÜV Italia S.r.l., organismo notificato di certificazione del controllo della produzione n. 0948, ha effettuato l'ispezione iniziale dello Stabilimento di produzione e del controllo di produzione in fabbrica, la sorveglianza continua, la verifica e la valutazione del controllo di produzione e ha rilasciato il certificato di conformità del controllo di produzione in fabbrica N. 0948-CPR-0104 rev. 4.	TÜV Italia S.r.l., notified body for factory production control certification n. 0948, performed the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control and issued the certificate of conformity of the factory production control N. 0948-CPR-0104 rev. 4.	TÜV Italia S.r.l., organisme notifié pour le certification du contrôle de la production en usine n. 0948, a effectué l' inspection initiale de l'établissement de fabrication, le contrôle de la production en usine, la surveillance continue, l'évaluation et l'appréciation permanentes du contrôle de la production en usine et a délivré le certificat de conformité du contrôle de la production en usine N. 0948-CPR-0104 rev. 4.	TÜV Italia S.r.l., zustellender Organismus für die Zertifizierung der Produktionskontrolle n. 0948, hat die Erstinspektion des Werks und die Produktionskontrolle beim Werk, die ununterbrochene Überwachung, die Prüfung und Bewertung der Produktionskontrolle im Werk durchgeführt und hat die Konformitätsbescheinigung für die Produktionskontrolle im Werk N. 0948-CPR-0104 rev. 4 erteilt.

8. Prestazione dichiarata / Declared performance / Performances déclarée / Erklärte Leistung

Caratteristiche essenziali / Essential characteristics / Caractéristique essentielles / Wesentliche Merkmale	Prestazione / Performance / Performances / Leistung		Specifica tecnica armonizzata / Harmonised technical specification/ Spécifications techniques harmonisées Harmonisierte technische Spezifikation
Tipo / Type / Type / Art	HV		EN 14399-1:2015
Classe di resistenza / Property class / Class de résistance / Festigkeitsklasse	**10.9 / 10**		
Prodotto di grado / Product grade / Produit de qualité / Produktklasse	Viti: C eccetto per le dimensioni c ed r Screw: C except for dimensions c and r Vis: C sauf pour les dimensions c et r Schrauben: C mit Ausnahme der Abmessungen c und r Tol. l ≥ 155 mm $^{+IT17}_{-1/2IT17}$		
	Dadi / Nuts / Écrous / Muttern:	B	
	Rondelle / Washers / Rondelles / Scheiben:	A	
k-class and k-Factor	K2: $0{,}10 \le k_m \le 0{,}23$ $V_k \le 0{,}06$		

IT	EN	FR	DE
9. La prestazione del prodotto di cui ai punti 1 e 2 è conforme alla prestazione dichiarata di cui al punto 8.	9. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 8.	9. Les performances du produit identifié aux point 1 et 2 sont conformes aux performances déclarées indiquées au point 8.	9. Die Leistung des Produkts gemäß den Nummern 1 und 2 entspricht der erklärten Leistung nach Nummer 8.
Si rilascia la presente dichiarazione di prestazione sotto la responsabilità esclusiva del fabbricante di cui al punto 4.	This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.	La présent déclaration des performances est établie sous la seule responsabilité du fabricant identifié au point 4.	Verantwortlich für die Erstellung dieser Leistungserklärung ist allein der Hersteller gemäß Nummer 4.
Firmato a nome e per conto di:	Signed for and on behalf of the manufacturer by:	Signé pour le fabricant et en son nom par:	Unterzeichnet für den Hersteller und im Namen des Herstellers von:

Alessandro Vescovini

SBE-VARVIT S.p.A. Presidente / Chairman / President / Präsident

Monfalcone, 31/07/2015

DICHIARAZIONE DI PRESTAZIONE / DECLARATION OF PERFORMANCE /DÉCLARATION DES PERFORMANCES / LEISTUNGSERKLÄRUNG n. 01HVK22015 PAG. 2/2

SBE VARVIT

STRUCTURAL BOLTING ASSEMBLIES

50 YEARS OF PASSION

Preloaded assemblies

EN 14399-10 HRC System (DoP)

VARVIT

VESCOVINI GROUP

DICHIARAZIONE DI PRESTAZIONE / DECLARATION OF PERFORMANCE / DÉCLARATION DES PERFORMANCES / LEISTUNGSERKLÄRUNG

n. 01HRC2015

IT

1. Codice di identificazione unico del prodotto-tipo:

Elementi di collegamento strutturali ad alta resistenza adatti al precarico. Sistema HRC.

2. Numero di tipo, lotto, serie o qualsiasi altro elemento che consenta l'identificazione del prodotto da costruzione ai sensi dell'articolo 11, paragrafo 4:

Elementi di collegamento strutturali ad alta resistenza adatti al precarico. Sistema HRC.

3. Uso previsto del prodotto da costruzione, conformemente alla relativa specifica tecnica armonizzata, come previsto dal fabbricante:

Opere metalliche strutturali

4. Nome, denominazione commerciale registrata o marchio registrato e indirizzo del fabbricante ai sensi dell'articolo 11, paragrafo 5:

EN

1. Unique identification code of the product-type:

High-strength structural bolting assemblies for preloading. HRC system.

2. Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11 (4):

High-strength structural bolting assemblies for preloading. HRC system.

3. Intended use of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer:

Structural metallic works.

4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required under Article 11 (5):

FR

1. Code d'identification unique du produit type:

Boulonnerie de construction métallique à haute résistance apte à la précontrainte. Système HRC.

2. Numéro de type, de loto u de série ou tout autre élément permettant l'identification du produit de construction, conformément à l'article 11, paragraphe 4:

Boulonnerie de construction métallique à haute résistance apte à la précontrainte. Système HRC-

3. Usage prévus du produit de construction, conformément à la spécification technique harmonisée applicable, comme prévu par le fabricant:

Travaux de construction métalliques.

4. Nom, raison sociale ou marque déposée et adresse de contact du fabricant, conformément à l'article 11, paragraphe 5:

DE

1. Eindeutiger Kenncode des Produkttyps:

Garnituren für hochfeste planmäßig Vorspannbare Schraubenverbindungen für den Metallbau. System HRC.

2. Typen-, Chargen- oder Seriennummer oder ein anderes Kennzeichen zur Identifikation des Bauprodukts gemäß Artikel 11 Absatz 4:

Garnituren für hochfeste planmäßig Vorspannbare Schraubenverbindungen für den Metallbau. System HRC-

3. Vom Hersteller vorgesehener Verwendungszweck des Bauprodukts gemäß der anwendbaren harmonisierten technischen Spezifikation:

Metallbau Werke.

4. Name, eingetragener Handelsname oder eingetragene Marke und Kontaktanschrift des Herstellers gemäß Artikel 11 Absatz 5:

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Tel. (+39) 0481 7146
Fax (+39) 0481 714714
e-mail: info@vescovinigroup.com

5. Se opportuno, nome e indirizzo del mandatario il cui mandato copre i compiti cui all'articolo 12, paragrafo 2:

Non applicabile

6. Sistema di valutazione e verifica della costanza della prestazione del prodotto da costruzione di cui all'allegato V:

Sistema 2+

5. Where applicable, name and contact address of the authorised representative whose mandate covers the tasks specified in Article 12 (2):

Not applicable

6. System of assessment and verification of constancy of performance of the construction product as set out in CPR, Annex V:

System 2+

5. Le cas échéant, nom et adresse de contact du mandataire dont le mandat couvre les tâches visées à l'article 12, paragraphe 2:

Non applicable

6. Le système d'évaluation et de vérification de la constance des performances du produit de construction, conformément à CPR, annexe V:

Système 2+

5. Gegebenenfalls Name und Kontaktanschrift des Bevollmächtigten, der mit den Aufgaben gemäß Artikel 12 Absatz 2 beauftragt ist:

Nicht anwendbar

6. System zur Bewertung und Überprüfung der Leistungsbeständigkeit des Bauprodukts gemäß in CPR, Anhang V:

System 2+

DICHIARAZIONE DI PRESTAZIONE / DECLARATION OF PERFORMANCE /DÉCLARATION DES PERFORMANCES / LEISTUNGSERKLÄRUNG n. 01HRC2015 PAG. 1/2

VARVIT

VESCOVINI GROUP

7. Nel caso di una dichiarazione di prestazione relativa ad un prodotto da costruzione che rientra nell'ambito di applicazione di una norma armonizzata:

TÜV Italia S.r.l., organismo notificato di certificazione del controllo della produzione n. 0948, ha effettuato l'ispezione iniziale dello Stabilimento di produzione e del controllo di produzione in fabbrica, la sorveglianza continua, la verifica e la valutazione del controllo di produzione e ha rilasciato il certificato di conformità del controllo di produzione in fabbrica N. 0948-CPR-0104 rev. 4.

7. In case of declaration of performance concerning a construction product covered by a harmonised standard:

TÜV Italia S.r.l., notified body for factory production control certification n. 0948, performed the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control and issued the certificate of conformity of the factory production control N. 0948-CPR-0104 rev. 4.

7. Dans le cas de la déclaration des performances concernant un produit de construction couvert par une norme harmonisée:

TÜV Italia S.r.l., organisme notifié pour le certification du contrôle de la production en usine n. 0948, a effectué l' inspection initiale de l'établissement de fabrication, le contrôle de la production en usine, la surveillance continue, l'évaluation et l'appréciation permanentes du contrôle de la production en usine et a délivré le certificat de conformité du contrôle de la production en usine N. 0948-CPR-0104 rev. 4.

7. Im Falle der Leistungserklärung, die ein Bauprodukt betriff, das von einer harmonisierten Norm erfasst wird:

TÜV Italia S.r.l., zustellender Organismus für die Zertifizierung der Produktionskontrolle n. 0948, hat die Erstinspektion des Werks und die Produktionskontrolle beim Werk, die ununterbrochene Überwachung, die Prüfung und Bewertung der Produktionskontrolle im Werk durchgeführt und hat die Konformitätsbescheinigung für die Produktionskontrolle im Werk N. 0948-CPR-0104 rev. 4 erteilt.

8. Prestazione dichiarata / Declared performance / Performances déclarée / Erklärte Leistung

Caratteristiche essenziali / Essential characteristics / Caractéristique essentielles / Wesentliche Merkmale	Prestazione / Performance / Performances / Leistung	Specifica tecnica armonizzata / Harmonised technical specification/ Spécifications techniques harmonisées Harmonisierte technische Spezifikation
Tipo / Type / Type / Art	HR	EN 14399-1:2015
Classe di resistenza / Property class / Class de résistance / Festigkeitsklasse	**10.9 / 10**	
Prodotto di grado / Product grade / Produit de qualité / Produktklasse	Viti: C eccetto per le dimensioni c ed r Screw: C except for dimensions c and r Vis: C sauf pour les dimensions c et r Schrauben: C mit Ausnahme der Abmessungen c und r Tol. l ≥ 155 mm + 4,0 mm	
	Dadi / Nuts / Écrous / Muttern: B	
	Rondelle / Washers / Rondelles / Scheiben: A	
k-class and k-Factor	K2: $0{,}10 \le k_m \le 0{,}23$ $V_k \le 0{,}06$	

9. La prestazione del prodotto di cui ai punti 1 e 2 è conforme alla prestazione dichiarata di cui al punto 8.

Si rilascia la presente dichiarazione di prestazione sotto la responsabilità esclusiva del fabbricante di cui al punto 4.

Firmato a nome e per conto di:

9. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 8.

This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Signed for and on behalf of the manufacturer by:

9. Les performances du produit identifié aux point 1 et 2 sont conformes aux performances déclarées indiquées au point 8.

La présent déclaration des performances est établie sous la seule responsabilité du fabricant identifié au point 4.

Signé pour le fabricant et en son nom par:

9. Die Leistung des Produkts gemäß den Nummern 1 und 2 entspricht der erklärten Leistung nach Nummer 8.

Verantwortlich für die Erstellung dieser Leistungserklärung ist allein der Hersteller gemäß Nummer 4.

Unterzeichnet für den Hersteller und im Namen des Herstellers von:

Alessandro Vescovini

SBE-VARVIT S.p.A. Presidente / Chairman / President / Präsident

Monfalcone, 31/07/2015

DICHIARAZIONE DI PRESTAZIONE / DECLARATION OF PERFORMANCE /DÉCLARATION DES PERFORMANCES / LEISTUNGSERKLÄRUNG n. 01HRC2015 PAG. 2/2

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

Production process for high-strength structural bolting

Bolts

Raw material	•Annealing heat treatment •Pickling, phosphating, lubricating
Cold forging	•Cold forging on multi-station machines
Threading	•Thread rolling
Heat treatment	•Hardening and tempering
Surface treatment	•e.g.: Hot-dip galvanization
Packaging	•Packaging and labelling

Nuts

Raw material	•Annealing heat treatment (cold forged nuts) •Pickling, phosphating, lubricating (cold forged nuts)
Forging	•Cold forging M12 to M24 •Hot forging above M12
Heat treatment	•Hardening and tempering
Surface treatment	•e.g.: Hot-dip galvanization
Threading	•Thread tapping
Surface treatment	•Lubrication
Packaging	•Packaging and labelling

Washers: are purchased from few selected Italian and German manufacturers according to our internal specification

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

Delivery condition

Preloaded bolting assemblies are very sensitive to differences occurred during the manufacturing and lubrication process. Therefore, it is important that the bolting assemblies are supplied by one manufacturer who is always responsible for the functionality of the bolting assemblies.

For the same reason it is important that the bolting assemblies coating is under the control of one manufacturer only.

Bolting assemblies shall be supplied in one of the following alternatives:

a) Single bolting assembly lot: Bolts, nuts and washers shall be supplied together as a set by one manufacturer. The components shall be packed together in one package, labelled with the single bolting assembly lot number and the manufacturer's identification. Components of the bolting assemblies are not interchangeable within the deliveries of other single bolting assembly lots

b) Extended bolting assembly lot: Bolts, nuts and washers shall be supplied as a set in which each component type is packed in separate packages, and labelled with the manufacturing lot number and the manufacturer's identification. The components of the bolting assemblies are interchangeable within the deliveries of the same manufacturer of an extended bolting assembly lot.

Bolting assemblies according to *k*-class K2 shall be supplied only according alternative a) i.e. single bolting assembly lot.

STRUCTURAL BOLTING ASSEMBLIES
Specifications and reference standards

Preloaded assemblies

		Bolt	Nut	Washers
Dimensions and tolerances		EN 14399-3, EN 14399-4, EN 14399-10		EN 14399-5/6
Material		Steel		
Thread	Tolerance	ISO 6g [a]	ISO 6H or ISO 6AZ	n.a.
	Standard	ISO 261, ISO 965-2, ISO 965-5		
Mechanical Properties	Property class	8.8 or 10.9 (HR) 10.9 (HV)	8 or 10 (HR) 10 (HV)	Hardness 300-370 HV
	Standard	ISO 898-1	ISO 898-2 [b]	
Surface finish	Normal	As processed [c]		
	Hot-dip galvanized	ISO 10684		
	Others	To be agreed [d]		
Surface discontinuity		ISO 6157-1	ISO 6157-2	[e]
Acceptability		ISO 3269		

[a] The tolerance class specified applies to bolts without or before any coating. Hot-dip galvanized bolts are intended for assembly with oversize tapped nuts only (6AZ)
[b] Increased proof load and hardness values for HR nuts (EN 14399-3)
[c] *As processed* means the normal finishing resulting from manufacture with a light coating of oil
[d] provided they do not impair the mechanical properties or the functional characteristics of the bolting assembly. Coatings of cadmium or cadmium alloy are not permitted
[e] Parts shall be uniform and free from irregularities or detrimental effects. No protruding burrs shall appear on the washers

STRUCTURAL BOLTING ASSEMBLIES

Marking

In addition to the binding marking requirements (ISO 898-1, ISO 898-2, EN 14399-3, EN 14399-4 and EN 14399-10), SBE bolts and nuts are marked both with an identification code that ensures the traceability of the production process records and with the CE marking.

Washers are marked according to EN 14399-5/6

STRUCTURAL BOLTING ASSEMBLIES

Tightening method

Beside the mechanical properties of the components, the functionality of the bolting assemblies requires that the specified preload can be achieved if the bolting assemblies are tightened with a suitable procedure.

The tightening torque necessary to achieve the minimum nominal preload ($F_{p,C}=0,7f_{ub}A_s$) has to be indicated on the package or on the label and shall include:

- First tightening step: tightening torque value in Nm, equals to 75% $M_{r,i}$ (for both torque and combined method)
- Second tightening step: final tightening torque, equals to 110% $M_{r,i}$ for the torque method, or the additional rotation angle for the combined method (torque-angle).

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

Tightening method

Tightening method according to EN 1090-2	Minimum information to be provided	*K*-class
Torque method	k_m = ……. 1st step: Torque = …… Nm 2nd step: Torque = …… Nm	K2
Combined method	1st step: Torque = …… Nm 2nd step: Further rotation	K1 (1)
HRC method	-	K0 (2) K2 (3)
DTI method	-	K0 (4)
(1) K2 can also be used (2) For HRD nuts	(3) For HR nuts (4) K1 or K2 could also be used, but declared as K0	

Preloaded assemblies

Tightening torque calculation (EN1090-2)

Torque method

$$M=k_m\ d\ F_{p,C}$$

a) **first tightening step:** the wrench shall be set to a torque value of about 0,75M. This step shall be completed for all bolts in one connection prior to commencement of the second step

b) **second tightening step:** the wrench shall be set to a torque value of 1,10 M

According to the standard, the torque method is applicable only to K2 assemblies. The torque method is considered the easiest solution but shall be calculated for each batch on the basis of the declared k_m, therefore different tightening torques shall be applied in the same building site.

The assemblies components must be packed together, resulting in a production cost increase.

STRUCTURAL BOLTING ASSEMBLIES

Tightening torque calculation (EN1090-2)

Combined method

a) **first tightening step:** the wrench shall be set to a torque value of about 0,75M ($M=0,13*d*F_{p,C}$ may be used unless otherwise specified). This step shall be completed for all bolts in one connection prior to commencement of the second step

b) **second tightening step:** a specified part turn is applied to the turned part of the assembly. The position of the nut relative to the bolt threads shall be marked after the first step, using a marking crayon or marking paint, so that in this second step the final rotation of the nut relative to the thread can be easily determined.

Table 21 — Combined method: additional rotation (8.8 and 10.9 bolts)

Total nominal thickness "t" of parts to be connected (including all packs and washers)	Further rotation to be applied, during the second step of tightening	
d = bolt diameter	Degrees	Part turn
$t < 2\,d$	60	1/6
$2\,d \le t < 6\,d$	90	1/4
$6\,d \le t \le 10\,d$	120	1/3

NOTE Where the surface under the bolt head or nut (allowing for taper washers, if used) is not perpendicular to the bolt axis, the required angle of rotation should be determined by testing

Introduction to SBE's solution

k-factor is the link between the tightening torque M and the preload force $F_{p,C}$ through the following relation:

$$M=k_m*d*F_{p,c}$$

where: **d**=nominal thread diameter (mm)

$\mathbf{F_{p,C}}=0,7*f_{ub}*A_s$

$\mathbf{f_{ub}}$=nominal tensile strength ($R_{m,nom}$) (MPa)

$\mathbf{A_s}$=nominal stress area of the bolt (mm^2)

Here below are some tightening torque calculation examples for an M24 10.9 assembly with different *k*-factors:

k=0,10 M=0,10*24*(0,7*1000*353) = **593 Nm**

k=0,16 M=0,16*24*(0,7*1000*353) = **949 Nm**

k=0,23 M=0,23*24*(0,7*1000*353) = **1364 Nm**

On the basis of the above, also in presence of bolting assemblies conform to the applicable standard, very different situations can be faced with the relevant uncertainty to choose the correct tightening torque.

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

SBE's solution

For all SBE's production batches, the recommended tightening torque to be applied with the torque method is indicated on the nuts packaging, even in case of components packed separately (k-class K1).

Exceeding the standard requirements, this value is the same regardless of the batch number, therefore the material is perfectly interchangeable, provided that only screws, nuts and washers produced and delivered by SBE are used and the relevant Operating Instructions are strictly observed.

OPERATING INSTRUCTIONS

Preloaded assemblies

OPERATING INSTRUCTIONS FOR HIGH-STRENGTH STRUCTURAL BOLTING EN 14399 MANUFACTURED BY SBE-VARVIT

ATTENTION! High strength structural bolting assemblies for preloading according to EN 14399 are very sensitive to differences in manufacture and lubrication.

For this reason:

1) according to EN 14399-1, bolts produced by SBE-VARVIT have to be used only with nuts and washers produced by SBE-VARVIT in the "as delivered" conditions;

2) nuts produced by SBE-VARVIT are treated with **a** long lasting lubricant. Utilization of other lubricants could modify the original and approved relationship between tightening and preloading and it is absolutely forbidden;

3) storage conditions from delivery to use on site must not compromise the surface conditions of bolts, nuts and washers and consequently the material has to be kept under roof and protected against atmospheric agents. Utilization of wet or oxidized components may lead to fail the requested preloading;

4) tightening can be carried out both with torque method (see tab. A) and combined method (see tab. B).

   The Final tightening torque Mr (=1,10 Mr,i) is shown on nuts packaging and has to be applied using calibrated torque wrenches with an accuracy of ± 4% according to EN ISO 6789 by rotation of the nut; different tightening procedures have to be approved by experimental tightening tests under site conditions as specified in annex H of European Standard EN 1090-2: 2008+A1:2011;

5) torque wrenches have to be checked for accuracy according to EN 1090-2:2008+A1:2011;

6) impact wrenches may be used only for the first tightening step (ref. EN 1090-2:2008+A1:2011 par. 8.5.3);

7) the thread length shall be chosen in such a way that after tightening the following requirements are met:

   7.1. the length of protrusion shall be at least the length of one thread pitch measured from the outer face of the nut to the end of the bolt;

   7.2. at least four full threads (in addition to the run out) shall remain clear between the bearing surface of the nut and the unthreaded part of the shank (system HR);

   7.3. clamp and grip length shall be in accordance with those specified in in Tables A.1 / A.2 of EN 14399-3 (system HR) and in Tables A.1 / A.2 of EN 14399-4 (system HV).

SBE-VARVIT S.p.A. declines all responsibility in case also one single point described above is not fulfilled.

OPERATING INSTRUCTIONS

HV - HR

Preloaded assemblies

INFORMATION RELATED TO TIGHTENING METHOD

TAB. A

Metodo a coppia / Torque method / Drehmomentverfahren / Méthode de couple

d	$F_{p,c}$ [kN]	k_m	Coppia di serraggio M_r [Nm] Tightening torque M_r [Nm] Anziehmoment M_r [Nm] Couple de serrage M_r [Nm]	
			1° / 1st step 1. Schritt 1ère étape	2° / 2nd step 2. Schritt 2ème étape
M12	59	0,129	70	100
M14	81	0,129	110	160
M16	110	0,129	170	250
M18	134	0,128	230	340
M20	172	0,119	300	450
M22	212	0,127	440	650
M24	247	0,123	550	800
M27	321	0,131	850	1250
M30	393	0,127	1120	1650
M33	486	0,125	1500	2200
M36	572	0,124	1900	2800

Preloaded assemblies

HV - HR

INFORMATION RELATED TO TIGHTENING METHOD

TAB. B

Metodo combinato / Combined method / Kombiniertes Anziehverfahren / Méthode combinée

1° step / 1st step / 1. Schritt / 1ère étape

d	M_r [Nm]
M12	70
M14	110
M16	170
M18	230
M20	330
M22	450
M24	580
M27	850
M30	1150
M33	1550
M36	2000

2° step / 2nd step / 2. Schritt / 2ème étape

Rotazione aggiuntiva da applicare nel secondo step di serraggio
Further rotation to be applied, during the second step of tightening
Zusätzliche Drehung, die bei zweiter Anziehphase anzuwenden ist
Rotation additionnelle à appliquer lors du deuxième step de serrage

t	Gradi Degrees Grad Degrés	Rotazione Part turn Drehung Rotation
t < 2d	60	1/6
2d ≤ t < 6d	90	1/4
6d ≤ t ≤10d	120	1/3

t = spessore nominale totale delle parti di collegamento (inclusi tutti gli spessori e le rondelle) / total nominal thickness of parts to be connected (including all packs and washers) / Nenndicke der Verbindungselemente (einschliesslich alle Zwischenstücke und Scheiben) / Rotation additionnelle à appliquer lors du deuxième step de serrage

***d** = diametro bullone / bolt diameter/ Bolzendurchmesser / diamètre boulon*

Nota: quando la superficie sotto la testa del bullone o del dado (che preveda rondelle coniche, laddove utilizzate) non è perpendicolare all'asse del bullone, l'angolo di rotazione richiesto dovrebbe essere determinato mediante prove.

Note: where the surface under the bolt head or nut (allowing for taper washers, if used) is not perpendicular to the bolt axis, the required angle of rotation should be determined by testing.

Anmerkung: Fails eine Neigung der Auflageflächen zwischen Schraubenkopt oder der Mutter (auch bei Einsatz von konischen Unterlegscheiben) und dem Bauteil auftritt, sollte der enforderlichen Drehwinkel durch Prüfungen festgelegt werden.

Remarque: quand la surface sous la tête du boulon ou de l'écrou (qui prévoit rondelles coniques, si utilisées) n'est pas perpendiculaire à l'axe du boulon, l'angle de rotation souhaité devrait être établi par des éssais.

OPERATING INSTRUCTIONS

Preloaded assemblies

OPERATING INSTRUCTIONS FOR HIGH-STRENGTH STRUCTURAL BOLTING SYSTEM HRC EN 14399-10 MANUFACTURED BY SBE-VARVIT

ATTENTION! High strength structural bolting assemblies for preloading according to EN 14399 standard are very sensitive to differences in manufacture and lubrication

For this reason:

1. according to EN 14399-1 standard, bolts produced by SBE-VARVIT have to be used only and exclusively with nuts and washers produced by SBE-VARVIT in the "as delivered" conditions;
2. assemblies produced by SBE-VARVIT are treated with **a** long lasting lubricant. Utilization of other lubricants should modify the original and approved relationship between tightening and preloading and it is absolutely forbidden;
3. storage conditions from delivery to use on site must not compromise the surface conditions of bolts, nuts and washers and consequently the material has to be kept under roof and protected against atmospheric agents. Utilization of wet or oxidized components may lead to fail the requested preloading;
4. the thread length shall be chosen in such a way that after tightening the following requirements are met:
   - 4.1 the length of protrusion shall be at least the length of one thread pitch measured from the outer face of the nut to the end of the bolt;
   - 4.2 at least four full threads (in addition to the run out) shall remain clear between the bearing surface of the nut and the unthreaded part of the shank;
   - 4.3 grip length shall be calculated using the following formula valid for bolting assemblies with two washers (10.9/10):

     $t_{s\ max} = l_{min} - m_{max} - 2h_{max} - 1P$

     $t_{s\ min} = l_{g\ max} + 4P - 2h_{min}$

     where:

     t_s = total thickness of the clamped parts between the nut bearing face and the bolt bearing face less the thickness of the washers

     l = length of the bolt

     m = height of the nut

     h = washer thickness

     P = thread pitch

     l_g = distance from the bearing face to the first full form thread

OPERATING INSTRUCTIONS

Preloaded assemblies

5. Nuts shall be assembled so that their designation markings are visible for inspection after assembly
6. Washers used under heads of bolts shall be chamfered according to EN 14399-6 and positioned with the chamfer towards the bolt head. Washers according to EN 14399-5 shall only be used under nuts. In case adjustment of the grip length is necessary only one additional plate washer may be used on the side that is turned, alternatively an additional plate washer or additional plate washers may be placed on the side that is not turned.
7. The HRC bolts shall be tightened using a specific shear wrench equipped with two co-axial sockets which react by torque one against the other. The outer socket which engages the nut rotates clockwise. The inner socket which engages the spline end of the bolt rotates anticlockwise. The specified preload requirement is controlled by the HRC bolt itself by means of the geometrical and torsion mechanical characteristics together with the lubrication conditions. The equipment does not need calibration. In order to ensure that the preloads in fully installed bolts in connections meet the specified minimum preload requirement, the bolt installation process generally comprises two tightening steps; both using the shear wrench:

   The first tightening step is achieved at the latest when the shear wrench outer socket stops turning. If specified this first step is repeated as often as required. This first step shall be completed for all bolts in one connection prior to commencement of the second step (guidance of the equipment manufacturer may give additional information on how to identify if pre-tightening has occurred, e.g. sound of shear wrench changing, or if other methods of pre-tightening are suitable).

   The second tightening step is achieved when the spline end of the bolt shears off at the break-neck.

8. If the assembly conditions are such that it is not possible to use the shear wrench on the HRC bolt assembly, e.g. for lack of space, tightening shall be carried out using a procedure in accordance with the torque control method with the aid of the k-class K2 information, shown on our certificates. The torque tightening method comprises at least the two following steps and shall satisfy also the following items 9. 10. 11.:

   First tightening step: the wrench shall be set to a torque value of about 0,75 $M_{r,2}$ (Mr,2 = k_m d $F_{p,C}$). This first step shall be completed for all bolts in one connection prior to commencement of the second step;

   Second tightening step: the wrench shall be set to a torque value of 1,10 $M_{r,2}$.

9. the tightening torque values shown on the relevant certificates have to be applied using calibrated torque wrenches with an accuracy of ± 4% according to EN ISO 6789 by rotation of the nut; different tightening procedures have to be approved by experimental tightening tests under site conditions as specified in annex H of European Standard EN 1090-2: 2008+A1:2011;
10. torque wrenches used for tightening by torque method has to be checked for accuracy at least weekly according to EN 1090 2:2008+A1:2011;
11. impact wrenches may be used only for the first tightening step (ref. EN 1090-2:2008+A1:2011 par. 8.5.3);
12. If a bolt assembly has been tightened to the minimum preload and is later un-tightened, it shall be removed and the whole assembly shall be discarded;

SBE-VARVIT S.p.A. declines all responsibility in case also one single point described above is not fulfilled.

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

We can fully satisfy also K class K2 requirements if requested by the site management or by specific projects design. In this case, the higher costs due to the packaging shall be taken into consideration to calculate the sale price.

To return to the previous example, SBE recommends for an M24 10.9 a final tightening torque of 800 Nm, equivalent to a *k*-factor=0,123 [(0,123*24*0,7*1000*353)*1,1=729*1,1=802 Nm].

With *k*-factor=0,123 max the minimum preload conditions will always be met ($F_{p,C\ min}$ =247 kN):

$$F_{p,C\ min} = M/k*d = 800/0,123*24 = 271\ kN$$

Similarly, the minimum value of *k* to be observed is calculated to satisfy the standard requirement for $F_{bi,max} \geq 0,9\ f_{ub}$ and at the same time to avoid the risk of undesirable overloads.

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

Advantages of SBE's solution

- Complete interchangeability of individual components (screw, nut and washers) ➔ simplified site management
- Torque tightening system ➔ much easier to apply and to control, according to EN 1090-2 ➔ significant risk reduction due to human errors
- Use of a constant tightening torque (indicated on the nuts box labels) for all batches supplied ➔ simplification of assembly operations and subsequent maintenance work ➔ reduced timing and assembly costs
- Since the constant torque is declared and guaranteed, there is no longer any technical reason for delivering assemblies in single packages, and consequently the product can be packed separately using high productivity automatic systems, thus avoiding unnecessary cost increasing for the customers ➔ reduction of the purchase costs (separate packages)

STRUCTURAL BOLTING ASSEMBLIES

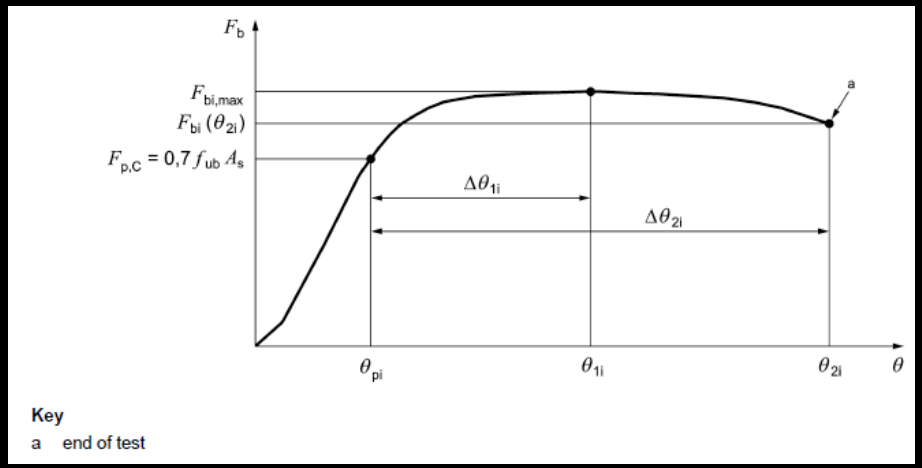
Preloaded assemblies

Size	$F_{p,C}$ (kN)	k_m	Torque (Nm)	
			1st step	2nd step
M12	59	0,129	70	100
M14	81	0,129	110	160
M16	110	0,129	170	250
M18	134	0,128	230	340
M20	172	0,119	300	450
M22	212	0,127	440	650
M24	247	0,123	550	800
M27	321	0,131	850	1250
M30	393	0,127	1120	1650
M33	486	0,125	1500	2200
M36	572	0,124	1900	2800

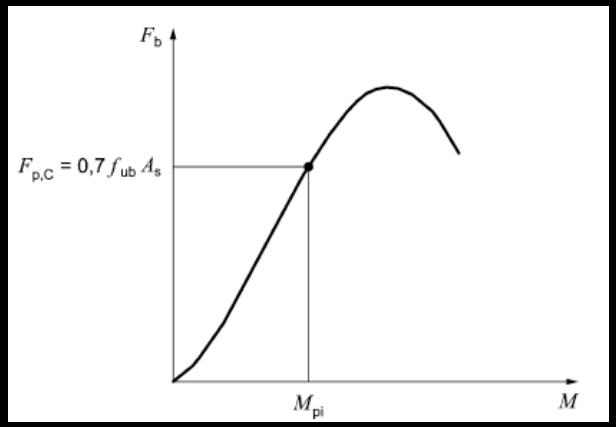
STRUCTURAL BOLTING ASSEMBLIES

Suitability test – Evaluation of the test results

Rotation/bolt force curve



Torque/bolt force curve at the design preload



$$k_i = \frac{M_{pi}}{d\, F_{p,C}}$$

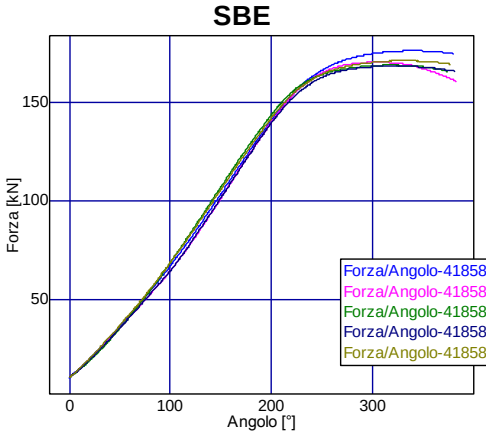
$$s_k = \sqrt{\frac{\sum (k_i - k_m)^2}{n-1}} \quad \text{with} \quad k_m = \frac{\sum_{i=1}^{n} k_i}{n}$$

$$V_k = \frac{s_k}{k_m}$$

Example of suitability test report

TEST REPORT

Customer	: Example
Thread size	: M16
Type	: EN 14399-4 HV
Article number	: 0965701602000
Surface conditions	: PLAIN
Bolt strength	: 10.9
Nut strength	: 10
Thread diameter d [mm]	: 16
Pitch p [mm]	: 2
Inner face diameter di [mm]	: 17.30
Outer face diameter do [mm]	: 25.40
Clamping length [mm]	: 55
Delta theta 1 [°]	: 120
Delta theta 2 [°]	: 210
Bolt batch nbr.	: 423059-0
Nut batch nbr.	: 418586-0
Washer batch nbr.	: 431147-0



Results:

	Fp Prog kN	Mtot FIND Nm	Fbi,max MAX kN	Delta Theta 1 Prog °	Delta Theta 2 Prog °	K Prog	Fend END kN	F 250 Nm FIND kN
Upper limit						0.160		
Lower limit			141.00	120.00	210.00	0.100	109.67	100.00
n	5	5	5	5	5	5	5	5
Max	109.67	232.00	175.79	178.16	220.35	0.132	173.64	131.39
Min	109.67	213.73	167.91	141.14	220.22	0.122	159.56	118.88
x	109.67	226.25	170.54	163.23	220.29	0.129	166.15	122.45
s	0.00	7.18	3.14	14.94	0.05	0.004	5.22	5.12
v	0.00	0.03	0.02	0.09	0.00	0.032	0.03	0.04
m	0.00	3.21	1.41	6.68	0.02	0.002	2.33	2.29
418586_0_001.PRB	109.67	228.72	175.79	178.16	220.22	0.130	173.64	121.93
418586_0_002.PRB	109.67	213.73	169.95	141.14	220.29	0.122	159.56	131.39
418586_0_003.PRB	109.67	232.00	168.38	160.73	220.35	0.132	164.50	118.88
418586_0_004.PRB	109.67	227.69	167.91	160.04	220.30	0.130	164.76	119.99
418586_0_005.PRB	109.67	229.11	170.66	176.08	220.31	0.131	168.30	120.06

Date: 07/01/2016

Operator: F. Miniussi

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

Tightening test Equipments

SBE Laboratory is equipped with n. 2 test benches to test high-strength structural bolting assemblies with diameter up to M48 10.9 (M52 8.8).

- Force 0 - 600 kN;
- Tightening torque 0 -3200 Nm;
- Max testing speed 30 min -1.

- Force 0 - 1800 kN;
- Tightening torque 0 -18000 Nm;
- Max testing speed 13 min -1.

STRUCTURAL BOLTING ASSEMBLIES
Main differences

Preloaded assemblies

		HV	HR	HRC
Bolt	Property class	10.9	8.8 – 10.9	10.9
	Thread sizes	M12 to M36		
	Thread length	short	ISO 888	
	Head width across flats	Large series except M12 and M20		Large series except M12 and M20 or cup or countersunk [a] head
Nut	Property class	10	8 – 10	10
	Height	m_{max}=0,8 D	ISO Style 1 m_{min}≥0,8 D	ISO Style 1 m_{min}≥0,8D (HR) m=1D (HRD)
	Proof load	ISO 898-2	Higher than ISO 898-2	Higher than ISO 898-2 (HR) and than HR (HRD)
Washers	Type	EN 14399-6	EN 14399-6 or EN 14399-5 [b]	
	Number [c]	2	1 (8.8) or 2 (10.9)	2

[a] New draft standard

[b] Under nut only

[c] See following page for more details

STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

ABSTRACT FROM EN 1090-2:2008+A1:2011

Washers used under heads of preloaded bolts shall be chamfered according to EN 14399-6 and positioned with the chamfer towards the bolt head. Washers according to EN 14399-5 shall only be used under nuts.

Plain washers (or if necessary hardened taper washers) shall be used for preloaded bolts as follows:

a) for 8.8 bolts a washer shall be used under the bolt head or the nut, whichever is to be rotated;

b) for 10.9 bolts washers shall be used under both the bolt head and the nut.

Plate washers shall be used for connections with [A1] slotted [A1] and oversized holes. One additional plate washer or up to [A1] three additional washers with a maximum combined thickness of 12 mm may be used to adjust [A1] the grip length of bolt assemblies. [A1] For preloaded bolt assemblies tightened by the torque control method (including system HRC) only one additional plate washer may be used on the side that is turned, alternatively an additional plate washer or additional washers may be placed on the side that is not turned. Otherwise, in preloaded and non-preloaded applications, an additional plate washer or additional washers may be placed either on the side that is turned or on the side that is not turned. [A1]

[A1] NOTE Any use of additional washers or plate washers can cause a relocation of the shear plane for bolts with a shank and should therefore be checked to be in line with the design. [A1]

Dimensions and steel grades of plate washers shall be specified. They shall not be thinner than 4 mm.

Taper washers shall be used if the surface of the constituent product is at an angle to a plane perpendicular to the bolt axis of more than:

a) 1/20 (3°) for bolts with $d \leq 20$ mm;

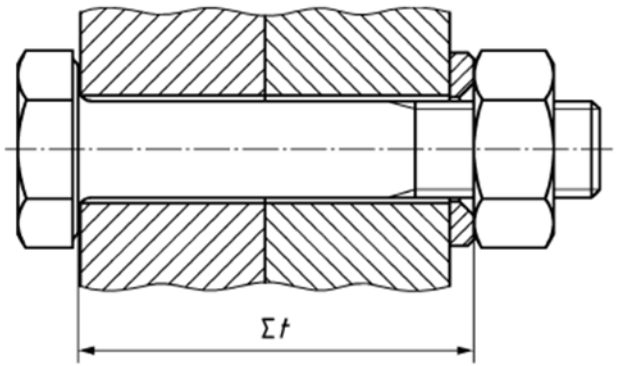
b) 1/30 (2°) for bolts with $d > 20$ mm.

Dimensions and steel grades of taper washers shall be specified.

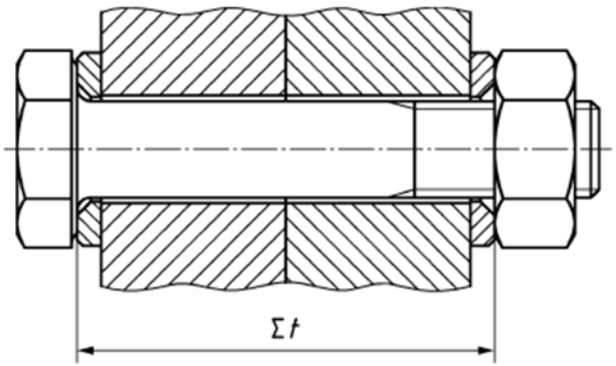
STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

Clamp length and grip length



a) Clamp length with one washer



b) Clamp length with two washers

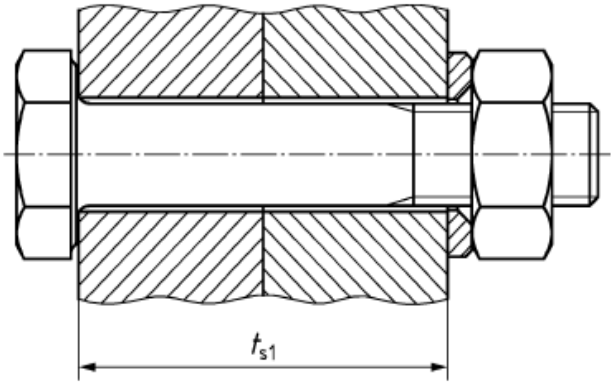


Figure A.2 — Grip Length with one washer t_{s1}

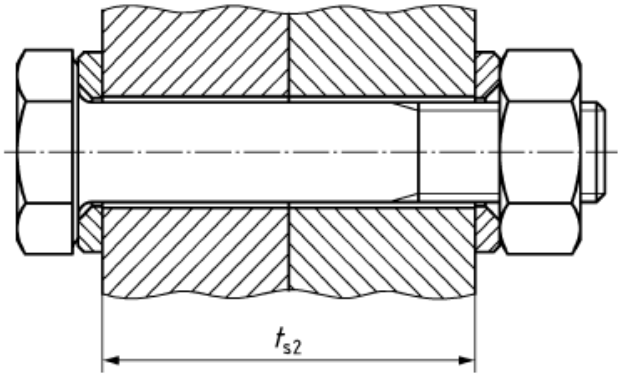


Figure A.3 — Grip Length with two washers t_{s2}

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Table A.1 — Clamp Length with one or two washers Σt

Dimensions in millimetres

Thread (d)			M12		(M14)		M16		(M18)		M20		M22		M24		M27		M30		M36	
l			Σt_{min} and Σt_{max}																			
nom.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
35	33,75	36,25	14	21																		
40	38,75	41,25	14	26			16	21														
45	43,75	46,25	22	31			16	26														
50	48,75	51,25	27	36	16	33	16	31			20	28	20	26								
55	53,5	56,5	32	40	29	38	16	36			20	33	20	31								
60	58,5	61,5	37	45	34	43	30	41	20	40	20	38	20	36	24	34	24	31				
65	63,5	66,5	42	50	39	48	35	46	33	45	20	43	20	41	24	39	24	36				
70	68,5	71,5	47	55	44	53	40	51	38	50	34	48	20	46	24	44	24	41	28	39		
75	73,5	76,5	52	60	49	58	45	56	43	55	39	53	35	51	24	49	24	46	28	44		
80	78,5	81,5	57	65	54	63	50	61	48	60	44	58	40	56	24	54	24	51	28	49		
85	83,25	86,75	62	70	59	68	55	66	53	64	49	62	45	61	43	58	24	56	28	54	32	48
90	88,25	91,75	67	75	64	73	60	71	58	69	54	67	50	66	48	63	42	61	28	59	32	53
95	93,25	96,75	72	80	69	78	65	76	63	74	59	72	55	71	53	68	47	66	28	64	32	58
100	98,25	101,75	77	85	74	83	70	81	68	79	64	77	60	76	58	73	52	71	48	69	32	63
110	108,25	111,75			84	93	80	91	78	89	74	87	70	86	68	83	62	81	58	79	32	73
120	118,25	121,75			94	103	90	101	88	99	84	97	80	96	78	93	72	91	68	89	58	83
130	128	132			98	113	94	111	92	109	88	107	84	106	82	103	76	101	72	98	62	93
140	138	142			108	123	104	121	102	119	98	117	94	116	92	113	86	111	82	108	72	103
150	148	152			118	133	114	131	112	129	108	127	104	126	102	123	96	121	92	118	82	113
160	156	164			128	141	124	139	122	137	118	135	114	134	112	131	106	129	102	126	92	121
170	166	174													122	141	116	139	112	136	102	131
180	176	184													132	151	126	149	122	146	112	141
190	186	194													142	161	136	159	132	156	122	151
200	196	204													152	171	146	169	142	166	132	161

For the calculation of the clamp lengths Σt the following formulae have been used: Bolting assemblies with either one washer or two washers

$\Sigma t_{max} = l_{min} - m_{max} - 1P$

Σt_{min} (fully threaded bolts) $= a_{max} + 4P$

Σt_{min} (partially threaded bolts) $= l_{g,max} + 4P$

where

Σt clamp length given as the total thickness of the clamped parts between the nut bearing face and the bolt bearing face, (mm)

m height of the nut, (mm)

l length of the bolt, (mm)

P thread pitch, (mm)

a distance from the bearing face to the first form (full profile) thread, (mm);

l_g distance from the bearing face to the first full form (full profile) thread, (mm)

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Table A.2 — Grip lengths with one washer t_{s1}

Dimensions in millimetres

Thread (*d*)			M12		(M14)		M16		(M18)		M20		M22		M24		M27		M30		M36	
l			$t_{s1,min}$ and $t_{s1,max}$																			
nom.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
35	33,75	36,25	12	17																		
40	38,75	41,25	12	22			13	17														
45	43,75	46,25	20	27			13	22														
50	48,75	51,25	25	32	14	30	13	27			17	23	17	22								
55	53,5	56,5	30	37	27	35	13	32			17	28	17	27								
60	58,5	61,5	35	42	32	40	27	37	17	35	17	33	17	32	21	29	20	26				
65	63,5	66,5	40	47	37	45	32	42	30	40	17	38	17	37	21	34	20	31				
70	68,5	71,5	45	52	42	50	37	47	35	45	31	43	17	42	21	39	20	36	24	33		
75	73,5	76,5	50	57	47	55	42	52	40	50	36	48	32	47	21	44	20	41	24	38		
80	78,5	81,5	55	62	52	60	47	57	45	55	41	53	37	52	21	49	20	46	24	43		
85	83,25	86,75	60	67	57	65	52	62	50	60	46	58	42	57	40	54	20	50	24	48	27	41
90	88,25	91,75	65	72	62	70	57	67	55	65	51	63	47	62	45	59	38	55	24	53	27	46
95	93,25	96,75	70	77	67	75	62	72	60	70	56	68	52	67	50	64	43	60	24	58	27	51
100	98,25	101,75	75	82	72	80	67	77	65	75	61	73	57	72	55	69	48	65	44	63	27	56
110	108,25	111,75			82	90	77	87	75	85	71	83	67	82	65	79	58	75	54	73	27	66
120	118,25	121,75			92	100	87	97	85	95	81	93	77	92	75	89	68	85	64	83	53	76
130	128	132			96	109	91	106	89	105	85	103	81	101	79	99	72	95	68	93	57	86
140	138	142			106	119	101	116	99	115	95	113	91	111	89	109	82	105	78	103	67	96
150	148	152			116	129	111	126	109	125	105	123	101	121	99	119	92	115	88	113	77	106
160	156	164			126	137	121	134	119	133	115	131	111	129	109	127	102	123	98	121	87	114
170	166	174													119	137	112	133	108	131	97	124
180	176	184													129	147	122	143	118	141	107	134
190	186	194													139	157	132	153	128	151	117	144
200	196	204													149	167	142	163	138	161	127	154

For the calculation of the grip lengths t_{s1} the following formulae have been used:

$t_{s1,max} = l_{min} - m_{max} - h_{max} - 1P$

$t_{s1,min} = l_{g,max} + 4P - h_{min}$

where

t_{s1} grip length given as the total thickness of the clamped parts between the nut bearing face and the bolt bearing faceless the thickness of the washer, (mm)

l length of the bolt, (mm)

m height of the nut, (mm)

h washer thickness, (mm)

P thread pitch, (mm)

l_g distance from the bearing face to the first full form (full profile) thread. For fully threaded bolts $l_{g,max}$ has the 'a'$_{max}$ value for product grade C screws from ISO 3508 (mm)

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Table A.3 — Grip lengths with two washers t_{s2}

Dimensions in millimetres

Thread (*d*)			M12		(M14)		M16		(M18)		M20		M22		M24		M27		M30		M36	
l			$t_{s2,min}$ and $t_{s2,max}$																			
nom.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
35	33,75	36,25	9	14																		
40	38,75	41,25	9	19			9	13														
45	43,75	46,25	17	24			9	18														
50	48,75	51,25	22	29	11	27	9	23			13	19	13	18								
55	53,5	56,5	27	34	24	32	9	28			13	24	13	23								
60	58,5	61,5	32	39	29	37	23	33	13	31	13	29	13	28	17	25	16	20				
65	63,5	66,5	37	44	34	42	28	38	26	36	13	34	13	33	17	30	16	25				
70	68,5	71,5	42	49	39	47	33	43	31	41	27	39	13	38	17	35	16	30	20	28		
75	73,5	76,5	47	54	44	52	38	48	36	46	32	44	28	43	17	40	16	35	20	33		
80	78,5	81,5	52	59	49	57	43	53	41	51	37	49	33	48	17	45	16	40	20	38		
85	83,25	86,75	57	64	54	61	48	57	46	56	42	54	38	52	36	50	16	45	20	42	22	35
90	88,25	91,75	62	69	59	66	53	62	51	61	47	59	43	57	41	55	34	50	20	47	22	40
95	93,25	96,75	67	74	64	71	58	67	56	66	52	64	48	62	46	60	39	55	20	52	22	45
100	98,25	101,75	72	79	69	76	63	72	61	71	57	69	53	67	51	65	44	60	40	57	22	50
110	108,25	111,75			79	86	73	82	71	81	67	79	63	77	61	75	54	70	50	67	22	60
120	118,25	121,75			89	96	83	92	81	91	77	89	73	87	71	85	64	80	60	77	48	70
130	128	132			93	106	87	102	85	101	81	98	77	97	75	94	68	90	64	87	52	79
140	138	142			103	116	97	112	95	111	91	108	87	107	85	104	78	100	74	97	62	89
150	148	152			113	126	107	122	105	121	101	118	97	117	95	114	88	110	84	107	72	99
160	156	164			123	134	117	130	115	129	111	126	107	125	105	122	98	118	94	115	82	107
170	166	174													115	132	108	128	104	125	92	117
180	176	184													125	142	118	138	114	135	102	127
190	186	194													135	152	128	148	124	145	112	137
200	196	204													145	162	138	158	134	155	122	147

For the calculation of the grip lengths t_{s2} the following formulae have been used:

$t_{s2,max} = l_{min} - m_{max} - 2h_{max} - 1P$

$t_{s2,min} = l_{g,max} + 4P - 2h_{min}$

where

t_{s2} grip length given as the total thickness of the clamped parts between the nut bearing face and the bolt bearing face less the thickness of the two washers, (mm)

l length of the bolt, (mm)

m height of the nut, (mm)

h washer thickness, (mm)

P thread pitch, (mm)

l_g distance from the bearing face to the first full form (full profile) thread. For fully threaded bolts $l_{g,max}$ has the 'a'$_{max}$ value for product grade C screws from ISO 3508 (mm)

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Table A.1 — Clamp lengths Σt^a

Dimensions in millimetres

Thread (*d*)			M12		M16		M20		M22		M24		M27		M30		M36	
l			Σt_{min} and Σt_{max}															
nom.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
35	33,75	36,25	16	21														
40	38,75	41,25	21	26	17	22												
45	43,75	46,25	26	31	22	27	18	23										
50	48,75	51,25	31	36	27	32	23	28	22	27								
55	53,5	56,5	36	41	32	37	28	33	27	32								
60	58,5	61,5	41	46	37	42	33	38	32	37	29	34						
65	63,5	66,5	46	51	42	47	38	43	37	42	34	39						
70	68,5	71,5	51	56	47	52	43	48	42	47	39	44	36	41				
75	73,5	76,5	56	61	52	57	48	53	47	52	44	49	41	46	39	44		
80	78,5	81,5	61	66	57	62	53	58	52	57	49	54	46	51	44	49		
85	83,25	86,75	66	71	62	67	58	63	57	62	54	59	51	56	49	54	43	48
90	88,25	91,75	71	76	67	72	63	68	62	67	59	64	56	61	54	59	48	53
95	93,25	96,75	76	81	72	77	68	73	67	72	64	69	61	66	59	64	53	58
100	98,25	101,75			77	82	73	78	72	77	69	74	66	71	64	69	58	63
105	103,25	106,75			82	87	78	83	77	82	74	79	71	76	69	74	63	68
110	108,25	111,75			87	92	83	88	82	87	79	84	76	81	74	79	68	73

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Preloaded assemblies

Table A.1 — Clamp lengths Σt[a]

Dimensions in millimetres

Thread (*d*)			M12		M16		M20		M22		M24		M27		M30		M36	
l			Σt_{min} and Σt_{max}															
nom.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
115	113,25	116,75			92	97	88	93	87	92	84	89	81	86	79	84	73	78
120	118,25	121,75			97	102	93	98	92	97	89	94	86	91	84	89	78	83
125	123	127			102	107	98	103	97	102	94	99	91	96	89	94	83	88
130	128	132			107	112	103	108	102	107	99	104	96	101	94	99	88	93
135	133	137					108	113	107	112	104	109	101	106	99	104	93	98
140	138	142					113	118	112	117	109	114	106	111	104	109	98	103
145	143	147					118	123	117	122	114	119	111	116	109	114	103	108
150	148	152					123	128	122	127	119	124	116	121	114	119	108	113
155	153	159					128	133	127	132	124	129	121	126	119	124	113	118
160	158	164							132	137	129	134	126	131	124	129	118	123
165	163	169							137	142	134	139	131	136	129	134	123	128
170	168	174									139	144	136	141	134	139	128	133
175	173	179									144	149	141	146	139	144	133	138
180	178	184									149	154	146	151	144	149	138	143
185	182,7	189,6									154	159	151	156	149	154	143	148
190	187,7	194,6									159	164	156	161	154	159	148	153
195	192,7	199,6									164	169	161	166	159	164	153	158
200	197,7	204,6											166	171	164	169	158	163

NOTE Preferred lengths are defined in terms of lengths Σt_{min} and Σt_{max}.

a For proper function of the preloaded bolted joint the following condition for the clamp length Σt shall be fulfilled:
$(l_{g,max} + 2P) < \Sigma t < (l_{min} - P - m_{max})$, where P is the pitch of thread and m_{max} is the maximum nut height according to Table 4.
The values of Σt_{min} and Σt_{max} specified in Table A.1 are within this range.
The Σt_{max} values are specified on the condition that the minimum bolt protrusion beyond the unloaded nut face shall be 1 P.

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STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

Table A.2 — Grip length t_{s2}[a]

Dimensions in millimetres

Thread (*d*)	M12		M16		M20		M22		M24		M27		M30		M36	
l	$t_{s2,min}$ and $t_{s2,max}$															
nom.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
35	10	15														
40	15	20	9	14												
45	20	25	14	19	10	15										
50	25	30	19	24	15	20	14	19								
55	30	35	24	29	20	25	19	24								
60	35	40	29	34	25	30	24	29	21	26						
65	40	45	34	39	30	35	29	34	26	31						
70	45	50	39	44	35	40	34	39	31	36	26	31				
75	50	55	44	49	40	45	39	44	36	41	31	36	29	34		
80	55	60	49	54	45	50	44	49	41	46	36	41	34	39		
85	60	65	54	59	50	55	49	54	46	51	41	46	39	44	31	36
90	65	70	59	64	55	60	54	59	51	56	46	51	44	49	36	41
95	70	75	64	69	60	65	59	64	56	61	51	56	49	54	41	46
100			69	74	65	70	64	69	61	66	56	61	54	59	46	51
105			74	79	70	75	69	74	66	71	61	66	59	64	51	56
110			79	84	75	80	74	79	71	76	66	71	64	69	56	61
115			84	89	80	85	79	84	76	81	71	76	69	74	61	66
120			89	94	85	90	84	89	81	86	76	81	74	79	66	71

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STRUCTURAL BOLTING ASSEMBLIES

Preloaded assemblies

Table A.2 — Grip length t_{s2}[a]

Dimensions in millimetres

Thread (*d*)	M12		M16		M20		M22		M24		M27		M30		M36	
l	$t_{s2,min}$ and $t_{s2,max}$															
nom.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
125			94	99	90	95	89	94	86	91	81	86	79	84	71	76
130			99	104	95	100	94	99	91	96	86	91	84	89	76	81
135					100	105	99	104	96	101	91	96	89	94	81	86
140					105	110	104	109	101	106	96	101	94	99	86	91
145					110	115	109	114	106	111	101	106	99	104	91	96
150					115	120	114	119	111	116	106	111	104	109	96	101
155					120	125	119	124	116	121	111	116	109	114	101	106
160							124	129	121	126	116	121	114	119	106	111
165							129	134	126	131	121	126	119	124	111	116
170									131	136	126	131	124	129	116	121
175									136	141	131	136	129	134	121	126
180									141	146	136	141	134	139	126	131
185									146	151	141	146	139	144	131	136
190									151	156	146	151	144	149	136	141
195									156	161	151	156	149	154	141	146
200											156	161	154	159	146	151

NOTE The popular lengths are defined in terms of lengths $t_{s2,min}$ and $t_{s2,max}$.

[a] For proper function of the preloaded bolted joint the following condition for the grip length t_{s2} shall be fulfilled:

$(l_{g,max} + 2P - 2h_{min}) < t_{s2} < (l_{min} - P - m_{max} - 2h_{max})$, where P is the pitch of thread, m_{max} is the maximum nut height and h_{min} is the minimum washers thickness.

The values of $t_{s2,min}$ and $t_{s2,max}$ specified in Table A.2 are within this range.

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Thank you for your attention

VESCOVINI GROUP