

---

---

**Steels for the reinforcement  
of concrete — Reinforcement couplers  
for mechanical splices of bars —**

**Part 1:  
Requirements**

*Aciers pour l'armature du béton — Coupleurs d'armature destinés  
aux rabotages mécaniques de barres —  
Partie 1: Exigences*

ISO 15835-1:2009

<https://standards.iteh.ai/catalog/standards/sist/a56bc1c6-4a31-431c-939b-83aef767a9da/iso-15835-1-2009>



**PDF disclaimer**

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

ISO 15835-1:2009

<https://standards.iteh.ai/catalog/standards/sist/a56bc1c6-4a31-431c-939b-83aef767a9da/iso-15835-1-2009>



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2009

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

Page

Foreword.....	iv
<b>1 Scope .....</b>	<b>1</b>
<b>2 Normative references .....</b>	<b>1</b>
<b>3 Terms and definitions.....</b>	<b>2</b>
<b>4 Symbols .....</b>	<b>3</b>
<b>5 Requirements .....</b>	<b>3</b>
5.1 General.....	3
5.2 Strength and ductility under static forces .....	4
5.3 Slip under static forces .....	5
5.4 Properties under high cycle elastic fatigue loading .....	5
5.5 Properties under low cycle reverse elastic-plastic loading .....	5
5.6 Marking and traceability.....	6
5.7 Installation instructions .....	6
<b>6 Evaluation of conformity.....</b>	<b>6</b>
<b>Annex A (normative) System for certification of couplers .....</b>	<b>7</b>
<b>Annex B (normative) Evaluation of conformity based on testing of batches.....</b>	<b>11</b>
<b>Annex C (informative) Categories of reinforcement couplers .....</b>	<b>12</b>
<b>Annex D (informative) Items to be specified.....</b>	<b>13</b>
<b>Annex E (informative) Example of calculation of 99 % characteristic strength based on test results .....</b>	<b>14</b>

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15835-1 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 16, *Steels for the reinforcement and prestressing of concrete*.

ISO 15835 consists of the following parts, under the general title *Steels for the reinforcement of concrete — Reinforcement couplers for mechanical splices of bars*:

— *Part 1: Requirements*

[ISO 15835-1:2009](#)

— *Part 2: Test methods*

<https://standards.iteh.ai/catalog/standards/sist/a56bc1c6-4a31-431c-939b-83aef767a9da/iso-15835-1-2009>

# Steels for the reinforcement of concrete — Reinforcement couplers for mechanical splices of bars —

## Part 1: Requirements

### 1 Scope

This part of ISO 15835 specifies requirements for reinforcement couplers, hereafter called couplers, to be used for splicing of steel reinforcing bars.

This part of ISO 15835 specifies requirements for couplers to be used for mechanical splices in reinforced concrete structures under predominantly static loads and additional requirements for couplers to be used in structures subject to high cycle elastic fatigue loading and/or to low cycle elastic-plastic reverse loading.

This part of ISO 15835 is intended to be applicable in relation to the various reinforced concrete design standards as well as in relation to the various standards for steel reinforcing bars.

This part of ISO 15835 also provides directions for the evaluation of conformity of couplers.

Compression-only couplers such as end-bearing sleeves are not covered by this part of ISO 15835.

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6935-2, *Steel for the reinforcement of concrete — Part 2: Ribbed bars*

ISO 9001, *Quality management systems — Requirements*

ISO 15630-1, *Steel for the reinforcement and prestressing of concrete — Test methods — Part 1: Reinforcing bars, wire rod and wire*

ISO 15835-2:2009, *Steels for the reinforcement of concrete — Reinforcement couplers for mechanical splices of bars — Part 2: Test methods*

ISO 16020, *Steel for the reinforcement and prestressing of concrete — Vocabulary*

### 3 Terms and definitions

For the purposes of this part of ISO 15835, the terms and definitions given in ISO 16020 and the following apply.

#### 3.1 coupler length

actual length of the coupler including all load-transferring parts, if more than one, and including lock nuts, if any

#### 3.2 length of mechanical splice

coupler length plus two times the nominal bar diameter at both ends of the coupler

NOTE This is a conventionally agreed definition to take account of the affected zone in an approximate way.

#### 3.3 mechanical splice

complete assembly of a coupler or an end-bearing sleeve including any additional intervening material or other components providing a splice of two reinforcing bars

#### 3.4 reinforcement coupler

coupling sleeve or threaded coupler for mechanical splices of reinforcement bars for the purpose of providing transfer of axial tension and/or compression from one bar to the other where

- coupling sleeve is a device fitting over the ends of two reinforcing bars,
- threaded coupler is a threaded device for joining reinforcing bars with matching threads

#### 3.5 slip

permanent extension of a mechanical splice after being loaded to a defined load level

#### 3.6 slip measurement device

ensemble constituted by the extensometer and any system used to fix it to the mechanical splice

#### 3.7 qualification test

test performed at the initiation of a product to demonstrate that the properties conform to the requirements

iTeh STANDARD PREVIEW  
(standards.iteh.ai)

[ISO 15835-1:2009](https://standards.iteh.ai/catalog/standards/sist/a56bc1c6-4a31-431c-939b-83aef767a9da/iso-15835-1-2009)

<https://standards.iteh.ai/catalog/standards/sist/a56bc1c6-4a31-431c-939b-83aef767a9da/iso-15835-1-2009>

## 4 Symbols

See Table 1.

Table 1 — Symbols

Symbol	Unit	Designation
$A_5$	%	Percentage elongation after fracture on an original gauge length of $5d$
$A_{10}$	%	Percentage elongation after fracture on an original gauge length of $10d$
$A_{gt}$	%	Percentage total elongation at maximum tensile force, $F_{max}$
$d$	mm	Nominal diameter of the reinforcing bar
$F_{max}$	N	Maximum tensile force
$N$	—	Specified number of load cycles in axial load fatigue test
$R_{eH, spec}$	MPa <sup>a</sup>	Specified characteristic (or nominal) yield strength value of the reinforcing bar
$R_{m, spec}$	MPa	Specified (or nominal) tensile strength value of the reinforcing bar
$(R_m/R_{eH})_{spec}$	—	Specified tensile/yield strength ratio of the reinforcing bar
$u_4, u_8, u_{20}$	mm	Residual elongation after 4, 8, 20 cycles, respectively
$2\sigma_a$	MPa	Stress range for high cycle fatigue test
$\sigma_{max}$	MPa	Maximum stress in axial load fatigue test
$\sigma_{min}$	MPa	Minimum stress in axial load fatigue test
<sup>a</sup> 1 MPa = 1 N/mm <sup>2</sup>		

ISO 15835-1:2009

<https://standards.iteh.ai/catalog/standards/sist/a56bc1c6-4a31-431c-939b-83aef767a9da/iso-15835-1-2009>

## 5 Requirements

### 5.1 General

The requirements apply to the coupler even though the check of the properties of the coupler is carried out on a mechanical splice that has been installed in accordance with the manufacturer's written instructions.

The technical requirements for couplers are related to the following properties where a) and b) are mandatory while c) and d) are related to categories defined in Annex C:

- strength and ductility under static forces;
- slip under static forces;
- properties under high cycle fatigue loading in the elastic range;
- properties under low cycle reverse loading in the elastic-plastic range.

Testing of these properties shall be carried out in accordance with ISO 15835-2.

Further requirements are specified for:

- identification and marking;
- installation instructions.

Additional requirements can exist in the reference standard for the steel reinforcing bars to be connected in the mechanical splice. In this case, the purchaser and the supplier should agree on any additional technical requirements.

If a material other than steel is used in a coupler, the suitability for use of such material in fire-rated structures as well as any health implications should be evaluated.

## 5.2 Strength and ductility under static forces

### 5.2.1 General

Strength and ductility of the mechanical splice shall be verified by testing to satisfy the requirements of both 5.2.2 and 5.2.3 with the following exception.

If all samples of the mechanical splice tensile strength tests fail outside the length of the mechanical splice and the test results satisfy the product standard of the bar, no further verification of tensile strength or ductility of the mechanical splice is required.

### 5.2.2 Strength

The tensile strength of the mechanical splice shall be at least  $R_{eH, spec} \times (R_m/R_{eH})_{spec}$ .

If  $R_{m, spec}$  is the only value specified in the reinforcing bar standard, the tensile strength of the mechanical splice shall be at least  $R_{m, spec}$ .

### 5.2.3 Ductility

The ductility of spliced bars shall be verified directly by option 1. Subject to national provisions, the indirect method of option 2 may also be used.

Requirements for ductility of spliced bars should ensure that the use of the mechanical splice maintains a minimum amount of ductility in the reinforcement. Ductility of the coupler itself is not subject to testing.

**Option 1)** The minimum  $A_{gt}$  measured in accordance with ISO 15630-1 in the reinforcing bar outside the length of the mechanical splice shall not be less than  $0,7A_{gt}$ , where  $A_{gt}$  is the specified characteristic value of the reinforcing bar taken from ISO 6935-2.

Where  $A_{gt}$  is not specified for the reinforcing bars, a minimum value of 3 % should be reached in the bar outside the mechanical splice before failure of the test piece.

NOTE 1 The  $A_{gt}$  value specified for the reinforcing bars is normally a characteristic value. Since it is not practical to specify a characteristic  $A_{gt}$  value for mechanical splices, a minimum value for the bar is specified.

NOTE 2 If an  $A_5$  or  $A_{10}$  value is specified for the reinforcing bars instead of an  $A_{gt}$  value, this value cannot be used for evaluation of mechanical splices since the failure could occur within the mechanical splice; the  $A_5$  or  $A_{10}$  value cannot then be determined.

**Option 2)** The samples tested shall have a 99 % characteristic strength of not less than the minimum specified tensile strength of the reinforcing bar. Where this criterion is not fulfilled, further samples may be tested to increase the population size.

NOTE 3 Annex E gives an example of the calculation of 99 % characteristic strength based on test results.

If couplers are used to connect bars of different sizes, strength and ductility, requirements shall be based on the smaller reinforcing bar diameter.

iTeh STANDARD PREVIEW  
(standards.iteh.ai)

[ISO 15835-1:2009](https://standards.iteh.ai/catalog/standards/sist/a56bc1c6-4a31-431c-939b-85ac77a24b5c/iso-15835-1-2009)

<https://standards.iteh.ai/catalog/standards/sist/a56bc1c6-4a31-431c-939b-85ac77a24b5c/iso-15835-1-2009>



### 5.3 Slip under static forces

#### 5.3.1 Testing requirements

The slip shall be found by one of the following two options for testing.

**Option 1)** The slip across the mechanical splice shall be found as the measured length of the mechanical splice under a force corresponding to at least  $0,6R_{eH, spec}$ , where  $R_{eH, spec}$  is the specified yield strength of the reinforcing bar minus the calculated length of an unspliced bar under similar force.

**Option 2)** The slip across the mechanical splice shall be found as the measured length of the mechanical splice after unloading from a load level of at least  $0,6R_{eH, spec}$ , where  $R_{eH, spec}$  is the specified yield strength of the reinforcing bar minus the length prior to loading.

#### 5.3.2 Slip requirement

The total slip value measured shall not exceed 0,10 mm.

NOTE Slip requirement is important for limitation of crack widths in reinforced concrete structures.

For certain types of couplers, e.g. couplers with a length larger than 300 mm for bars with a diameter larger than 40 mm, a greater slip than 0,10 mm may be accepted if specified in national provisions.

### 5.4 Properties under high cycle elastic fatigue loading

#### 5.4.1 Fatigue properties

Mechanical splices of category F shall sustain a fatigue loading of at least 2 megacycles with a stress range,  $2\sigma_a$ , of 60 MPa without failure. The upper stress,  $\sigma_{max}$ , in the test shall be  $0,6R_{eH, spec}$ . Other values for the maximum stress, the stress range or the number of cycles may be specified in national provisions.

The following acceptance criteria shall be complied with:

- if all test samples resist the fatigue loading, the test is passed;
- if one test sample fails the test, three additional samples of the same type and diameter that have failed shall be tested. If all three additional test samples pass, the test is passed;
- if two or more test samples fail the fatigue test, the test is failed.

#### 5.4.2 *S-N* diagram (optional)

The performance of a mechanical splice under high cycle stresses of different amplitudes can be characterised by an *S-N* diagram. If an *S-N* diagram is determined, the provisions in ISO 15835-2:2009, 5.5.4, shall be applied.

### 5.5 Properties under low cycle reverse elastic-plastic loading

There are two sets of low cycle fatigue requirements, one simulating moderate-scale earthquakes (couplers of category S1) and one simulating violent earthquakes (couplers of category S2).

Couplers of categories S1 and S2 shall satisfy the requirements of 5.5.1 and 5.5.2 respectively. Couplers tested according to category S2 satisfy the testing requirements of category S1.

### 5.5.1 Couplers of category S1

The performance requirements for couplers subject to tension and compression tests simulating a moderate-scale earthquake are:

- tensile strength: at least  $R_{m, spec}$  or  $R_{eH, spec} \times (R_m/R_{eH})_{spec}$  (as in 5.2);
- residual elongation:  $u_{20} \leq 0,3$  mm.

The requirement on  $u_{20}$  may be disregarded if allowed in national provisions and agreed between purchaser and supplier.

### 5.5.2 Couplers of category S2

Performance requirements for couplers subject to tension and compression tests of large deformation in the simulated violent earthquake are:

- tensile strength: at least  $R_{m, spec}$  or  $R_{eH, spec} \times (R_m/R_{eH})_{spec}$  (as in 5.2);
- residual elongation:  $u_4 \leq 0,3$  mm,  $u_8 \leq 0,6$  mm.

The requirements on  $u_4$  and  $u_8$  may be disregarded if allowed in national regulations and agreed between purchaser and supplier.

### 5.6 Marking and traceability

Each coupler shall be legibly and durably marked (e.g. hard stamped) with the identification of the manufacturer, the nominal bar size for which it is intended, and a batch mark for traceability purposes. Each coupler shall be traceable back to its production data.

NOTE The provisions and methods for traceability can differ according to national provisions.

### 5.7 Installation instructions

The supplier shall provide a clear written installation instruction. The described installation process of the couplers shall be achievable in construction site conditions.

## 6 Evaluation of conformity

The conformity of the couplers to the requirements of this part of ISO 15835 shall be evaluated according to either of the following methods:

- if conformity to the applicable requirements of this part of ISO 15835 is verified by system certification, the conditions in Annex A shall be applied;
- if conformity to the applicable requirements of this part of ISO 15835 is verified by batches, the conditions in Annex B shall be applied.

## Annex A (normative)

### System for certification of couplers

#### A.1 General

To assure the purchaser of the couplers that the performance criteria of this part of ISO 15835 are met, the manufacturer of the couplers shall have a quality system approved by a certification body. It is the task of the certification body to check and certify that the performance criteria can be sustainably met.

The certification of a coupler is based on qualification testing, factory production control, and on continuous third party surveillance of the factory production control.

The purpose of this annex is to provide rules for a product certification of couplers.

The manufacturer and the certification body have different tasks to carry out in the certification process, as specified in Clauses A.2 and A.3, respectively.

NOTE The product certification applies to the mechanical coupler, but is tested in the form of a mechanical splice.

#### A.2 Tasks of the manufacturer

##### A.2.1 General

The manufacturer of the couplers shall have a quality system based on a sectorial application of ISO 9001.

A quality system which meets the requirements of ISO 9001 (with or without certification) and which addresses the requirements of this part of ISO 15835 is acceptable. The certification body should accept quality management system certificates from other bodies which verify compliance with this subclause.

##### A.2.2 Qualification testing

Random samples shall be taken from the products to be tested, which reflect the properties of the products to be delivered. Tests shall be carried out on a full cross-section of the products. Tests shall be performed for all characteristics of the products, mandatory or optional, for which the manufacturer intends to declare conformity.

The tests may be carried out by the manufacturer under supervision of the certification body. Independent control tests may be carried out at the discretion of the certification body.

The qualification test shall comprise testing of the following items:

- strength and ductility under static actions;
- slip under static actions;
- marking and traceability;
- installation instructions.

Optionally, the behaviour under the following fatigue conditions shall be tested:

- high cycle fatigue in the elastic range;
- low cycle reverse fatigue loading.