INTERNATIONAL STANDARD

ISO 15835-1

Second edition
2018-10

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 raboutages mécaniques de barres —
Partie 1: Exigences

Reference number
ISO 15835-1:2018(E)

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Published in Switzerland

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 17, *Steel*, Subcommittee SC 16, *Steels for the reinforcement and prestressing of concrete*.

This second edition cancels and replaces the first edition (ISO 15835-1:2009), which has been technically revised with changes made to Clauses 1, 2, 3, 4 and 5, 3.2, 3.5, 5.2, 5.3, 5.5 and 5.6, Table 1, and Annexes C and D. Clause 6 and Annexes A and B have been revised and have been moved out into a new document: ISO 15835-3.

A list of all the parts in the ISO 15835 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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

Part 1: Requirements

1 Scope

This document specifies requirements for couplers for the mechanical splicing of steel reinforcing bars. More onerous requirements can be specified by the customer.

This document is applicable to the continuous production of coupler components. It is intended to be used with adequate control measures for the processing of reinforcing bars, i.e. the production of the mechanical splice.

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

NOTE ISO 15835-3 specifies the quantity of tests.

Compression-only couplers such as end-bearing sleeves are not covered by the ISO 15835 series.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 15630-1, *Steel for the reinforcement and prestressing of concrete — Test methods — Part 1: Reinforcing bars, wire rod and wire*

ISO 15835-2:2018, *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 document, the terms and definitions given in ISO 16020 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

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 1 to entry: This is a theoretical definition aimed at including the length of bar that could have been affected by the bar-end preparation process.

3.3
mechanical splice
complete assembly of a coupler, including any additional intervening material or other components providing a splice of two reinforcing bars

3.4
coupler
coupling sleeve or threaded coupler for mechanical splicing of reinforcing 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
relative displacement between the components of a mechanical splice while being loaded to a defined load level

3.6
slip measurement device
ensemble constituted by the extensometer and any system used to fasten it to the mechanical splice

3.7
batch
number of couplers of the same type and diameter, manufactured from the same cast of incoming material, as a discrete unit defined by the manufacturer

3.8
lot
number of couplers of the same type and diameter, of various batches, delivered at the same time to the same purchaser

4 Symbols

Table 1 — Symbols

Symbol	Unit	Designation
A_{gt}	%	Percentage total elongation at maximum tensile force, F_{max}
d	mm	Nominal diameter of the reinforcing bar
F_{max}	kN	Maximum tensile force
N	—	Specified number of load cycles in high cycle fatigue test
$R_{eH,\,spec}$	MPa[a]	Specified characteristic (or nominal) yield strength value of the reinforcing bar
R_{eH}	MPa	Yield strength value of the reference bar
$R_{m,\,spec}$	MPa	Specified (or nominal) tensile strength value of the reinforcing bar
$(R_m/R_{eH})_{spec}$	—	Specified minimum tensile/yield strength ratio of the reinforcing bar
u_{20}	mm	Residual elongation after 20 cycles

[a] 1 MPa = 1 N/mm^2.

Table 1 *(continued)*

Symbol	Unit	Designation
$2\sigma_a$	MPa	Stress range for high-cycle fatigue test
σ_{max}	MPa	Maximum stress in axial load fatigue test
σ_{min}	MPa	Minimum stress in axial load fatigue test

[a] 1 MPa = 1 N/mm2.

5 Requirements

5.1 General

The requirements apply to the coupler even though the verification of the properties of the coupler is performed on a mechanical splice.

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 5.2:

a) strength and ductility under static forces;

b) slip under static forces;

c) properties under high-cycle fatigue loading in the elastic range;

d) properties under low-cycle reverse loading in the elastic-plastic range.

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

Further requirements are specified for:

e) identification and marking;

f) 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 and safety implications should be evaluated.

5.2 Categories of mechanical splices

Table 2 provides a summary of the categories of mechanical splices specified in this document, with reference to the subclauses where the requirements and test methods for their properties are given.

Table 2 — Categories of mechanical splices[a]

Category designation	Properties tested	Requirement subclauses in this document	Testing subclauses in ISO 15835-2
B (Basic)	Strength, ductility and slip under static forces	5.3, 5.4	5.1, 5.2, 5.3, 5.4
F (Fatigue)	As for B + High-cycle fatigue	As for B + 5.5	As for B + 5.5
S (Seismic)	As for B + Low-cycle loading	As for B + 5.6	As for B + 5.6

[a] If the coupler in a mechanical splice has been tested according to both class F and class S, it can be classified as FS.

5.3 Strength and ductility under static forces

5.3.1 General

Strength and ductility of the mechanical splice shall be verified by testing to satisfy the requirements of both 5.3.2 and 5.3.3. A reference bar from the same heat of steel shall be tested to verify that its measured strength and ductility satisfy the minimum values specified in the product standard of the bar.

It is preferable that the test splice and the reference bar come from the same length of reinforcing bar.

NOTE 1 A tensile strength and ductility level higher than specified at 5.3.2 and 5.3.3 could be required in cases where the development of the full ductility of the parent reinforcing bar material is necessary. This would be specified separately by the purchaser.

For surveillance testing, if all samples of the mechanical splice tensile strength tests fail outside the length of the mechanical splice and the mode of failure of the bar is ductile (including necking), and the measured tensile strengths comply with the product standard of the bar, no verification of the ductility of the mechanical splice is required.

NOTE 2 The purpose of this provision is to save the time of marking the specimens for the A_{gt} measurement, when the manufacturer is confident that the tensile failure will occur outside the mechanical splice.

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

5.3.2 Strength

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

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

5.3.3 Ductility

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

The minimum A_{gt} measured in accordance with ISO 15630-1 on 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 the product standard of the reinforcing bar.

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

NOTE 1 The A_{gt} specified for 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 the elongation after fracture 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 elongation after fracture cannot then be determined.

5.4 Slip under static forces

5.4.1 Testing requirements

The slip under static forces shall be measured by one of the following two testing options.

Option 1: The slip across the mechanical splice shall be determined as the measured change in length of the mechanical splice under a force corresponding to $0{,}6R_{eH,\ spec}$, minus the calculated change in length of an unspliced bar under similar force.

Option 2: The slip across the mechanical splice shall be determined as the measured length of the mechanical splice after unloading from a load level of $0{,}6R_{eH,\ spec}$, minus the length measured prior to loading.

5.4.2 Slip requirement

The median value of all test results shall not exceed 0,10 mm. The outlier values shall, however, not exceed the maximum allowable slip by more than 0,05 mm.

NOTE 1 Slip requirement is important for limitation of crack widths in exposed reinforced concrete structures.

NOTE 2 The purpose of using the median value for the evaluation of results is to filter-out questionably high and low values, as this test is performed by a multitude of measurement devices and fixtures that are not yet covered by a standard.

For couplers longer than 100 mm, a slip greater than 0,10 mm may be accepted as per Figure 1.

NOTE 3 The reason for this provision is that, the longer the coupler, the larger the volume of concrete through which the coupler slip will dissipate.