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European Technical Assessment

ETA-13/0840
of 20.12.2021

General part

Technical Assessment Body issuing the European Technical Assessment	Österreichisches Institut für Bautechnik (OIB) Austrian Institute of Construction Engineering
Trade name of the construction product	High strength reinforcing system SAS 670
Product family to which the construction product belongs	Kit for reinforced concrete members with high strength reinforcing steel but limited tensile utilisation
Manufacturer	Stahlwerk Annahütte Max Aicher GmbH & Co. KG 83404 Ainring-Hammerau Germany
Manufacturing plant	Stahlwerk Annahütte Max Aicher GmbH & Co. KG 83404 Ainring-Hammerau Germany
This European Technical Assessment contains	38 pages including Annexes 1 to 21, which form an integral part of this assessment.
This European Technical Assessment is issued in accordance with Regulation (EU) № 305/2011, on the basis of	European Assessment Document (EAD) 160011-00-0301 – Kit for reinforced concrete members with high strength reinforcing steel but limited tensile utilisation.
This European Technical Assessment replaces	European Technical Assessment ETA-13/0840 of 23.06.2020

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Remarks

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Specific parts

1 Technical description of the product

1.1 General

The European Technical Assessment[1] – ETA – applies to a kit, the

High strength reinforcing system SAS 670,

comprising the following components.

- Reinforcing bar with hot rolled thread ribs, see Table 1
- End anchorages
  - Anchor piece with anchor nut or lock nut
  - Anchorage end plate
- Splices
  - Torqued standard coupler with lock nuts
  - Contact coupler
  - Turnbuckle with lock nuts
  - Reducing coupler with lock nuts
  - Reducing contact coupler

Table 1 Nominal strength characteristics of the steel bar S 670/800

Nominal diameter	**mm**	18	22	25	28	30	35	43	50	57.5	63.5	75
Designation	—	18 TR	22 TR	25 TR	28 TR	30 TR	35 TR	43 TR	50 TR	57 TR	63 TR	75 TR
Steel bar S 670/800												
Nominal yield strength	**N/mm²**	670										
Nominal tensile strength	**N/mm²**	800										

[1] ETA-13/0840 was firstly issued in 2013 as European technical approval with validity from 28.06.2013, converted and amended in 2018 to European Technical Assessment ETA-13/0840 of 28.06.2018, converted 2020 to European Technical Assessment ETA-13/0840 of 23.06.2020, and amended 2021 to European Technical Assessment ETA-13/0840 of 20.12.2021.

Steel bar

1.2 General

The load-bearing element is a hot-rolled and in line heat treated steel bar S 670/800, nominal diameter $\varnothing_s$ = 18 to 75 mm, with right-hand thread ribs. The steel is referred to as SAS 670. The steel bar S 670/800 is developed for geotechnical and reinforcement applications.

Table 1 lists the nominal steel bar diameters and Table 2 nominal cross-sectional areas and characteristic forces of the High strength reinforcing system SAS 670. Due to its characteristics, the steel is classified as reinforcing steel but compared to standard reinforcing steel the steel bar features higher strength properties.

End anchorage of the steel bar is achieved with either a torqued anchor piece with additional bonded length or by contact with anchorage end plate.

The steel bars are connected with torqued couplers for tension, compression, and alternating loading or contact couplers for only compression loading.

1.3 Strength characteristics of steel bar

The characteristic strength of the steel bar S 670/800 exceeds the values of common reinforcing steel.

The most important characteristics are

– Nominal diameter.....$\varnothing_s$ = 18, 22, 25, 28, 30, 35, 43, 50, 57.5, 63.5, and 75 mm
– Relative rib area.....$f_R \geq 0.075$
– Characteristic yield strength.....$R_{p0.2} \geq 670$ N/mm^2
– Characteristic tensile strength.....$R_m \geq 800$ N/mm^2
– Elongation at maximum load.....$A_{gt} \geq 5$ %

Table 2 Nominal cross-sectional areas and characteristic forces of the steel bar S 670/800

Designation	Nominal diameter	Nominal cross-sectional area	Characteristic yield force	Characteristic maximum force
	$\varnothing_s$	A_s	$A_s \cdot R_{p0.2}$	$A_s \cdot R_m$
	mm	mm^2	kN	kN
18 TR	18	254	170	204
22 TR	22	380	255	304
25 TR	25	491	329	393
28 TR	28	616	413	493
30 TR	30	707	474	565
35 TR	35	962	645	770
43 TR	43	1 452	973	1 162
50 TR	50	1 963	1 315	1 570
57 TR	57.5	2 597	1 740	2 077
63 TR	63.5	3 167	2 122	2 534
75 TR	75	4 418	2 960	3 534

The specifications of the steel bar are listed in Annex 1 and Annex 2 and are in accordance or exceed the specifications of Eurocode 2[2], in particular EN 1992-1-1, Annex C.

1.4 Welding of steel bar

The steel bar is suitable for welding. However, welding is performed according to defined procedures in accordance with EN ISO 17660.

1.5 Bending of steel bar

The steel bars with nominal diameters of $\varnothing_s \leq 57.5$ mm may be bent according to Eurocode 2. For specific applications, bending of even larger nominal diameters may be verified.

Anchorages and splices, components

1.6 General

Available components of end anchorages and splices of the steel bars are listed in Annex 3. The material specifications of the components are listed in Annex 4 and the main dimensions in Annex 8 to Annex 13. Materials, material parameters and tolerances of the components are specified in the technical file[3] of the European Technical Assessment.

1.7 End anchorages

1.7.1 General

The end anchorage comprises a torqued anchor piece with bursting reinforcement and an additional bonded length, l_v, to reduce slip. End anchorage subjected to only compression loads may also be by direct contact of the steel bar to an anchor end plate in steel.

1.7.2 End anchorage with anchor piece

For nominal diameters 18–63.5 mm, this anchorage comprises an anchor piece with nut. It is assembled for the respective loading according to Annex 7 and tightened to the torque moments listed in Annex 3. The additional bonded length, l_v, according to Annex 14 is observed and considered in the design of the structure.

The anchor piece is shown and the main dimensions are given in Annex 10.

1.7.3 End anchorage with anchor end plate

This anchorage for all nominal diameters is employed for a steel bar subjected to only compression loads. The force is transferred to the anchor end plate in steel by direct contact – end bearing anchorage. The form-fit and force-fit connection is ensured by square cut of the front face of the steel bar with a maximum angle tolerance of $\pm$ 0.5 °. The position of the steel bar is ensured either by means of an anchor nut or lock nut welded onto the anchor end plate or by fastening the steel bar directly onto the anchor end plate.

The end anchorage with anchor end plate is verified according to Eurocode 2 and Eurocode 3.

1.8 Splices

1.8.1 General

The steel bars are connected with couplers. For tensile, compression, and alternate loading, the splice comprises a coupler locked with nuts. For splices subjected to only compression loads, contact couplers are employed.

[2] Standards and other documents referred to in the European Technical Assessment are listed in Annex 20 and Annex 21.

[3] The technical file of the European Technical Assessment is deposited at Österreichisches Institut für Bautechnik.

1.8.2 Splice with standard coupler

For all nominal diameters, this splice comprises a standard coupler and, depending on the loading, two short lock nuts for tensile loading, or two long lock nuts for compressive or alternate loading. The splice is assembled according to Annex 6 and tightened to the torque moment according to Annex 3. See Clause 3.2.1.2 regarding limited slip.

The components of the splice with standard coupler are shown and the main dimensions are given in the following Annexes.

- Standard coupler in Annex 11
- Long lock nut in Annex 8
- Short lock nut and short lock nut cast in Annex 9

1.8.3 Splice with contact coupler

Bars of all nominal diameters subjected to only compression loading may be connected with contact couplers. Thereby, the contact coupler ensures the concentric position of both steel bars in the splice.

The form-fit and force-fit contact of the front faces of both steel bars is ensured by square cut of the steel bars with a maximum angle tolerance of ± 0.5 ° and by hand-tight locking of the steel bars according to Annex 3 – end bearing splice.

A standard coupler according to Clause 1.8.2 can also be used as contact coupler.

The contact coupler is shown and the main dimensions are given in Annex 11.

1.8.4 Splice with turnbuckle

For nominal diameters 18–63.5 mm, this splice is employed for length compensation, where two rigidly placed steel bars with ends in a given co-axial distance are to be jointed.

The turnbuckle comprises a change over coupler and a tensioning coupler and, depending on the loading, two short lock nuts for tensile loading, or two long lock nuts for compressive or alternate loading. The splice is assembled according to Annex 6 and tightened to the torque moment according to Annex 3.

The components of the splice with turnbuckle are shown and the main dimensions are given in the following Annexes.

- Turnbuckle components, i.e. change over coupler and tensioning coupler in Annex 12
- Long lock nut in Annex 8
- Short lock nut and short lock nut cast in Annex 9

1.8.5 Splice with reducing coupler

For nominal diameters 18–63.5 mm, this splice is employed to joint two steel bars with different nominal diameters and is appropriate for nominal diameters of the larger steel bar of 22 to 63.5 mm.

The splice comprises a reducing coupler and, depending on the loading, two short lock nuts for tensile loading, or two long lock nuts for compressive or alternate loading. The splice is assembled according to Annex 6 and tightened to the torque moment according to Annex 3.

The components of the splice with reducing coupler are shown and the main dimensions are given in the following Annexes.

- Reducing coupler in Annex 13
- Long lock nut in Annex 8
- Short lock nut and short lock nut cast in Annex 9

1.8.6 Splice with reducing contact coupler

This splice is employed to joint two steel bars with different nominal diameters, subjected to only compression loading, and is appropriate for nominal diameters of the larger steel bar of 22–75 mm. The contact coupler ensures the concentric position of both steel bars in the splice.

The form-fit and force-fit contact of the front faces of both steel bars is ensured by square cut of the bars with a maximum angle tolerance of ± 0.5 ° and by hand-tight locking of the steel bars according to Annex 3 – end bearing splice.

A reducing coupler according to Clause 1.8.5 can also be used as reducing contact coupler.

The reducing contact coupler is shown and the main dimensions are given in Annex 13.

1.9 Load transfer to the structure

Load transfer to structural concrete via end anchorage with anchor piece according to Clause 1.7.2 is with additional reinforcement – bursting reinforcement. All centre spacings and edge distances have been determined with regard to requirements on load-bearing capacity, depending on the concrete strength class.

- Nominal diameter of steel bar 18–63.5 mm
- Compressive strength of concrete at time of loading $f_{cm,\,0,\,cube\,150} \geq 30$, 75, or 95 N/mm^2
- Minimum concrete strength class C25/30, C60/75, or C80/95 according to EN 206
- Centre spacing and edge distance of the end anchorages according to Annex 14 to Annex 16
- Additional reinforcement is in ribbed reinforcing steel with a yield strength of $R_e \geq 500$ N/mm^2, is centrally arranged to the steel bar, and conforms to Annex 14 to Annex 16
- To reduce slip, an additional bonded length, l_v, according to Annex 14 is observed.

Small differences in load, induced by load transfer e.g. through slabs or by creep redistributions are covered by bond stresses and do not require end anchorages.

See Clause 1.7.3 for load transfer with anchor end plate.

2 Specification of the intended use in accordance with the applicable European Assessment Document (hereinafter EAD)

2.1 Intended use

The High strength reinforcing system SAS 670 is intended to be installed in buildings and civil engineering structures featuring the following characteristics.

- In-situ concrete and precast elements
- Concrete strength classes from C25/30 to C80/95
- Geometric reinforcement ratio up to 20 %, observing the required spacing and concrete cover of the steel bars
- Reinforced concrete members designed to transfer static, predominantly static, and accidental loads.
- Reinforced concrete compression members, e.g. columns and walls
- Reinforced concrete members to transfer tensile loads from static and predominantly static actions observing following constraints according to Eurocode 2.
  - Either the yield strength is limited to ≤ 600 N/mm^2 or
  - For bending with significant axial compression, the serviceability limit states are verified
- Reinforced concrete members to transfer tensile loads from accidental actions

2.2 Assumptions

2.2.1 General

Concerning product packaging, transport, storage, maintenance, replacement, and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on transport, storage, maintenance, replacement, and repair of the product as he considers necessary.

2.2.2 Packaging, transport and storage

Advice on packaging, transport, and storage includes.

- Temporary protection of steel bars and other components in order to prevent damaging corrosion during transportation from the production site to the job site. Light surface rust is acceptable.
- Transportation, storage, and handling of steel bars and other components in a manner as to avoid damage by mechanical or chemical impact
- Protection of steel bars and other components from moisture

2.2.3 Design

2.2.3.1 General

In general, for reinforced concrete members subjected to predominantly compressive loading, the reinforcement specifications of Eurocode 2 apply. In addition, the following items are observed.

- The stress-strain curves, both under tension and compression, of the steel bars are identical.
- In order to fully exploit the steel's compressive yield strength, creep and shrinkage redistribution may be taken into account. The respective loading history is considered.
- Verifications take increased deformations due to redistribution into account. In particular, the increased deformations are considered for stability verifications.
- The compressive strain limits of concrete for serviceability limit state are verified.
- Characteristic and design bond strength, dependent on concrete strength class, are listed in Table 3.
- Moment redistributions are applicable only if exact verifications are carried out.
- Stress range in fatigue tests are given in Table 4.
- See Clause 3.2.1.2 regarding limited slip at anchorages and splices.
- For structural members subjected to bending and tensile loading, the following assumptions are applied according to Eurocode 2
  - The characteristic yield strength to transfer tension loads is limited to $f_{yk} \leq 600$ N/mm^2 in the ultimate limit state.
  - The required verifications are carried out for the serviceability limit state.
  - Crack widths are verified and, if required, additional skin reinforcement is installed to facilitate crack width control.
  - For exceptional load cases, limitation of the yield strength is not required.

Table 3 Bond strength in N/mm²

—	Concrete strength class								
	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60	C55/67	C60/75	C80/95
τ_k	5.7	6.2	6.7	7.2	7.6	8.1	8.5	8.8	10.2
τ_d	3.8	4.2	4.5	4.8	5.1	5.4	5.6	5.9	6.8

Table 4 Stress range in fatigue test

Nominal diameter	Fatigue strength	
$\varnothing_s$	Bar without component	Splice, end anchorage with anchor piece
mm	N/mm²	N/mm²
18–43	150	55
50–63.5	120	
75	100	40 [1)]

[1)] Only splice

2.2.4 Detailing

If not stated otherwise, the detailing provisions of Eurocode 2 apply.

- The geometric reinforcement ration does not exceed 20 %.
- Anchorage of steel bars nominal diameter 18–63.5 mm is obtained by end anchorages with anchor pieces, see Clause 1.7.2 and Clause 1.9. For steel bars of all nominal diameters subjected to only compression loads, anchorages with anchor end plates in steel are likewise available, see Clause 1.7.3.
- Percentage of coupled steel bars with contact splices in one cross section may be 100 %. However, for reasons of practicability, the splices should be staggered as specified in Annex 17 and percentage of contact splices per cross section reduced to ~ 50 %.
- Percentage of coupled steel bars with splices with torqued coupler in one cross section may be 100 %. For tensile loading, the splices should be staggered as specified in Annex 17 and percentage of splices per cross section reduced to ~ 50 %.
- Minimum diameter and the maximum centre spacing of the stirrup reinforcement may be taken according to Table 5. Above and below floor slabs or beams, stirrup spacing is reduced accordingly.
- Steel bars with a nominal diameter of $\varnothing_s > 57.5$ mm are not bent.
- Centre and edge distances of end anchorages with anchor piece are given in Annex 14 to Annex 16.

Table 5 Minimum stirrup diameters and maximum stirrup spacing in mm

Nominal diameter	$\varnothing_s$	18	22	25	28	30	35	43	50	57.5	63.5	75
Minimum stirrup diameter	$d_{Bü}$	6	6	8	8	8	10	10	12	12	14	14
Maximum centre spacing of stirrups	s_{max}	$\min \begin{cases} b_{min} \\ 20 \cdot \varnothing_s \\ 400 \end{cases}$			$\min \begin{cases} b_{min} \\ 400 \end{cases}$				$\min \begin{cases} b_{min} \\ 450 \end{cases}$			

Where

b_{min} .....Minimum dimension of cross section of the reinforced concrete member

2.2.5 Installation

It is assumed that the product will be installed according to the manufacturer's instructions or – in absence of such instructions – according to the usual practice of the building professionals.

Assembly and installation of the High strength reinforcing system SAS 670 is only carried out by appropriately qualified specialist companies with the required resources and experience in the execution of reinforced concrete works.

For execution, the relevant Eurocodes and EN 13670 are considered. Anchorage of steel bars nominal diameter 18–63.5 mm is obtained by end anchorages with anchor piece. The length of the reinforcement is achieved by connecting the required number of steel bars with couplers. End anchorages and splices are tightened to the specified torque moments, see Annex 3, and minimum engagement depths are observed. End bearing anchorages with anchor end plates in steel and end bearing splices with contact couplers are available for steel bars of all nominal diameters subjected to only compression loading.

2.3 Assumed working life

The European Technical Assessment is based on an assumed working life of the High strength reinforcing system SAS 670 of 100 years, provided that the High strength reinforcing system SAS 670 is subject to appropriate installation, use, and maintenance, see Clause 2.2.

In normal use conditions, the real working life may be considerably longer without major degradation affecting the basic requirements for construction works[4].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee, neither given by the product manufacturer or his representative nor by EOTA nor by the Technical Assessment Body, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

[4] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works are subject, as well as on the particular conditions of design, execution, use, and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than the assumed working life.

3 Performance of the product and references to the methods used for its assessment

3.1 Essential characteristics

The performances of the High strength reinforcing system SAS 670 for the essential characteristics are given in Table 6.

Table 6 Essential characteristics and performances of the product

№	Essential characteristic	Product performance
Basic requirement for construction works 1: Mechanical resistance and stability		
1	Resistance to static load at anchorages and splices	See Clause 3.2.1.1.
2	Slip at anchorages and splices	See Clause 3.2.1.2.
3	Resistance to fatigue at anchorages and splices	See Clause 3.2.1.3.
4	Load transfer to the structure	See Clause 3.2.1.4.
5	Resistance to corrosion	See Clause 3.2.1.5.
Steel bar		
6	Shape	See Annex 1.
7	Cross sectional area	See Annex 1.
8	Mass per metre	See Annex 1.
9	Surface geometry	See Annex 1.
10	Weldability	See Clause 1.4.
11	Strength characteristics	See Annex 2.
12	Modulus of elasticity	See Annex 2.
13	Elongation at maximum force	See Annex 2.
14	Bendability	See Annex 2.
15	Resistance to fatigue	See Annex 2.
16	Material	See Annex 4.
17	Bond characteristics	See Table 3.
Nuts, couplers, and anchor piece		
18	Shape	See Annex 8 to Annex 13.
19	Dimensions	See Annex 8 to Annex 13.
20	Material	See Annex 4.
21	Hardness	See Annex 5.
Basic requirement for construction works 2: Safety in case of fire		
22	Reaction to fire	See Clause 3.2.2.1.
23	Resistance to fire	See Clause 3.2.2.2.

№	Essential characteristic	Product performance
Basic requirement for construction works 3: Hygiene, health, and the environment		
—	No characteristic assessed.	—
Basic requirement for construction works 4: Safety and accessibility in use		
24	Same as for Basic requirement for construction works 1	—
Basic requirement for construction works 5: Protection against noise		
—	Not relevant. No characteristic assessed.	—
Basic requirement for construction works 6: Energy economy and heat retention		
—	Not relevant. No characteristic assessed.	—
Basic requirement for construction works 7: Sustainable use of natural resources		
—	No characteristic assessed.	—

3.2 Product performance

3.2.1 Mechanical resistance and stability

3.2.1.1 Resistance to static load at anchorages and splices

The High strength reinforcing system SAS 670 as described in the ETA meets the acceptance criteria of EAD 160011-00-0301, Clause 2.2.1. The characteristic values of yield strength, $R_{e,\,nom}$, and tensile strength, $R_{m,\,nom}$, of the steel bar are given Annex 2.

3.2.1.2 Slip at anchorages and splices

The High strength reinforcing system SAS 670 as described in the ETA meets the acceptance criteria of EAD 160011-00-0301, Clause 2.2.2. The characteristic value of yield strength, $R_{e,\,nom}$, of the steel bar is given Annex 2.

Slip criteria of EAD 160011-00-0301 are met

- For nominal diameter 18–63.5 mm with limited yield strength according to Clause 2.2.3.1 of 600 N/mm^2 for Option 2 of ISO 15835-1 as well.
- For nominal diameter 75 mm with limited yield strength of 450 N/mm^2 for Option 1 and Option 2 of ISO 15835-1.

3.2.1.3 Resistance to fatigue at anchorages and splices

For resistance to fatigue of anchorages and splices see Table 4.

Fatigue resistance of anchorages and splices was tested and verified with an upper force of $0.65 \cdot F_{pk}$, and $2 \cdot 10^6$ load cycles.

3.2.1.4 Load transfer to the structure

The High strength reinforcing system SAS 670 as described in the ETA meets the acceptance criteria of EAD 160011-00-0301, Clause 2.2.5. The characteristic values of yield strength, $R_{e,\,nom}$, and tensile strength, $R_{m,\,nom}$, of the steel bar are given Annex 2.

Conformity with the stabilisation and crack width criteria specified for the load transfer test was verified to a force level of $0.65 \cdot A_s \cdot R_{e,\,nom}$.

3.2.1.5 Resistance to corrosion

The corrosion protection of the High strength reinforcing system SAS 670 is ensured by an appropriate concrete cover.

3.2.2 Safety in case of fire

3.2.2.1 Reaction to fire

The performance of components made of steel is Class A1 without testing.

3.2.2.2 Resistance to fire

Fire resistance of the structure is attained by appropriate dimensions of the cross section of the structure and appropriate axis distance of the steel bar from the nearest surface exposed to fire.

3.3 Assessment methods

The assessment of the essential characteristics in Clause 3.1 of the High strength reinforcing system SAS 670 for the intended use and in relation to the requirements for mechanical resistance and stability, safety in case of fire, and safety and accessibility in use in the sense of the basic requirements for construction works № 1, 2, and 4 of Regulation (EU) № 305/2011 has been made in accordance with EAD 160011-00-0301, Kit for reinforced concrete members with high strength reinforcing steel but limited tensile utilisation.

3.4 Identification

The European Technical Assessment for High strength reinforcing system SAS 670 is issued on the basis of agreed data that identify the assessed product[5]. Changes to materials, to composition, or to characteristics of the product, or to the production process could result in these deposited data being incorrect. Österreichisches Institut für Bautechnik should be notified before the changes are introduced, as an amendment of the European Technical Assessment is possibly necessary.

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

4.1 System of assessment and verification of constancy of performance

According to Commission Decision 97/597/EC, the system of assessment and verification of constancy of performance to be applied to the High strength reinforcing system SAS 670 is System 1+. System 1+ is detailed in Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, Annex, point 1.1, and provides for the following items.

(a) The manufacturer shall carry out

(i) factory production control;

(ii) further testing of samples taken at the manufacturing plant by the manufacturer in accordance with the prescribed test plan[6].

(b) The notified product certification body shall decide on the issuing, restriction, suspension or withdrawal of the certificate of constancy of performance of the construction product on the basis of the outcome of the following assessments and verifications carried out by that body

(i) an assessment of the performance of the construction product carried out on the basis of testing (including sampling), calculation, tabulated values or descriptive documentation of the product;

(ii) initial inspection of the manufacturing plant and of factory production control;

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5 The technical file of the European Technical Assessment is deposited at Österreichisches Institut für Bautechnik.

6 The prescribed test plan has been deposited with Österreichisches Institut für Bautechnik and is handed over only to the notified product certification body involved in the procedure for the assessment and verification of constancy of performance. The prescribed test plan is also referred to as control plan.

(iii) continuing surveillance, assessment, and evaluation of factory production control;

(iv) audit-testing of samples taken by the notified product certification body at the manufacturing plant or at the manufacturer's storage facilities.

4.2 AVCP for construction products for which a European Technical Assessment has been issued

Notified bodies undertaking tasks under System 1+ shall consider the European Technical Assessment issued for the construction product in question as the assessment of the performance of that product. Notified bodies shall therefore not undertake the tasks referred to in Clause 4.1, point (b) (i).

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

5.1 Tasks for the manufacturer

5.1.1 Factory production control

In the manufacturing plant, the manufacturer establishes and continuously maintains a factory production control. All procedures and specifications adopted by the manufacturer are documented in a systematic manner. Purpose of factory production control is to ensure the constancy of performances of the High strength reinforcing system SAS 670 with regard to the essential characteristics.

The manufacturer only uses raw materials supplied with the relevant inspection documents as laid down in the control plan. The incoming raw materials are subjected to controls by the manufacturer before acceptance. Check of incoming materials includes control of inspection documents presented by the manufacturer of the raw materials.

Testing within factory production control is in accordance with the prescribed test plan. The results of factory production control are recorded and evaluated. The records are presented to the notified product certification body involved in continuous surveillance and are kept at least for ten years after the product has been placed on the market. On request, the records are presented to Österreichisches Institut für Bautechnik.

If test results are unsatisfactory, the manufacturer immediately implements measures to eliminate the defects. Products or components that are not in conformity with the requirements are removed. After elimination of the defects, the respective test – if verification is required for technical reasons – is repeated immediately.

At least once a year the manufacturer audits the manufacturers of the components given in Annex 19.

The basic elements of the prescribed test plan are given in Annex 18.

5.1.2 Declaration of performance

The manufacturer is responsible for preparing the declaration of performance. When all the criteria of the assessment and verification of constancy of performance are met, including the certificate of constancy of performance issued by the notified product certification body, the manufacturer draws up the declaration of performance. Essential characteristics to be included in the declaration of performance for the corresponding intended use are given in Table 6**.**

5.2 Tasks for the notified product certification body

5.2.1 Initial inspection of the manufacturing plant and of factory production control

The notified product certification body verifies the ability of the manufacturer for a continuous and orderly manufacturing of the High strength reinforcing system SAS 670 according to the European Technical Assessment. In particular, the following items are appropriately considered.

- Personnel and equipment
- Suitability of the factory production control established by the manufacturer
- Full implementation of the prescribed test plan

5.2.2 Continuing surveillance, assessment, and evaluation of factory production control

The notified product certification body visits the factory at least once a year for routine inspection. Inspection of factory production control of steel bar is at least twice a year. In particular, the following items are appropriately considered.

- Manufacturing process including personnel and equipment
- Factory production control
- Implementation of the prescribed test plan

Each manufacturer of the components given in Annex 19 is audited at least once in five years. It is verified that the system of factory production control and the specified manufacturing process are maintained, taking account of the prescribed test plan.

The results of continuous surveillance are made available on demand by the notified product certification body to Österreichisches Institut für Bautechnik. When the provisions of the European Technical Assessment or the prescribed test plan are no longer fulfilled, the certificate of constancy of performance is withdrawn by the notified product certification body.

5.2.3 Audit-testing of samples taken by the notified product certification body at the manufacturing plant or at the manufacturer's storage facilities

During surveillance inspections, the notified product certification body takes samples of components of the High strength reinforcing system SAS 670 for independent testing. For the most important components, Annex 19 summarises the minimum procedures performed by the notified product certification body.

Issued in Vienna on 20 December 2021
by Österreichisches Institut für Bautechnik

The original document is signed by:

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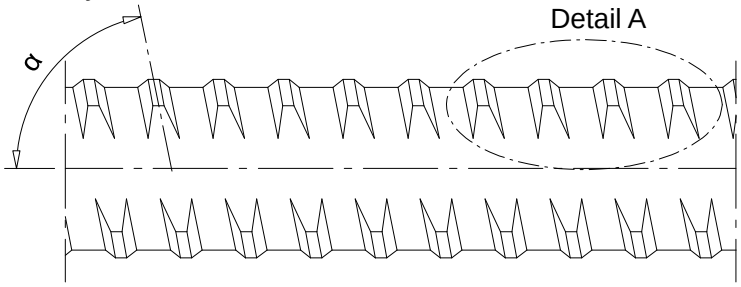
High strength reinforcing system SAS 670

Steel bar – Nominal dimensions and mass, rib geometry

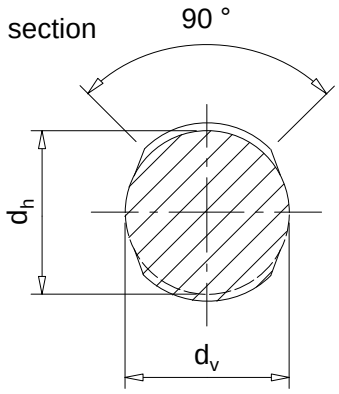
Annex 1
of European Technical Assessment
ETA-13/0840 of 20.12.2021

Steel bar SAS 670

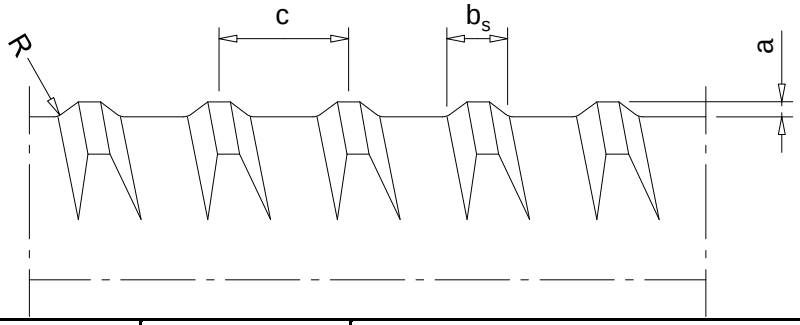
Geometry



Cross section



Detail A



Nominal			Core diameter		Ribs, right hand thread				
Diameter	Mass per metre [1]	Cross-sectional area			Height	Width	Pitch	Angle	Radius
$\varnothing_s$	G	A_s	d_h	d_v	min a	b_s	c	α	R
mm	kg/m	mm^2	mm	mm	mm	mm	mm	°	mm
18	2.00	254	17.5	17.2	1.10	4.1	8.0	82.5	1.0
22	2.98	380	21.7	21.4	0.90	3.9	8.0	83.8	1.0
25	3.85	491	24.3	23.9	1.30	5.5	10.0	83.3	1.0
28	4.83	616	27.3	26.9	1.45	5.6	11.0	83.4	1.5
30	5.55	707	29.5	29.1	1.50	5.6	11.0	83.9	1.5
35	7.55	962	34.3	33.8	1.70	6.3	14.0	83.3	2.0
43	11.40	1 452	42.4	41.9	2.00	8.0	17.0	83.4	2.0
50	15.40	1 963	49.2	48.7	2.00	8.5	18.0	83.6	2.5
57.5	20.38	2 597	56.2	55.7	2.40	9.8	20.0	84.0	2.5
63.5	24.86	3 167	62.4	60.7	2.40	10.5	21.0	84.4	2.5
75	34.68	4 418	74.0	72.5	2.70	11.9	24.0	84.4	3.0

[1] Tolerance to nominal mass ± 4.5 %

Max Aicher GmbH & Co. KG
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High strength reinforcing system SAS 670

Steel bar – Mechanical-technological characteristics

Annex 2
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Steel bar SAS 670

	Characteristics and requirements				
	Nominal diameter $\varnothing_s$	Characteristic Yield force F_e		Ultimate force F_m	
	mm	kN		kN	
1	18	170		204	
	22	255		304	
	25	329		393	
	28	413		493	
	30	474		565	
	35	645		770	
	43	973		1 162	
	50	1 315		1 570	
	57.5	1 740		2 077	
	63.5	2 122		2 534	
	75	2 960		3 534	
2	Characteristic yield strength [1), 2)]		$R_{e,\,nom}$	N/mm²	670
3	Characteristic tensile strength [1)]		$R_{m,\,nom}$	N/mm²	800
4	Ratio		$\frac{R_m}{R_e}$	—	≥ 1.10
5	Elongation at maximum load following $A_{gt} = A_g + \frac{R_m}{E} \cdot 100$ [3)]		A_{gt}	%	≥ 5.0
6	Relative rib area		f_R	—	≥ 0.075
7	Stress range in fatigue test Upper stress level $\sigma_{max} = 0.7 \cdot R_{e,\,nom}$ and $N = 2 \cdot 10^6$ cycles	$\varnothing_s$ = 18–43 mm	$2 \cdot \sigma_A$	N/mm²	150
		$\varnothing_s$ = 50–63.5 mm		N/mm²	120
		$\varnothing_s$ = 75 mm		N/mm²	100
8	Suitability for bending			$\varnothing_s \le 57.5$ mm	
9	Suitability for welding			$\varnothing_s$ = 18–75 mm	

1) 5%-fractile
2) Yield strength R_e corresponds to $R_{p0.2}$, 0.2 % proof strength
3) Modulus of Elasticity E ~ 200 000 N/mm²
A_g as plastic extension at maximum force

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High strength reinforcing system SAS 670

Overview of components
Torque moments

Annex 3
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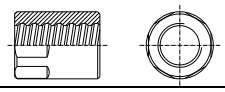
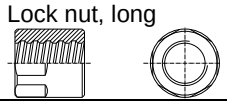
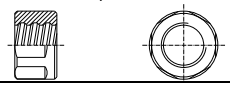
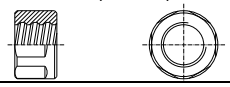
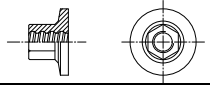
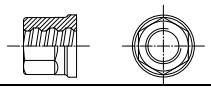
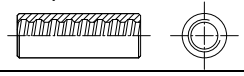
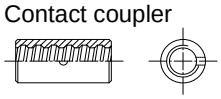
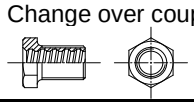
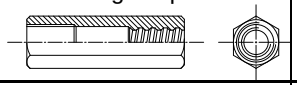
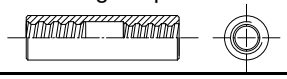
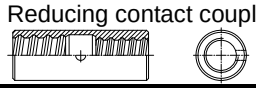
Designation			Nominal diameter $\varnothing_s$ of steel bar in mm										
Component	Number	Pos.	18	22	25	28	30	35	43	50	57.5	63.5	75
Anchor nut 	TR 2002-∅	1	●	●	●	●	●	●	●	●	●	●	—
Lock nut, long 	TR 2003-∅	2	●	●	●	●	●	●	●	●	●	●	●
Lock nut, short 	TR 2040-∅	3	●	●	●	●	●	●	●	●	●	●	●
Lock nut, short, cast 	TR 2040-∅ C	4	●	●	●	●	●	●	●	●	●	●	—
Anchor piece 	TR 2073-∅	5	●	●	●	●	●	●	●	●	●	●	—
Anchor nut with flange 	TR 2163-∅	6	●	●	●	●	●	●	●	●	●	●	—
Coupler, standard 	TR 3003-∅	7	●	●	●	●	●	●	●	●	●	●	●
Contact coupler 	TR 3006-∅ cast TR 3006-∅ C	8	●	●	●	●	●	●	●	●	●	●	●
Change over coupler 	TR 3013-∅	9	●	●	●	●	●	●	●	●	●	●	—
Tensioning coupler 	TR 3014-∅	10	●	●	●	●	●	●	●	●	●	●	—
Reducing coupler 	TR 3102-∅	11	—	●	●	●	●	●	●	●	●	●	—
Reducing contact coupler 	TR 3106-∅	12	—	●	●	●	●	●	●	●	●	●	●

Key ..... ● Component available ..... — Component not available

End anchorage and splice	$\varnothing_s$	Torque moment in kNm										
		18	22	25	28	30	35	43	50	57.5	63.5	75
Splice with locked coupler [1)]		0.6	0.8	1.0	1.4	1.6	3.0	6.0	9.0	12.0	16.0	25.0
End anchorage with anchor piece		0.6	0.8	1.0	1.4	1.6	3.0	6.0	9.0	12.0	13.0	—
Splice with contact coupler		0.2	0.2	0.2	0.2	0.25	0.27	0.31	0.35	0.35	0.50	0.50

1) For reducing coupler, the torque moment of the smaller steel bar applies.

Max Aicher GmbH & Co. KG
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High strength reinforcing system SAS 670

Overview of components
Material specifications

Annex 4
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Component		Standard or Specification
SAS 670/800	Steel bar	Steel, Annexes 1 and 2
TR 2002	Anchor nut ∅ 18, 22, 25, 28, 30, 35 and 43 mm ∅ 50, 57.5, and 63.5 mm	 EN 10277 EN 10210-1
TR 2163	Anchor nut with flange ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, and 63.5 mm	 EN 10293
TR 2073	Anchor piece ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, and 63.5 mm	 EN 10293
TR 2003	Lock nut, long ∅ 18, 22, 25, 28, 30, 35 and 43 mm ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, and 63.5 mm ∅ 50, 57.5, and 63.5 mm ∅ 75 mm	 EN 10277 EN 683-2 EN 10210-1 EN 683-2
TR 2040	Lock nut, short ∅ 18, 22, 25, 28, 30, 35 and 43 mm ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, and 63.5 mm ∅ 50, 57.5, and 63.5 mm ∅ 75 mm	 EN 10277 EN 683-2 EN 10210-1 EN 683-2
TR 2040 C	Lock nut, short, cast ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, and 63.5 mm	 EN 10293
TR 3003	Coupler, standard ∅ 18, 22, 25, 28, 30, and 35 mm ∅ 43, 50, 57.5, and 63.5 mm ∅ 75 mm	 EN 10025-2 EN 10210-1 EN 683-2
TR 3006	Contact coupler ∅ 18, 22, 25, 28, 30, 35, and 43 mm ∅ 50, 57.5, 63.5, and 75 mm	 EN 10025-2 EN 10210-1
TR 3006 C	Contact coupler, cast ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, 63.5, and 75 mm	 EN 10293
TR 3013	Change over coupler ∅ 18, 22, 25, 28, 30, and 35 mm ∅ 43, 50, and 57.5 mm ∅ 63.5 mm	 EN 10277 EN 10025-2 EN 683-2
TR 3014	Tensioning coupler ∅ 18, 22, 25, 28, 30, and 35 mm ∅ 43, 50, and 57.5 mm ∅ 63.5 mm	 EN 10277 EN 10025-2 EN 683-2
TR 3102	Reducing coupler ∅ 22, 25, 28, 30, 35, 43, 50, and 57.5 mm ∅ 63.5 mm	 EN 10025-2 EN 683-2
TR 3106	Reducing contact coupler ∅ 22, 25, 28, 30, 35, 43, 50, 57.5, 63.5, and 75 mm	 EN 10025-2
—	Additional reinforcement	Ribbed reinforcing steel, $R_e \geq 500$ N/mm^2

Member of EOTA

Max Aicher GmbH & Co. KG
83404 Ainring–Hammerau

High strength reinforcing system SAS 670

Components – Hardness

Annex 5
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ETA-13/0840 of 20.12.2021

Component		Hardness
TR 2002	Anchor nut ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, and 63.5 mm	≥ 140 HBW
TR 2163	Anchor nut with flange ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, and 63.5 mm	≥ 193 HBW
TR 2073	Anchor piece ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, and 63.5 mm	≥ 193 HBW
TR 2003	Lock nut, long ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, and 63.5 mm ∅ 75 mm	≥ 140 HBW ≥ 340 HBW
TR 2040	Lock nut, short ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, and 63.5 mm ∅ 75 mm	≥ 140 HBW ≥ 340 HBW
TR 2040 C	Lock nut, short, cast ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, and 63.5 mm	≥ 193 HBW
TR 3003	Coupler, standard ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, and 63.5 mm ∅ 75 mm	≥ 140 HBW ≥ 340 HBW
TR 3006	Contact coupler ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, 63.5, and 75 mm	≥ 140 HBW
TR 3006 C	Contact coupler, cast ∅ 18, 22, 25, 28, 30, 35, 43, 50, 57.5, 63.5, and 75 mm	≥ 193 HBW
TR 3013	Change over coupler ∅ 18, 22, 25, 28, 30, and 35 mm ∅ 43, 50, and 57.5 mm ∅ 63.5 mm	≥ 140 HBW ≥ 133 HBW ≥ 252 HBW
TR 3014	Tensioning coupler ∅ 18, 22, 25, 28, 30, and 35 mm ∅ 43, 50, and 57.5 mm ∅ 63.5 mm	≥ 140 HBW ≥ 133 HBW ≥ 252 HBW
TR 3102	Reducing coupler ∅ 22, 25, 28, 30, 35, 43, 50, and 57.5 mm ∅ 63.5 mm	≥ 140 HBW ≥ 252 HBW
TR 3106	Reducing contact coupler ∅ 22, 25, 28, 30, 35, 43, 50, 57.5, 63.5, and 75 mm	≥ 133 HBW

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High strength reinforcing system SAS 670

Splices

Annex 6
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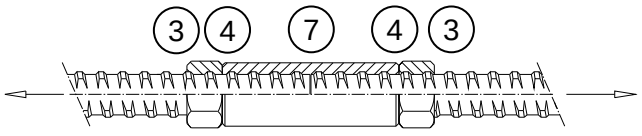
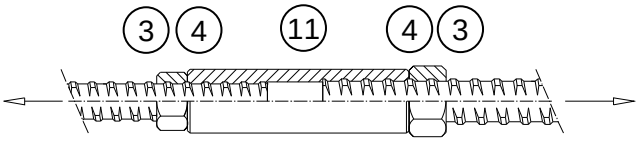
Tensile load

Coupler, standard TR 3003

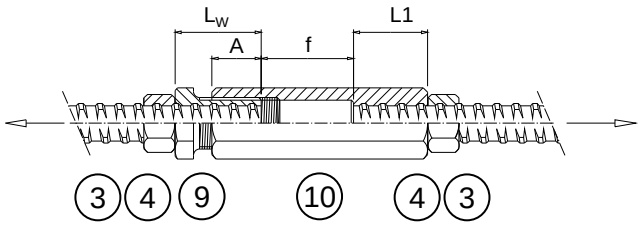


Reducing coupler TR 3102



$\varnothing_s$	mm	18	22	25	28	30	35	43	50	57.5	63.5	75
Min. engagement depth	mm	50	55	65	70	75	90	100	105	125	150	130

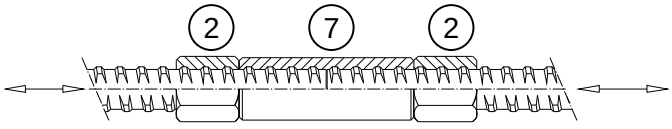
Turnbuckel TR 3105, comprising change over coupler TR 3013 and tensioning coupler TR 3014



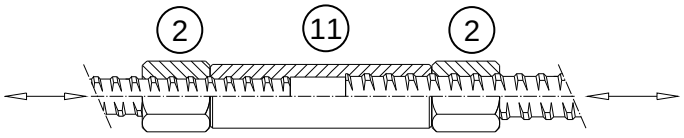
$\varnothing_s$	mm	18	22	25	28	30	35	43	50	57.5	63.5
L1	mm	50	55	60	65	70	75	100	100	125	140
Lw	mm	60	65	70	80	95	100	115	125	135	140
min. A	mm	30	35	40	45	50	55	60	75	75	80
f, ± 5 mm	mm	65	70	75	80	95	100	120	125	145	145

Compression and alternating load

Coupler, standard TR 3003

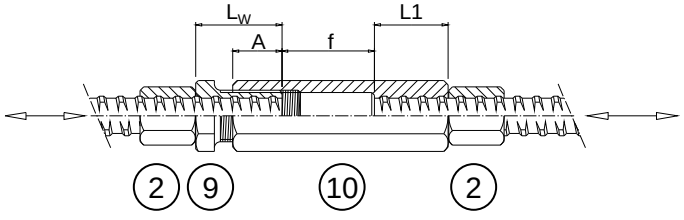


Reducing coupler TR 3102



$\varnothing_s$	mm	18	22	25	28	30	35	43	50	57.5	63.5	75
Min. engagement depth	mm	50	55	65	70	75	90	100	105	125	150	130

Turnbuckel TR 3105 comprising change over coupler TR 3013 and tensioning coupler TR 3014

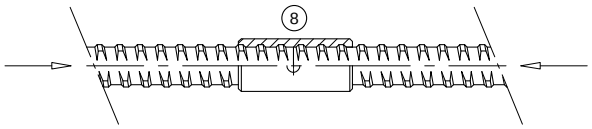


$\varnothing_s$	mm	18	22	25	28	30	35	43	50	57.5	63.5
L1	mm	50	55	60	65	70	75	100	100	125	140
Lw	mm	60	65	70	80	95	100	115	125	135	140
min. A	mm	30	35	40	45	50	55	60	75	75	80
f, ± 5 mm	mm	65	70	75	80	95	100	120	125	145	145

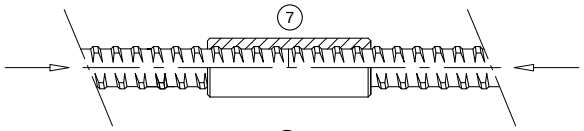
Max Aicher GmbH & Co. KG 83404 Ainring–Hammerau	**High strength reinforcing system SAS 670** Splices with contact coupler End anchorage with anchor piece	**Annex 7** of European Technical Assessment **ETA-13/0840** of 20.12.2021

Compression load only

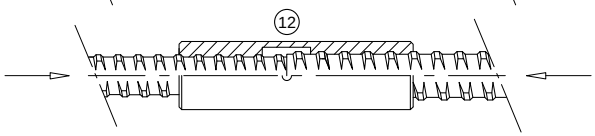
Contact coupler TR 3006,
Contact coupler, cast TR 3006 C



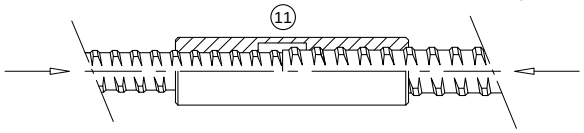
Standard coupler TR 3003



Reducing contact coupler TR 3106

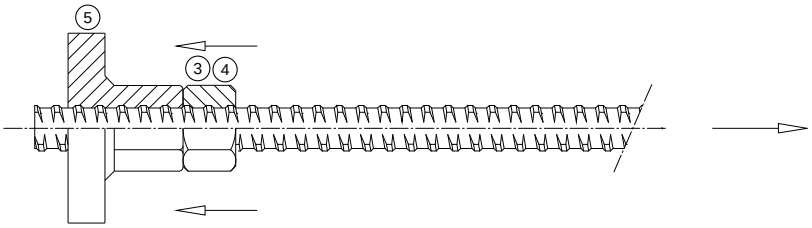


Reducing coupler TR 3102

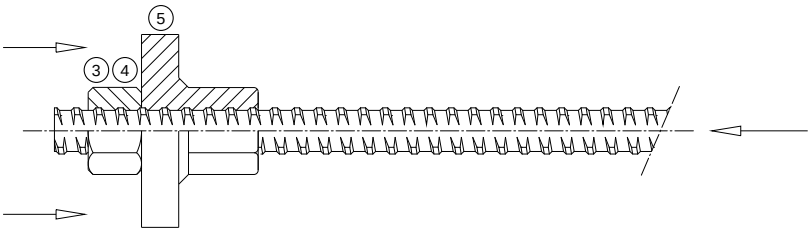


End anchorage with Anchor piece TR 2073-∅

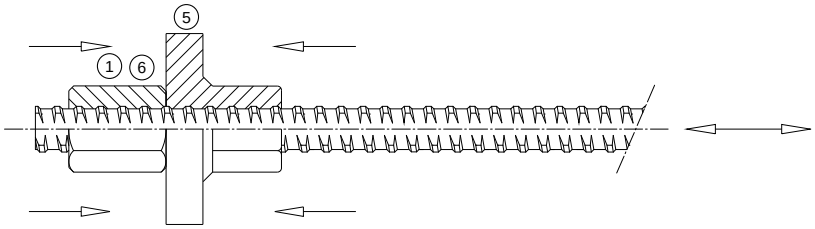
Tensile load



Compression load



Alternating load



Max Aicher GmbH & Co. KG
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High strength reinforcing system SAS 670

Components
Anchor nut and lock nut, long

Annex 8
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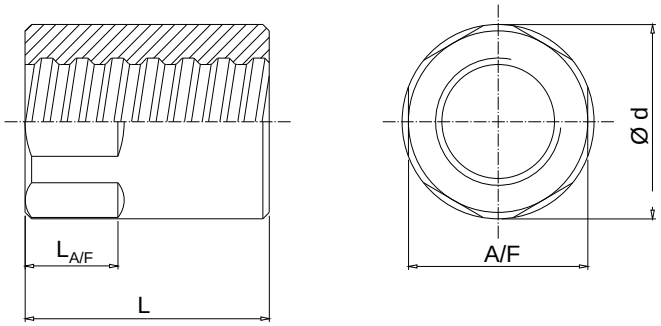
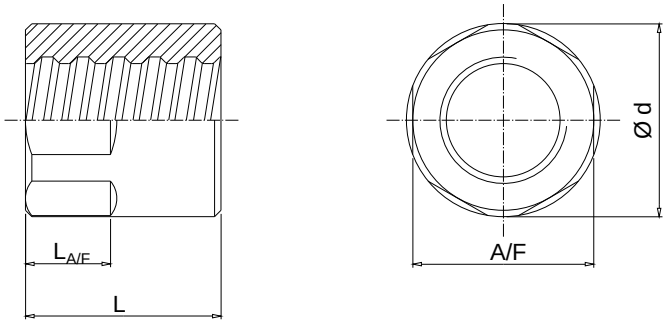
① Anchor nut
TR 2002-∅



Nominal diameter $\varnothing_s$ mm	A/F mm	L mm	$L_{A/F}$ mm	∅ d mm
18	36	45	—	—
22	41	50	—	—
25	46	55	—	—
28	50	60	—	—
30	55	65	—	—
35	65	70	—	—
43	80	90	—	—
50	80	100	—	—
57.5	90	120	50	102
63.5	100	145	55	114

② Lock nut, long
TR 2003-∅



Nominal diameter $\varnothing_s$ mm	A/F mm	L mm	$L_{A/F}$ mm	∅ d mm
18	30	40	—	—
22	36	45	—	—
25	41	50	—	—
28	46	55	—	—
30	50	60	—	—
35	55	65	—	—
43	70	80	—	—
50	80	90	—	—
57.5	90	100	50	102
63.5	100	115	50	114
75	100	120	70	108

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Components – Lock nut, short and lock nut, short, cast

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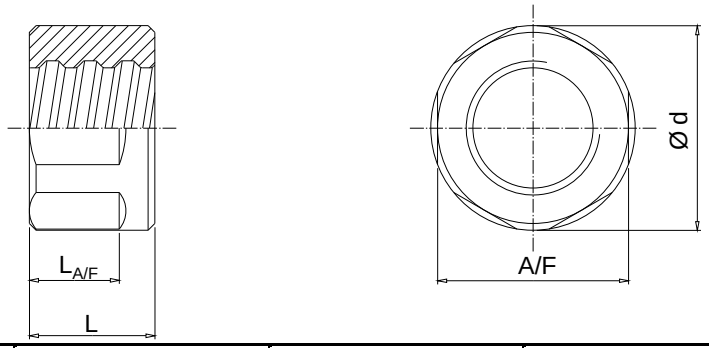
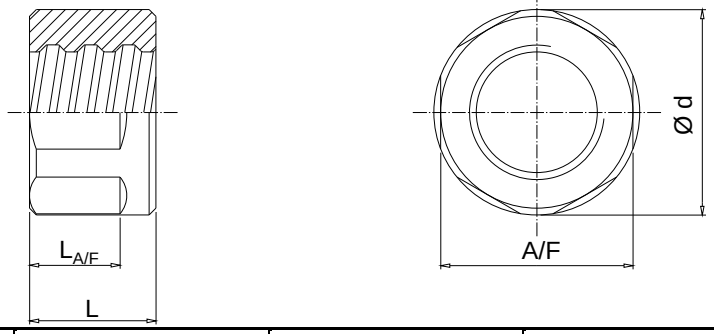
③ Lock nut, short
TR 2040-∅



Nominal diameter $\varnothing_s$ mm	A/F mm	L mm	$L_{A/F}$ mm	∅ d mm
18	30	22	—	—
22	36	22	—	—
25	41	22	—	—
28	46	30	—	—
30	50	30	—	—
35	55	40	—	—
43	70	50	—	—
50	80	50	—	—
57.5	90	60	50	102
63.5	100	70	50	114
75	100	80	70	108

④ Lock nut, short, cast
TR 2040-∅ C



Nominal diameter $\varnothing_s$ mm	A/F mm	L mm	$L_{A/F}$ mm	∅ d mm
18	30	22	16	35
22	36	22	16	42
25	41	22	16	47
28	46	30	24	53
30	50	30	24	58
35	55	40	32	64
43	70	50	40	81
50	80	50	40	90
57.5	90	60	50	102
63.5	100	70	50	114

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Components – Anchor piece and anchor nut with flange

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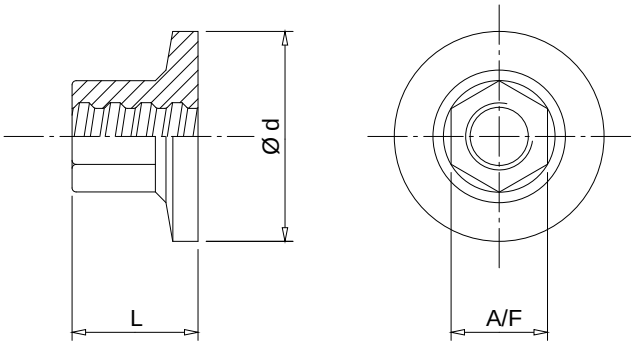
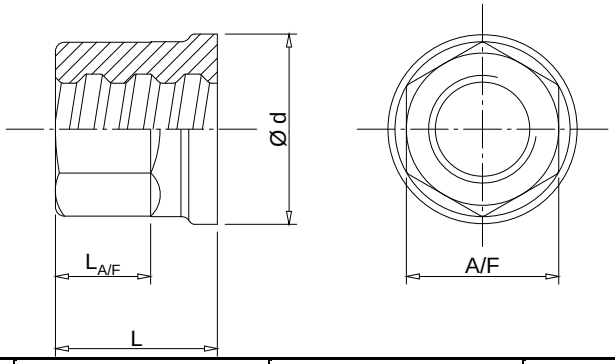
(5) Anchor piece
TR 2073-∅



Nominal diameter $\varnothing_s$ mm	A/F mm	L mm	∅ d mm
18	32	35	55
22	36	45	65
25	41	50	75
28	46	55	85
30	50	60	90
35	60	70	105
43	70	85	130
50	80	100	150
57.5	90	115	175
63.5	100	125	190

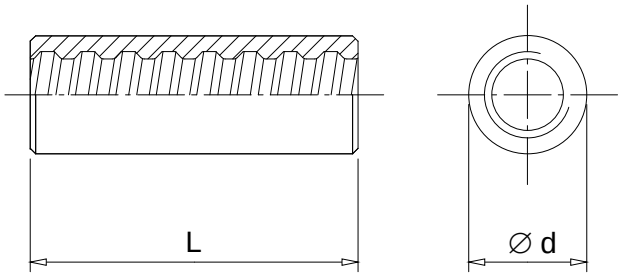
(6) Anchor nut with flange
TR 2163-∅



Nominal diameter $\varnothing_s$ mm	A/F mm	∅ d mm	L mm	$L_{A/F}$ mm
18	36	42	45	34
22	41	47	50	38
25	46	53	55	40
28	50	58	65	50
30	55	64	65	50
35	65	75	70	53
43	80	92	90	63
50	80	92	100	75
57.5	90	102	120	95
63.5	100	114	145	117

Max Aicher GmbH & Co. KG 83404 Ainring–Hammerau	**High strength reinforcing system SAS 670** Components Coupler, standard and contact coupler	**Annex 11** of European Technical Assessment **ETA-13/0840** of 20.12.2021

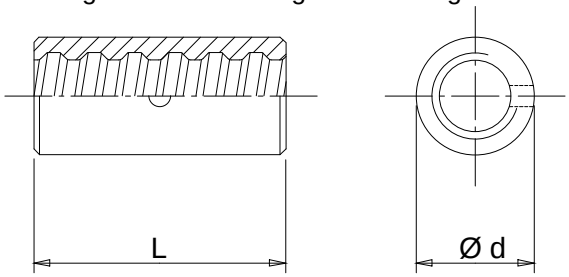
(7) Coupler, standard
TR 3003-∅



Nominal diameter $\varnothing_s$ mm	∅ d [1)] mm	L [1)] mm
18	36	100
22	40	110
25	45	130
28	50	140
30	55	150
35	65	180
43	80	200
50	90	210
57.5	102	250
63.5	114	300
75	108	260

1) Minimum dimensions. Standard couplers with larger diameter and greater in length are also available.

(8) Contact coupler
TR 3006-∅
Contact coupler, cast
TR 3006-∅ C

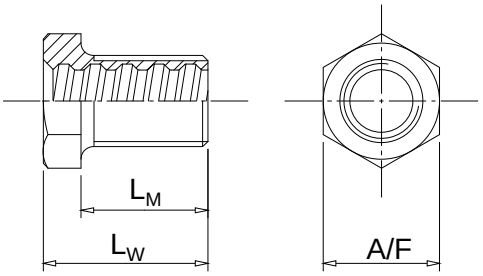


Nominal diameter $\varnothing_s$ mm	∅ d [1)] mm	L [1)] mm
18	27	70
22	32	75
25	40	80
28	45	90
30	45	90
35	50	120
43	65	160
50	70	170
57.5	83	180
63.5	89	200
75	102	230

1) Minimum dimensions. Contact couplers with larger diameter and greater in length are also available.

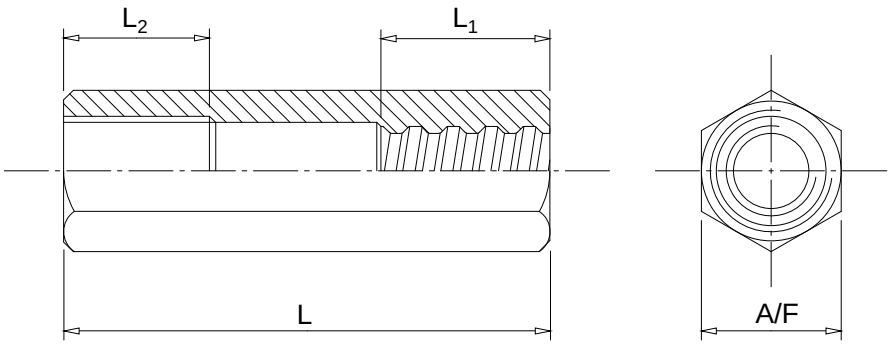
Max Aicher GmbH & Co. KG 83404 Ainring–Hammerau	**High strength reinforcing system SAS 670** Components – Turnbuckle – Change over coupler and tensioning coupler	**Annex 12** of European Technical Assessment **ETA-13/0840** of 20.12.2021

(9) Change over coupler
TR 3013-∅



Nominal diameter $\varnothing_s$ mm	A/F mm	L_W mm	L_M mm
18	41	60	45
22	46	65	50
25	55	70	55
28	60	80	60
30	65	95	70
35	80	100	75
43	90	115	90
50	100	125	100
57.5	100	135	100
63.5	100	140	105

(10) Tensioning coupler
TR 3014-∅



Nominal diameter $\varnothing_s$ mm	A/F mm	L mm	L_1 mm	L_2 mm
18	41	145	50	45
22	46	160	55	50
25	55	175	60	55
28	60	190	65	60
30	65	215	70	65
35	80	230	75	75
43	90	280	100	90
50	100	300	100	100
57.5	100	345	125	100
63.5	100	365	140	105

Max Aicher GmbH & Co. KG
83404 Ainring–Hammerau

High strength reinforcing system SAS 670

Components – Reducing coupler and reducing contact coupler

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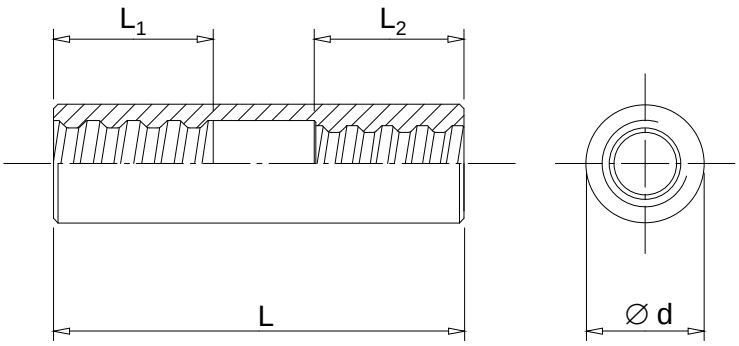
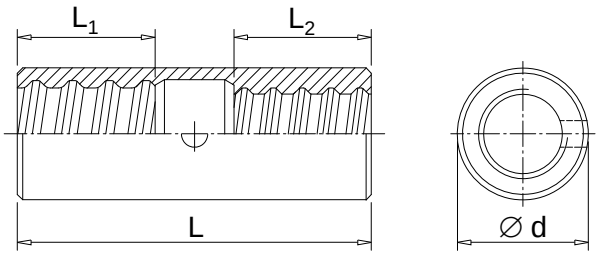
(11) Reducing coupler
TR 3102-∅



Nominal diameter $\varnothing_s$ [1] mm	∅ d [2] mm	L [2] mm	L_1 mm	L_2 mm
22 / 18	40	145	55	50
25 / 22	45	160	60	55
28 / 25	50	180	70	60
30 / 28	55	195	75	70
35 / 30	60	215	85	75
43 / 35	80	250	100	85
50 / 43	85	270	105	100
57.5 / 50	100	295	125	105
63.5 / 57.5	110	305	130	125

1) Nominal diameter of smaller bar may be replaced by any nominal diameter below.
2) Minimum dimensions. Reducing couplers with larger diameter and greater in length are also available.

(12) Reducing contact coupler
TR 3106-∅



Nominal diameter $\varnothing_s$ [1] mm	∅ d [2] mm	L [2] mm	L_1 mm	L_2 mm
22 / 18	32	90	35	35
25 / 22	40	95	40	35
28 / 25	45	110	45	40
30 / 28	45	115	45	45
35 / 30	50	135	60	45
43 / 35	65	185	80	60
50 / 43	70	210	85	80
57.5 / 50	81	220	90	85
63.5 / 57.5	90	245	100	90
75 / 63.5	102	270	115	100

1) Nominal diameter of smaller bar may be replaced by any nominal diameter below.
2) Minimum dimensions. Reducing contact couplers with larger diameter and greater in length are also available.

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High strength reinforcing system SAS 670

Centre spacing, edge distance, additional bonded length

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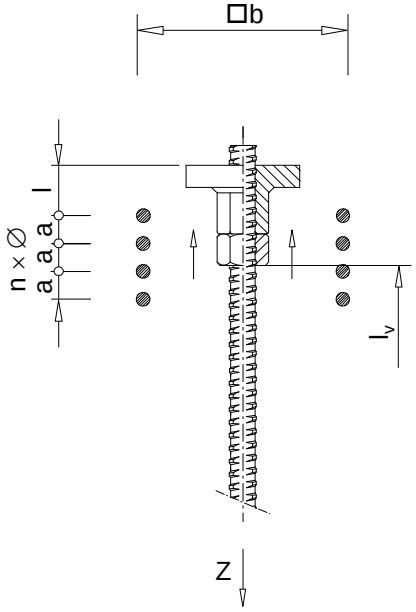
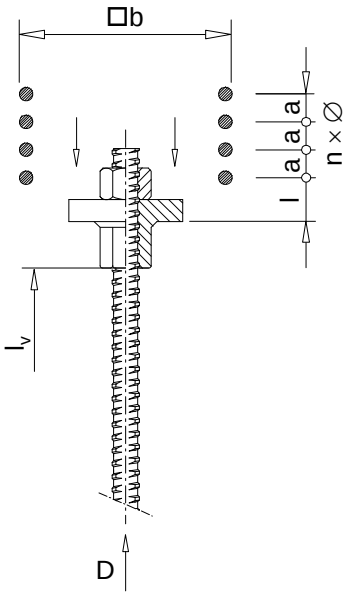
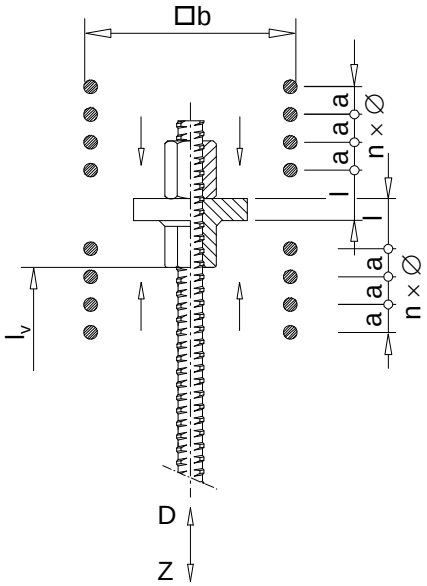
Tensile load



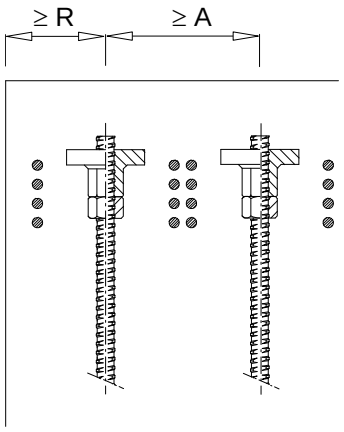
Compression load



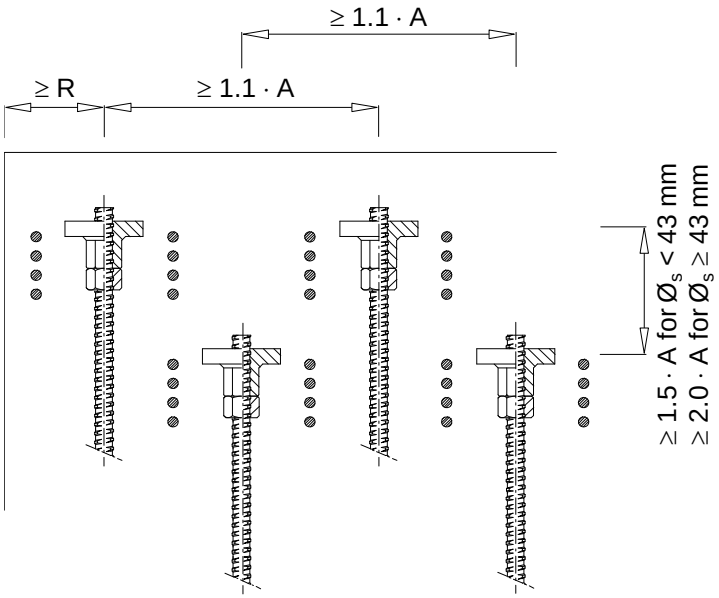
Alternating load



Regular arrangement



Staggered arrangement



Key ..... D loading in compression, Z loading in tension

Additional bonded length l_v									
Concrete strength class	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60	C55/67	C60/75	C80/95
Additional bonded length l_v	10 · ∅$_s$	9 · ∅$_s$	9 · ∅$_s$	8 · ∅$_s$	8 · ∅$_s$	7 · ∅$_s$	7 · ∅$_s$	6 · ∅$_s$	4 · ∅$_s$

Max Aicher GmbH & Co. KG
83404 Ainring–Hammerau

High strength reinforcing system SAS 670

Centre spacing, edge distance according to concrete strength class

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Concrete strength class ≥ C25/30							
Steel bar	Centre spacing [1]	Edge distance [2]	Additional reinforcement [3]				
$\varnothing_s$ mm	A mm	R mm	n	∅ mm	b mm	a mm	l mm
18	200	90 + c	2	8	180	70	125
22	250	115 + c	4	8	230	60	70
25	280	130 + c	4	10	260	70	60
28	310	145 + c	5	10	290	60	60
30	340	160 + c	6	10	320	60	55
35	390	185 + c	6	12	370	80	60
43	480	230 + c	8	12	460	70	55
50	580	280 + c	11	12	560	60	90
57.5	640	310 + c	13	12	620	60	90
63.5	710	345 + c	15	12	690	50	105

Concrete strength class ≥ C60/75							
Steel bar	Centre spacing [1]	Edge distance [2]	Additional reinforcement [3]				
$\varnothing_s$ mm	A mm	R mm	n	∅ mm	b mm	a mm	l mm
18	110	45 + c	2	8	90	80	40
22	130	55 + c	3	8	110	50	40
25	150	65 + c	4	8	130	40	40
28	165	75 + c	5	8	145	40	40
30	180	80 + c	5	8	160	40	40
35	205	95 + c	6	8	185	40	40
43	250	115 + c	8	8	230	40	40
50	300	140 + c	8	10	280	40	70
57.5	335	160 + c	6	12	315	55	100
63.5	360	170 + c	7	12	340	55	115

[1] Minimum centre spacing of anchorages may be reduced by up to 15 % in one direction, if the centre spacing in the perpendicular direction is increased by the same percentage.
[2] c as concrete cover
[3] Ribbed reinforcing steel, $R_e \geq 500$ N/mm²

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83404 Ainring–Hammerau

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Centre spacing, edge distance according to concrete strength class

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Concrete strength class ≥ C80/95							
Steel bar	Center spacing [1]	Edge distance [2]	Additional reinforcement [3]				
$\varnothing_s$ mm	A mm	R mm	n —	∅ mm	b mm	a mm	l mm
18	110	45 + c	2	8	90	80	40
22	130	55 + c	3	8	110	50	40
25	150	65 + c	4	8	130	40	40
28	165	75 + c	5	8	145	40	40
30	180	80 + c	5	8	160	40	40
35	205	95 + c	6	8	185	40	40
43	250	115 + c	8	8	230	40	40
50	300	140 + c	8	10	280	40	70
57.5	335	160 + c	6	12	315	55	100
63.5	360	170 + c	7	12	340	55	115

1) Minimum centre spacing of anchorages may be reduced by up to 15 % in one direction, if the centre spacing in the perpendicular direction is increased by the same percentage.
2) c as concrete cover
3) Ribbed reinforcing steel, $R_e \geq 500$ N/mm²

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83404 Ainring–Hammerau

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Recommended offset distance for splices

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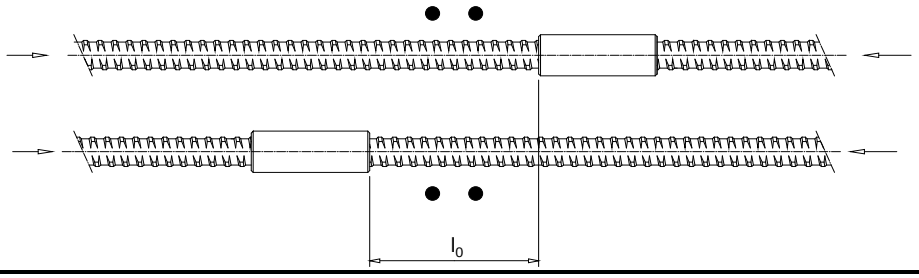
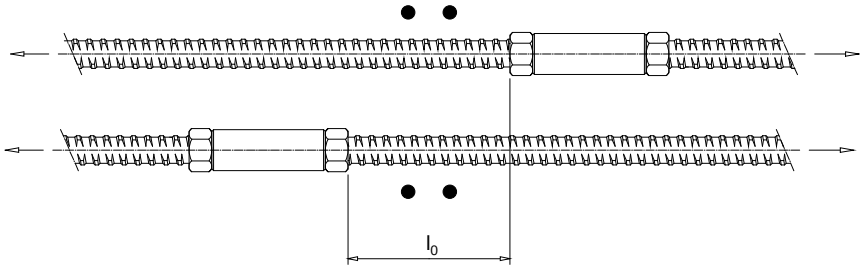


$\varnothing_s$ mm	Splice with contact coupler – Offset distance l_o in mm									Additional reinforce-ment cm²
	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60	C55/67	C60/75	C80/95	
18	400	380	370	360	350	340	335	330	315	0.17
22	445	420	405	395	385	375	365	360	340	0.26
25	475	450	435	420	405	395	390	380	355	0.33
28	510	480	460	445	430	420	410	400	375	0.41
30	530	500	480	465	450	435	425	415	385	0.48
35	585	550	525	505	490	475	465	450	415	0.65
43	675	630	600	575	555	535	525	505	465	0.98
50	750	700	665	635	610	590	575	555	510	1.32
57.5	835	775	735	705	675	645	630	610	555	1.75
63.5	900	835	790	755	720	695	675	650	590	2.13
75	1 025	950	895	850	815	785	755	730	660	2.80



$\varnothing_s$ mm	Splice with torqued coupler – Offset distance l_o in mm									Additional reinforce-ment cm²
	C25/30	C30/37	C35/45	C40/50	C45/55	C50/60	C55/67	C60/75	C80/95	
18	425	400	390	375	365	360	350	345	325	0.19
22	470	445	430	415	405	390	385	375	355	0.29
25	510	480	460	445	430	420	410	400	375	0.37
28	545	515	490	475	460	445	435	425	395	0.46
30	570	535	515	495	475	460	450	440	410	0.53
35	630	590	565	540	520	505	495	480	440	0.72
43	730	680	650	620	595	575	560	540	495	1.09
50	815	755	720	690	660	635	620	595	545	1.47
57.5	905	840	800	760	730	700	680	655	595	1.95
63.5	980	905	860	820	785	750	730	705	640	2.38
75	1 120	1 040	980	930	890	855	825	800	720	3.60

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Contents of the prescribed test plan

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Subject / type of control		Test or control method	Criteria, if any	Minimum number of samples [1]	Minimum frequency of control
End anchorage, Splices	Static load test [2]	Testing	[3]	0.2 % [4, 5] ≥ 2 [5]	continuous
	Resistance to fatigue [2]	Testing	[3]	1 [5]	continuous
	Traceability	full			
Steel bar	Mass per metre, cross-sectional area, surface geometry [6]	Testing	[3]	≥ 3 [7]	continuous
	Weldability	Testing	[8]	100 %	continuous
	Strength characteristics [6] $\varnothing_s$ < 57.5 mm $\varnothing_s$ ≥ 57.5 mm	Testing	[3]	≥ 3 [7] ≥ 1 [9]	continuous
	Elongation at maximum force [6] $\varnothing_s$ < 57.5 mm $\varnothing_s$ ≥ 57.5 mm	Testing	[3]	≥ 3 [7] ≥ 1 [9]	continuous
	Resistance to fatigue	Testing	[3]	≥ 5 [10]	continuous
	Bendability	Testing	[3]	≥ 1 [11]	continuous
	Visual inspection [12]	Checking	[3]	100 %	continuous
	Traceability	full			
Anchor nut, Anchor nut with flange, Anchor piece, Contact coupler, Contact coupler, cast, Coupler, standard, Lock nut, long, Lock nut, short, Lock nut, short, cast, Turnbuckle, Reducing coupler, Reducing contact coupler	Detailed dimensions	Testing	[3]	0.4 % [5, 13] ≥ 2 [5]	continuous
	Hardness	Testing	[3]	0.1 % [5, 13] ≥ 2 [5]	continuous
	Material	Checking	[14]	100 %	continuous
	Visual inspection [12]	Checking	[3]	100 %	continuous
	Traceability	full			

[1] For two specified numbers of samples, the higher number applies.
[2] Not for end bearing splice with contact coupler and not for end bearing anchorage
[3] Conformity with the specifications of the components
[4] Percentage of produced anchorages or splices per nominal diameter. After 5 years of successful manufacturing the frequency may be reduced to 0.1 %.
[5] For at least 1 nominal diameter. In case of a production of less than 20 items of 1 nominal diameter per year, testing that nominal diameter is not required. However, all nominal diameters are tested within 5 years.
[6] Assessment of long-term quality level according to EN 10080, clause 8.5.
[7] Per nominal diameter and rolling batch, at least however, as specified in EN 10080, clause 8.1.
[8] Carbon equivalent, CEV, does not exceed the specification of the steel bar.
[9] Per nominal diameter and rolling batch, at least however, as specified in EN 10080, clause 8.1, with 1 specimen instead of 3 specimens.
[10] Of one nominal diameter. Nominal diameters < 57.5 mm are all tested within 5 years. Nominal diameters ≥ 57.5 mm are represented by one of these nominal diameters, rotating for every 5 years. However, in case of failure, all of these nominal diameters are tested.
[11] Bend test and re-bend test per nominal diameter and rolling batch, at least however, as specified in EN 10080, clause 8.1.
[12] Successful visual inspection does not need to be documented.
[13] Percentage of produced component per nominal diameter and batch
[14] Checking of relevant certificate, the certificate is an inspection report 3.1 according to EN 10204.

Traceability	full	Full traceability of each component to its raw material.
Material		Defined according to technical specification deposited by the supplier
Detailed dimensions		Measuring of all the dimensions and angles according to the specification given in the test plan
Visual inspection		Main dimensions, gauge testing, correct marking or labelling, appropriate performance, surface, fins, kinks, smoothness, corrosion, etc.

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Audit testing

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Subject / type of control		Test or control method	Criteria, if any	Minimum number of samples [1]	Minimum frequency of control
End anchorage, Splices	Static load test	Testing	[2]	3 [3]	Each inspection
Steel bar	Mass per metre, cross-sectional area, surface geometry	Testing	[2]	[4]	Each inspection
	Weldability	Testing	[5]	[4]	Each inspection
	Strength characteristics	Testing	[2]	[4]	Each inspection
	Elongation at maximum force	Testing	[2]	[4]	Each inspection
	Bendability	Testing / Checking	[2]	[4]	Each inspection
	Visual inspection	Checking	[2]	[4]	Each inspection
Anchor nut, Anchor nut with flange, Anchor piece, Lock nut, long, Lock nut, short, Lock nut, short, casted Contact coupler, Contact coupler, cast, Coupler, standard, Turnbuckle, Reducing coupler, Reducing contact coupler	Detailed dimensions	Testing	[2]	3 [6]	Each inspection
	Material	Testing / Checking	[2]	3 [6]	Each inspection
	Visual inspection	Checking	[2]	3 [7]	Each inspection

[1] All samples are taken at random and be clearly identified.
[2] Conformity with the specifications of the components
[3] 1 nominal diameter, all nominal diameters are tested within 5 years.
[4] According to EN 10080, clause 8.3.1.
[5] Carbon equivalent, CEV, does not exceed the specification of the steel bar.
[6] Per component. One nominal diameter is sampled. All nominal diameters are sampled within 5 years.
[7] Each kind of component for all nominal diameters

Material	Defined according to technical specification deposited by the ETA holder at the Notified body
Detailed dimension	Measuring of all the dimensions and angles according to the specification given in the test plan
Visual inspection	Main dimensions, gauge testing, correct marking or labelling, appropriate performance, surface, fins, kinks, smoothness, corrosion, etc.

Max Aicher GmbH & Co. KG 83404 Ainring–Hammerau	**High strength reinforcing system SAS 670** Reference documents	**Annex 20** of European Technical Assessment **ETA-13/0840** of 20.12.2021

EAD 160011-00-0301	Kit for reinforced concrete members with high strength reinforcing steel but limited tensile utilisation
EN 206+A2, 03.2021	Concrete – Specification, performance, production and conformity
Eurocode 2	Eurocode 2 – Design of concrete structures
EN 1992-1-1, 12.2004 EN 1992-1-1+AC, 11.2010 EN 1992-1-1+A1, 12.2014	Eurocode 2: Design of concrete structures – Part 1-1: General rules and rules for buildings
Eurocode 3	Eurocode 3 – Design of steel structures
EN 10025-2, 08.2019	Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels
EN 10080, 05.2005	Steel for the reinforcement of concrete – Weldable reinforcing steel – General
EN ISO 683-2, 06.2018	Heat-treatable steels, alloy steels and free-cutting steels – Part 2: Alloy steels for quenching and tempering
EN 10204, 10.2004	Metallic products – Types of inspection documents
EN 10210-1, 04.2006	Hot finished structural hollow sections of non-alloy and fine grain steels – Part 1: Technical delivery conditions
EN 10277, 06.2018	Bright steel products – Technical delivery conditions
EN 10293, 01.2015	Steel castings – Steel castings for general engineering uses
EN 13670, 12.2009	Execution of concrete structures
EN ISO 17660-series, 09.2006	Welding – Welding of reinforcing steel
ISO 15835-1, 04.2009	Steels for the reinforcement of concrete – Reinforcement couplers for mechanical splices of bars – Part 1: Requirements

Max Aicher GmbH & Co. KG 83404 Ainring–Hammerau	**High strength reinforcing system SAS 670** Reference documents	**Annex 21** of European Technical Assessment **ETA-13/0840** of 20.12.2021

97/597/EC	Commission decision 97/597/EC of 14 July 1997 on the procedure for attesting the conformity of construction products pursuant to Article 20 (2) of Council Directive 89/106/EEC as regards reinforcing and prestressing steel for concrete, Official Journal of the European Communities L 240 of 02 September 1997, p. 4
305/2011	Regulation (EU) № 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC, OJ L 88 of 4 April 2011, p. 5, amended by Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, OJ L 157 of 27.05.2014, p. 76, Commission Delegated Regulation (EU) № 574/2014 of 21 February 2014, OJ L 159 of 28.05.2014, p. 41, and Regulation (EU) 2019/1020 of the European Parliament and of the Council of 20 June 2019, OJ L 169 of 15.06.2019, p. 1
568/2014	Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014 amending Annex V to Regulation (EU) № 305/2011 of the European Parliament and of the Council as regards the assessment and verification of constancy of performance of construction products, OJ L 157 of 27 May 2014, page 76