CARES Technical Approval Report TA1-A&B 5099

Issue 1

TERWA

Terwa
TFS/KB-F Cold Forged Standard Rebar Coupling System

Assessment of the Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System Product and Quality System for Production

CARES TECHNICAL APPROVAL 5099

UKAS PRODUCT CERTIFICATION 0002

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Product

Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System for reinforcing steel

Product approval held by:

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1 Product Summary

The Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System is for the mechanical connection of deformed high yield carbon steel bars for the reinforcement of concrete complying with the requirements of BS4449 Grades B500B and B500C in the size range as detailed in table 1 and scope in clause 1.1.

1.1 Scope of Application

The Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System in the size range 12-32mm as detailed in table 1 has been evaluated for use with grade B500B reinforcement as follows:

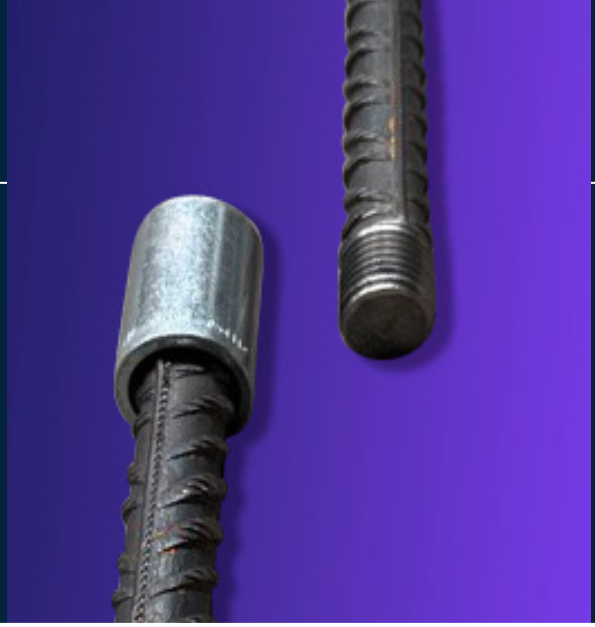
a) In accordance with CARES Appendix TA1-A and BS8597 tested in tension and high cycle fatigue test loading class D with grade B500B reinforcement.

b) In accordance with CARES appendix TA1-B and BS8597 tested in tension with grade B500B reinforcement.

The Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System in the size range 12-40mm as detailed in table 1 has been evaluated for use with grade B500C reinforcement as follows:

c) In accordance with CARES Appendix TA1-A and BS8597 tested in tension and high cycle fatigue test loading class D with grade B500C reinforcement.

d) In accordance with CARES appendix TA1-B and BS8597 tested in tension with grade B500C reinforcement.



1.2 Design Considerations

BS 8110 Clause 3.12.8.9 Laps and Joints states "Connections transferring stress may be lapped, welded or joined with mechanical devices. They should be placed, if possible, away from points of high stress and should preferably be staggered". However, BS 8110 Clause 3.12.8.16.2 Bars in tension states "The only acceptable form of full-strength butt joint for a bar in tension comprises a mechanical coupler" satisfying specified slip and tensile strength criteria.

Eurocode 2, Clause 8.7 Laps and mechanical couplers 8.7.1 General (1)P "Forces are transmitted from one bar to another by:

- lapping of bars, with or without bends or hooks;
- welding;
- mechanical devices assuring load transfer in tension-compression or in compression only."

Clause 8.8 Additional rules for large diameter bars goes on to state that "Splitting forces are higher and dowel action is greater with the use of large diameter bars. Such bars should be anchored with mechanical devices." The specified cover for fire resistance and durability should be provided to the coupler sleeve. The coupler as detailed in table 1 has been designed with controlled mechanical properties to be compatible with reinforcing bars complying with BS4449 Grades B500B and B500C.

1.3 Conclusion

It is the opinion of CARES that the Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System is satisfactory for use within the limits stated in paragraph 1.1 when applied and used in accordance with the manufacturer's instructions and the requirements of this certificate.

L. Brankley
Chief Executive Officer
August 2025

TECHNICAL APPROVAL 5099

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2 Technical Specification

2.1 General

The Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System is a high quality, economical reinforcement connection system. The rebar connection system is a simple, efficient method for connecting reinforcement bars, which eliminates the disadvantages of the traditional method for overlapping joints. Overlapping joints are time-consuming, cause greater congestion of rebar and are unsafe to use in seismic areas. The rebar coupling system's design allows a connection of the reinforcement steel in which the characteristics are equivalent to the uninterrupted reinforcing bar, and the loads are transferred in the bar, not in the concrete as in overlapped joints. Impact damage or a seismic event affects only the concrete, and the rebar connections retain their strength. The Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System allows easy installation of the reinforcement both on site and in the prefab factory using standard tools.

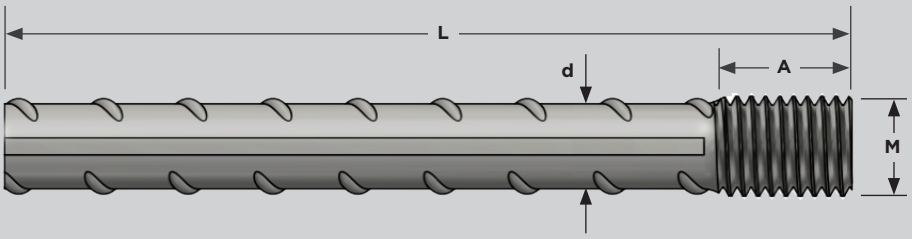
2.2 The Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System

Manufacture of the Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System involves specialised equipment and materials used in construction and engineering, specifically for creating strong, reliable connections between structural elements.

Production phases include cutting of the rebar end with a bandsaw, the rebar end is then cold forged allowing for the enlarged end to be threaded. By enlarging the end diameter more than the rebar diameter it increases the strength of the thread for tensile and shear loads.

The final important step is a thread stress release, where the end is stamped (with a 'T') indicating that this operation has been carried out.

TFS/KB-F Cold Forged Standard Rebar Coupling System – Threaded Rebar Component



Description	Product Number	d mm	A mm	M mm	Fatigue Class D	Tension Slip
TFS 12 – M14 - L	91815	12	14	M14 x 2	B500B / B500C	B500B / B500C
TFS 16 - M20 - L	91816	16	20	M20 x 2.5	B500B / B500C	B500B / B500C
TFS 20 - M24 - L	91818	20	24	M24 x 3	B500B / B500C	B500B / B500C
TFS 25 - M30 - L	91820	25	30	M30 x 3.5	B500B / B500C	B500B / B500C
TFS 32 – M36 - L	91822	32	36	M36 x 4	B500B / B500C	B500B / B500C
TFS 40 - M45 - L	91824	40	45	M45 x 4.5	B500C	B500C

Table 1

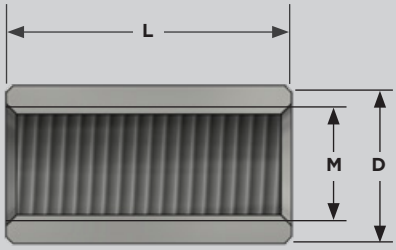
2.3 The Terwa Standard Connector KB-F

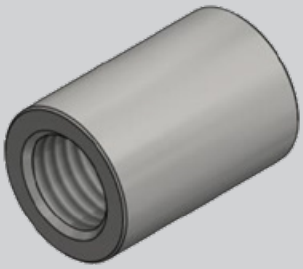
KB-F standard connectors are used to couple rebars in the diameter range between 12mm and 40mm.

The KB-F connector is fully threaded with a single right-hand thread.

KB-F standard connectors are made of quality non-alloy steel and are available in electrolytically galvanised (EV) and black finishes.

Standard Connector KB-F Component





Description	Product Number (EV)	Product Number Black	Rebar Diameter mm	M mm	L mm	D mm
KB-F M14	67979	68685	12	M14 x 2	28	20
KB-F M20	67305	68687	16	M20 x 2.5	40	27
KB-F M24	67306	68689	20	M24 x 3	48	33
KB-F M30	67307	68691	25	M30 x 3.5	60	40
KB-F M36	67308	68693	32	M36 x 4	72	50
KB-F M45	67309	68695	40	M45 x 4.5	90	62

Table 2

3 Product Performance and Characteristics

Full destructive tests have been carried out to demonstrate compliance with the performance requirements defined in CARES Appendices TA1-A and TA1-B when used with reinforcing steel BS4449 grade B500B or B500C as appropriate.

CARES APPENDIX TA1-A & TA1-B

- Permanent deformation is less than 0.10mm after loading to $0.65f_y$ in tension with BS4449 grade B500B and B500C reinforcement.
- 99% characteristic tensile strength is greater than 540MPa with grade B500B or 575MPa with grade B500C reinforcement.

CARES APPENDIX TA1-A

- D class fatigue requirements.

4 Manufacture and Installation

4.1 Process

Manufacture of the Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System involves specialised equipment and materials, specifically for creating strong, reliable connections between structural elements.

By offering the option of a complete, containerised solution for localised fabrication, Terwa ensures that all necessary components for the cold forged connection system are available and easily transportable, streamlining the installation process and maintaining high standards of quality and safety.

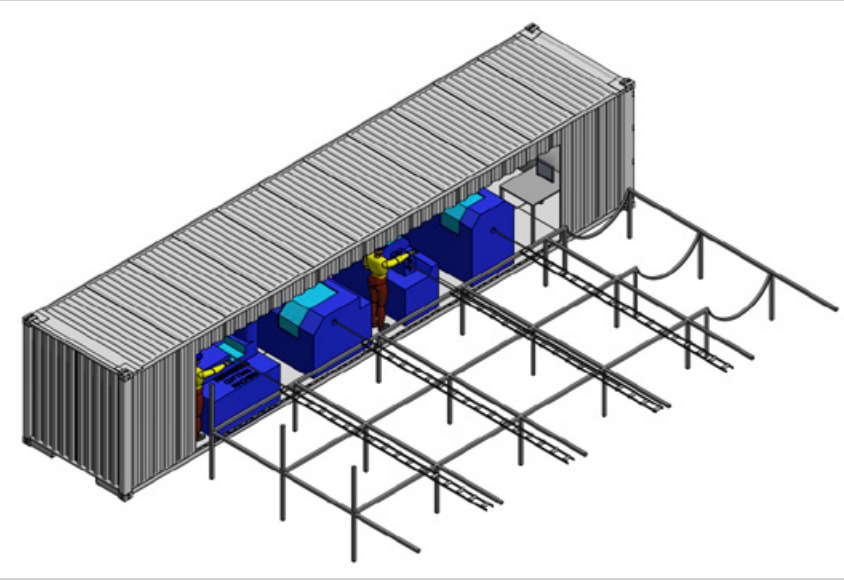
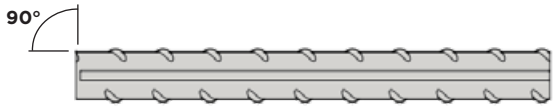


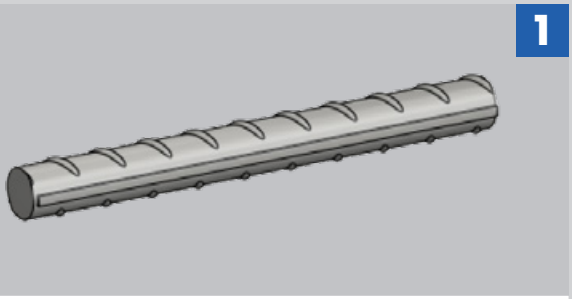
Figure 1 - Optional Terwa cold forged system containerised solution

4.2 Terwa Production Process

CUTTING

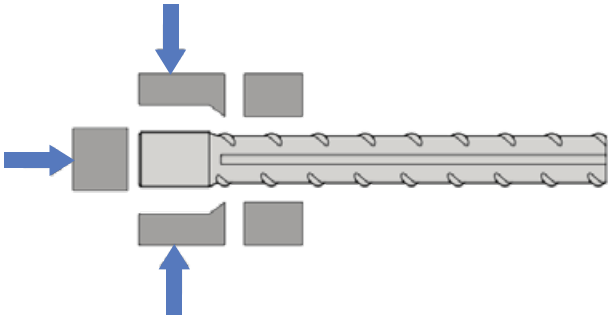
The rebar end is cut square with a bandsaw.

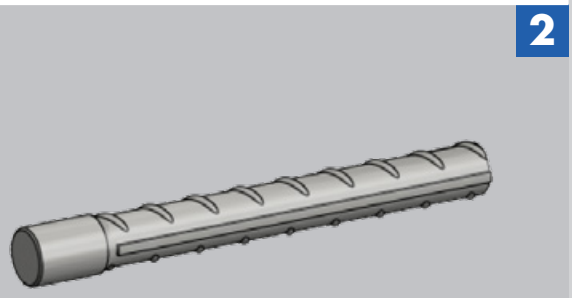




COLD FORGING

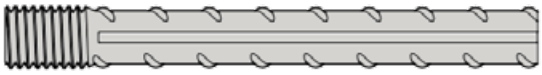
The sawn end of the rebar is then enlarged by cold pressing.

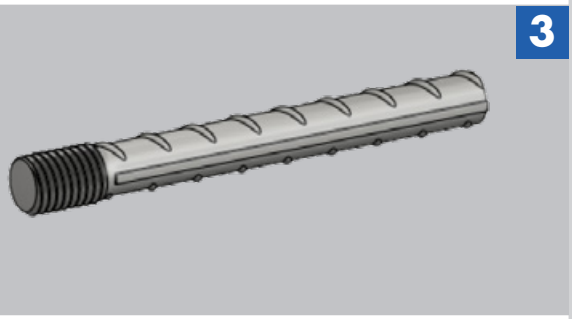




THREADING

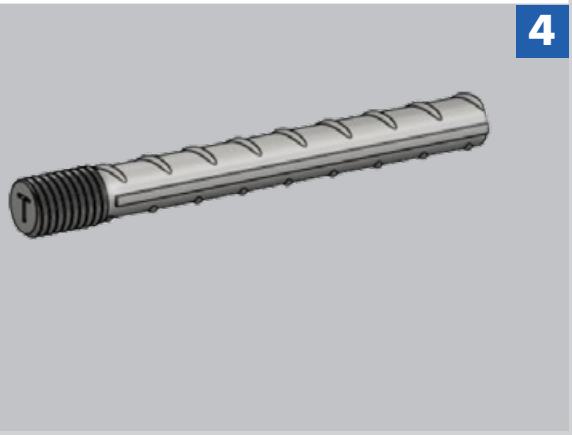
A thread is cut into the enlarged end of the bar.





THREAD STRESS RELEASE

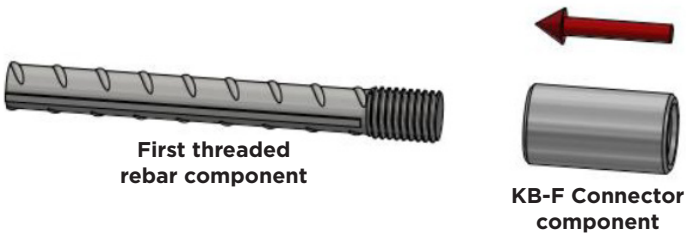
Stress release is applied to the thread. At the same time, the 'T' identification and proof mark is made.



4.3 Coupling Sequence

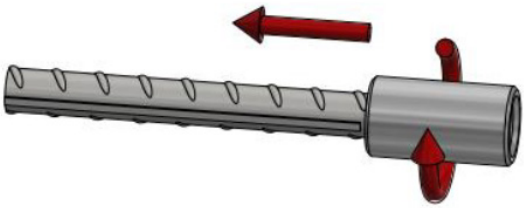
The first threaded rebar component is held firm in readiness to receive the internally threaded KB-F connector.

1



The KB-F connector is screwed onto the first threaded rebar until it comes to a natural stop. This assembly is then ready to be cast into the concrete.

2



On site, the second threaded rebar component is screwed into the KB-F connector.

3

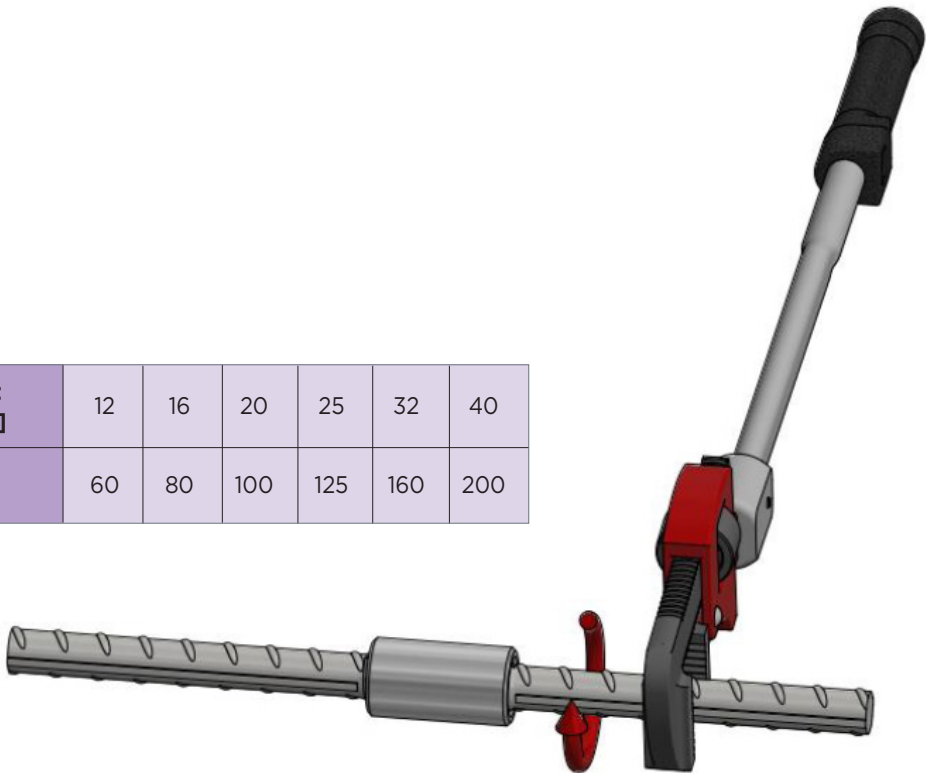
The connection should be tightened using a calibrated torque wrench.

The necessary torque for each diameter of rebar is shown below in table 3.

4

Reinforcement diameter [mm]	12	16	20	25	32	40
Torque [Nm]	60	80	100	125	160	200

Table 3



5 Safety Considerations

The Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System is supplied to site either bundled or on robust wooden pallets. If handling manually, bundles weighing up to 25kg must be handled with care. Heavier bundles require the use of mechanical handling equipment.

Protective gloves should be worn when installing the coupling system.

6 Product Testing and Evaluation

The Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System has been tested to satisfy the requirements of CARES Appendix TA1-A and TA1-B for Couplers with reinforcing bars to BS4449 Grade B500B or B500C as shown in table 1. The testing comprised the following elements.

- Tensile Strength
- Permanent Deformation
- Performance under fatigue

The products are subject to a programme of periodic testing to ensure continued compliance.

7 Quality Assurance

The Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System is produced under an EN ISO 9001 quality management system certified by CARES. The quality management system scheme monitors production of the coupling system and ensures that materials and geometry remain within the limits of this technical approval.

8 Building Regulations

8.1 The Building Regulations (England and Wales)

Structure, Approved Document A

The Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System, when used in EC2 based designs using the data contained within this technical approval, satisfy the relevant requirements of The Building Regulations (England and Wales), Approved Document A.

Materials and Workmanship, Approved Document

This technical approval gives assurance that the Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System complies with the material requirements of EC2.

8.2 The Building Regulations (Northern Ireland)

Materials and Workmanship

This technical approval gives assurance that the Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System complies with the material requirements of EC2 by virtue of regulation *23, Deemed to satisfy provisions regarding the fitness of materials and workmanship.*

8.3 The Building Standards (Scotland)

Fitness of Materials

This technical approval gives assurance the Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System complies with the material requirements of EC2 by virtue of *Clause 0.8.*

Structure

The Terwa TFS/KB-F Cold Forged Standard Rebar Coupling System, when used in EC2 based designs using the data contained within this technical approval, satisfies the requirements of *The Building Standards (Scotland) clause 1.*

9 References

- BS 4449: 2005: Steel for the reinforcement of concrete - Weldable reinforcing steel - Bar, coil and decoiled product - Specification.
- BS8110: Part 1: 1997: Structural Use of Concrete, Code of Practice for Design and Construction.
- BS EN 1992-1-1:2023 Eurocode 2. Design of concrete structures – General rules and rules for buildings, bridges and civil engineering structures.
- BS EN ISO 9001: Quality management systems - Requirements.
- CARES Appendix TA1-B: Quality and Operations Schedule for the Technical Approval of Couplers for Reinforcing Steel and Reinforcement Anchors For BS8110 and EN1992-1-1 Applications for Static Loading in Tension or Tension and Compression.
- CARES Appendix TA1-A: Quality and Operations Schedule for the Technical Approval of Couplers for Reinforcing Steel for use in Structures and Structural elements Designed in accordance with the Fatigue Requirements of Structural Eurocodes.
- BS 8597: 2015 Steels for the reinforcement of concrete. Reinforcement couplers. Requirements and test methods.

10 Conditions

1. The quality of the materials and method of manufacture have been examined by CARES and found to be satisfactory. This technical approval will remain valid providing that:

   a. The product design and specification are unchanged.
   b. The materials, method of manufacture and location are unchanged.
   c. The manufacturer complies with CARES regulations for technical approvals.
   d. The manufacturer holds a valid CARES Certificate of Product Assessment.
   e. The product is installed and used as described in this report.

2. CARES make no representation as to the presence or absence of patent rights subsisting in the product and/or the legal right of Terwa to market the product.

3. Any references to standards, codes or legislation are those which are in force at the date of this certificate.

4. Any recommendations relating to the safe use of this product are the minimum standards required when the product is used. These requirements do not purport to satisfy the requirements of the Health and Safety at Work act 1974 or any other relevant safety legislation.

5. CARES does not accept any responsibility for any loss or injury arising as a direct or indirect result of the use of this product.

6. This Technical Approval Report should be read in conjunction with CARES Certificate of Product Assessment No 5099. Confirmation that this technical approval is current can be obtained from CARES.

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Independent Product Assessments for the Construction Industry

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