

CARES Technical Approval Report TA1-B 5058

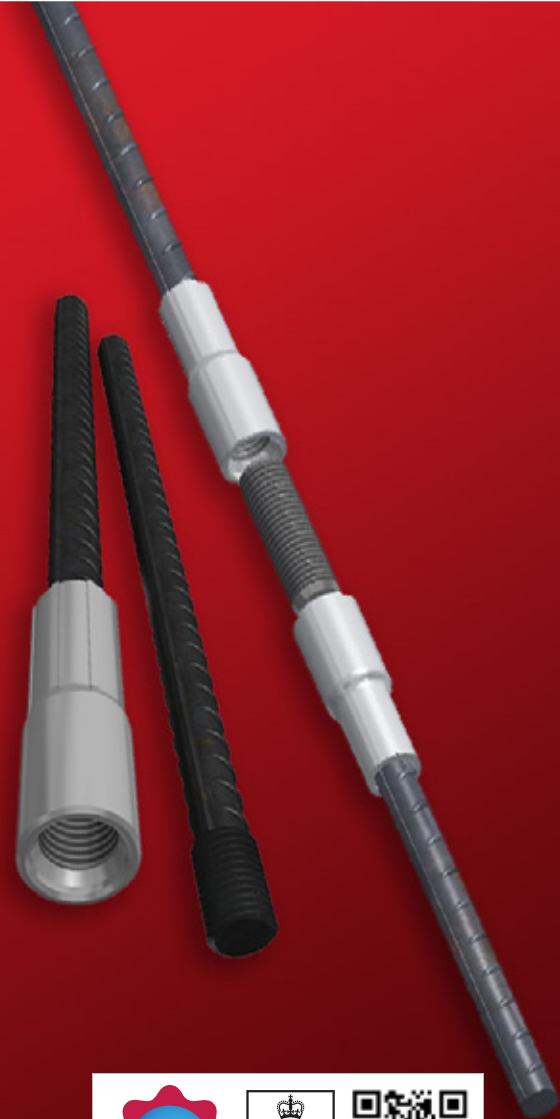


Issue 4



Terwa PSA/TSE and PSA/PSC Standard Couplers

Assessment of the
PSA/TSE and PSA/PSC
Standard Coupler Product
and Quality System
for Production



TECHNICAL
APPROVAL
5058



0002



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Product

Terwa PSA/TSE and PSA/PSC Standard Couplers for reinforcing steel

Product approval held by:

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1 Product Summary

Terwa PSA/TSE and PSA/PSC Standard Couplers in the size range 12mm - 32mm are 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 for PSA/TSE (see table 1 and 2) and BS4449 Grades B500B for PSA/PSC (see table 3 and 4).

1.1 Scope of Application

Terwa PSA/TSE Standard Couplers in the size range 12mm - 32mm have been evaluated for use as follows:

- a) TA1-B: Eurocode 2 and BS8110 for static applications in tension only with Grades B500B and B500C reinforcement.

Terwa PSA/PSC Standard Couplers in the size range 12mm - 32mm have been evaluated for use as follows:

- b) TA1-B: Eurocode 2 and BS8110 for static applications in tension only with Grades B500B 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. All couplers have been designed with controlled mechanical properties to be compatible with reinforcing bars complying with reinforcement of the relevant Grade in accordance with BS4449.

1.3 Conclusion

It is the opinion of CARES that Terwa PSA/TSE and PSA/PSC Standard Couplers in the size range 12mm - 32mm are 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
 September 2022

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2 Technical Specification

The function of Terwa PSA/TSE Couplers is to connect deformed steel reinforcing bars complying with BS 4449 Grade B500B or B500C as appropriate and thereby create structural continuity of the reinforcing system. Similarly Terwa PSA/PSC Couplers use Grade B500B.

The couplers systems uses reinforcement sizes 12mm to 32mm that complies with BS4449 Grades B500B and B500C (PSA/TSE) or B500B (PSA/PSC).

2.1 PSA/TSE Standard couplers

The 12mm - 32mm couplers comprise a female socket bar PSA (see figure 1 and table 1) and a male connector bar TSE (see figure 1 and table 2).

The 12mm - 32mm female socket bar PSA consists of an internally threaded collar, factory swaged by machine on to the reinforcement bars. The swaged collar dimensions are shown in Table 1. The threaded collar is manufactured from cold drawn, seamless precision steel tube dimensioned to LN2391 and using material grade 25CrMo4. Thread dimensions comply with BS3643-2-2017 tolerance class 6H.

The 12mm - 32mm male connector bars TSE as dimensioned in Table 2 consists of a reinforcing bar with a male threaded end that is compatible with the same sized female socket bar. The threaded part of the male bar is enlarged by hot forging prior to roll threading to retain the full cross sectional area of the bar. Thread dimensions comply with BS3643-2-2017 tolerance class 8g.

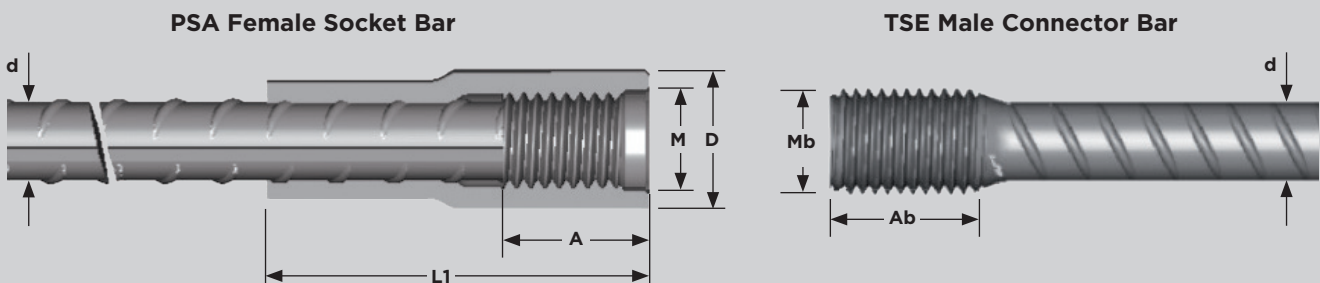


Figure 1

Description	d mm	M mm	A mm	D mm	L1 mm
PSA 12 - M16	12	16	25	22	62
PSA 16 - M20	16	20	38	28	86
PSA 20 - M24	20	24	42	34	99
PSA 25 - M30	25	30	52	42.5	117
PSA 32 - M42	32	42	65	56	153

Table 1 - PSA female socket bar

Description	d mm	Mb mm	Ab mm
TSE 12 - M16	12	16	min 23
TSE 16 - M20	16	20	min 30
TSE 20 - M24	20	24	min 38
TSE 25 - M30	25	30	min 44
TSE 32 - M42	32	42	min 54

Table 2 - TSE male socket bar

2.1 PSA/PSC Standard couplers

The 12mm - 32mm couplers comprise PSA female socket bars and a PSC metric bolt. (See figure 3).

Two PSA couplers and a threaded PSC bolt ensure the connection of two reinforcements for all types of precast concrete units. The PSC bolts are made of alloyed steel 34CrMo4 (W1.7220) or equivalent.

The relevant dimensions for PSC bolts are shown in the (table 4).

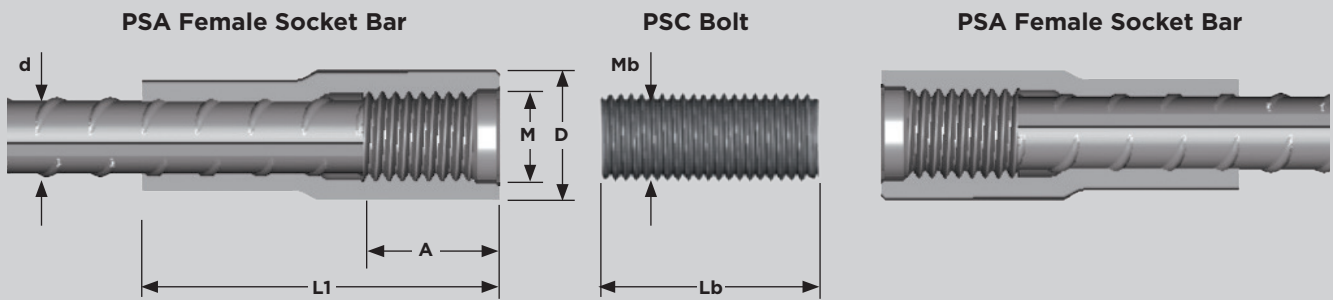


Figure 3

Description	d mm	M mm	A mm	D mm	L1 mm
PSA 12 - M16	12	16	25	22	62
PSA 16 - M20	16	20	38	28	86
PSA 20 - M24	20	24	42	34	99
PSA 25 - M30	25	30	52	42.5	117
PSA 32 - M42	32	42	65	56	153

Table 3 - PSA female socket bar

Description	Mb mm	Lb mm
PSC BOLT M16	16	49
PSC BOLT M20	20	75
PSC BOLT M24	24	83
PSC BOLT M30	30	103
PSC BOLT M42	42	129

Table 4 - PSC bolt

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3 Product Performance and Characteristics

Full destructive tests have been carried out to demonstrate compliance with the performance requirements defined in CARES Appendix TA1-B when used with reinforcing steel BS4449 Grade B500B and B500C as appropriate:

CARES APPENDIX TA1-B strength requirements

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

4 Installation

The bars to be spliced are cut straight. The PSA couplers with respectively male and female metric thread are pushed on the bars and clamped mechanically. The TSE bars are hot-upset and then finally threaded.

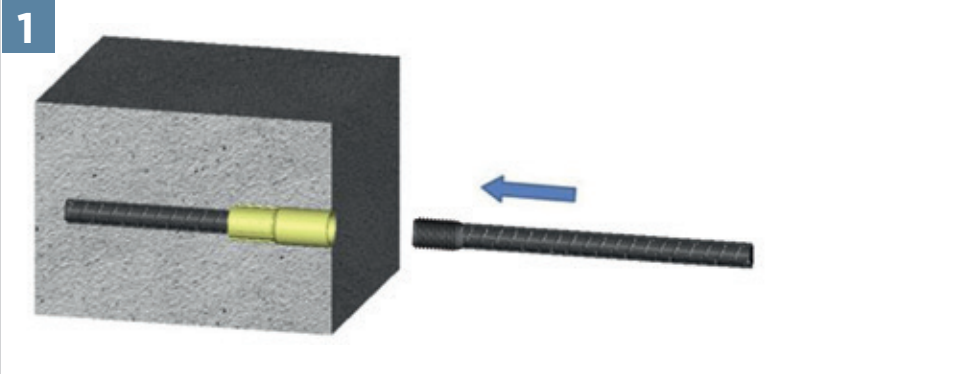
4.1 PSA/TSE and PSA/PSC Standard couplers installation

The reinforcement coupler PSA is composed of a reinforcement steel and a sleeve PKB with interior metric thread pressed at one end. In connection with a reinforcement coupler TSE, the coupler PSA ensures an uninterrupted reinforcement for all types of precast concrete units. These couplers can be made at different dimensions.

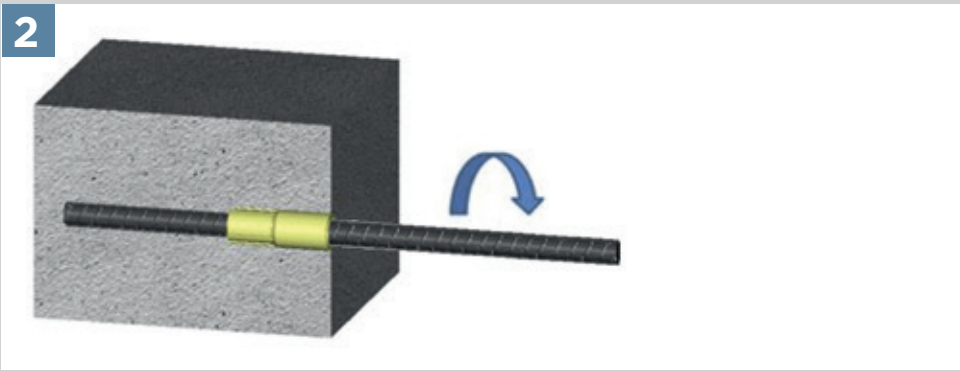
The PKB couplers are made of steel S 355 or equivalent. These couplers are marked with the company logo and the thread type. The reinforcement steel is made of BS4449 B500B or B500C.

The reinforcement coupler PSA is composed of a reinforcement steel. The PSC bolts are made of alloyed steel 34CrMo4 (W1.7220) or equivalent. The reinforcement steel is made of BS4449 B500B.

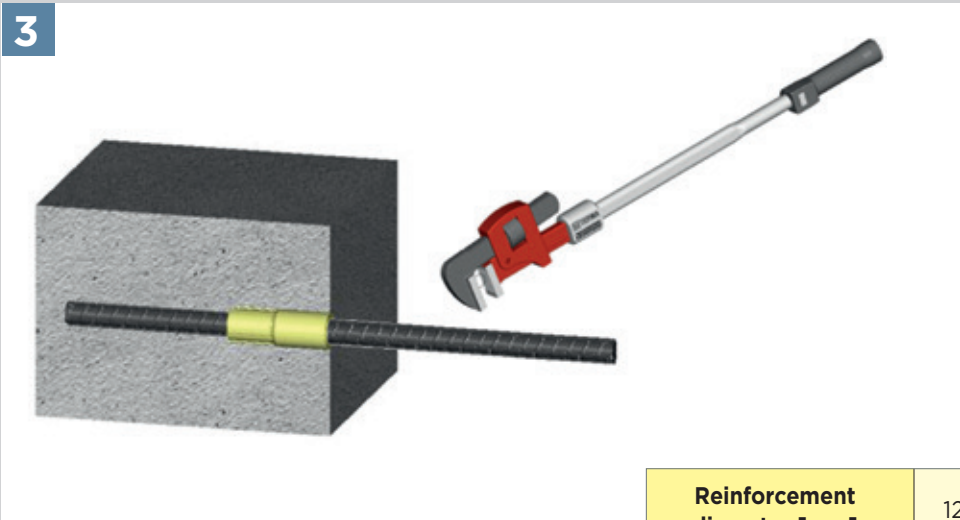
PSA/TSE Standard couplers installation



Place in and rotate the TSE coupler onto the PSA coupler already embedded in concrete.



Rotate by hand the TSE coupler onto the PSA coupler until the couplers are fastened.



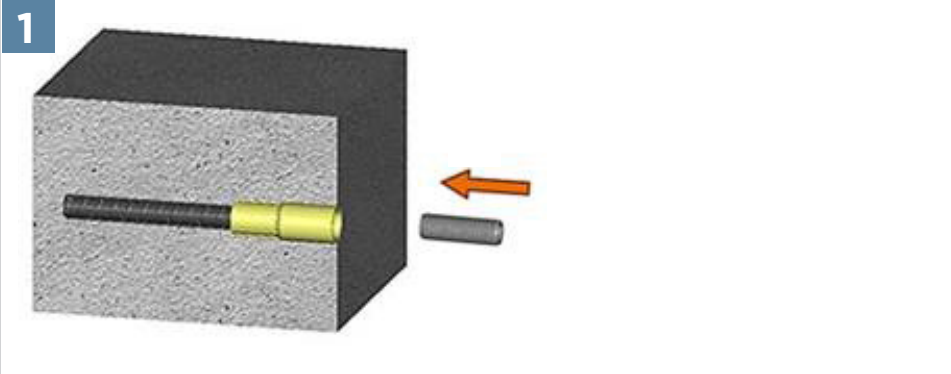
The connection is finished by using a special torque wrench made by Terwa to tighten the connection. The connection must be sufficiently tight to prevent movement during concrete placement. The necessary torque for each type of rebar is shown in table 5.

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

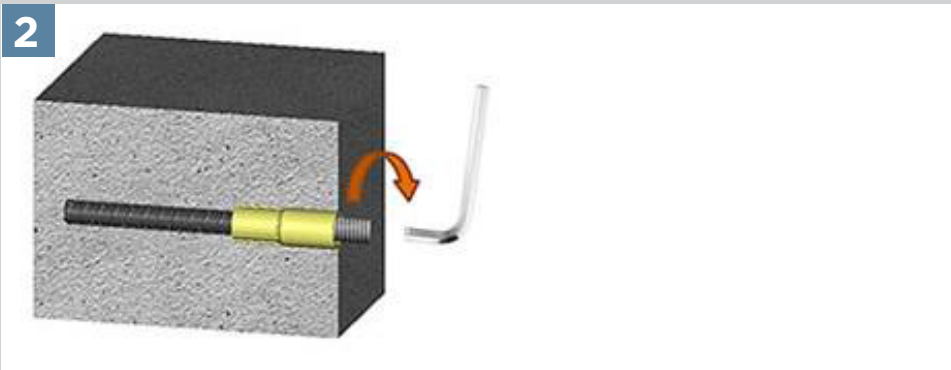
Table 5

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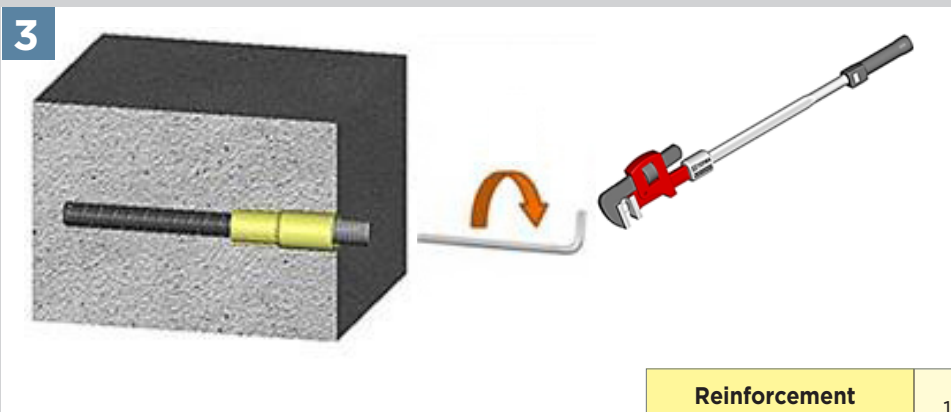
PSA/PSC Standard couplers installation



Place in and rotate the threaded PSC bolt onto the PSA coupler already embedded in concrete.



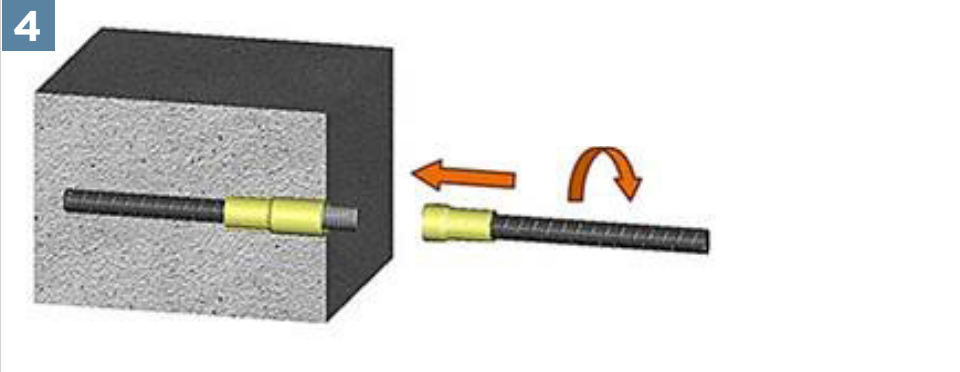
Screw the threaded PSC bolt using an allen key into the PSA coupler.



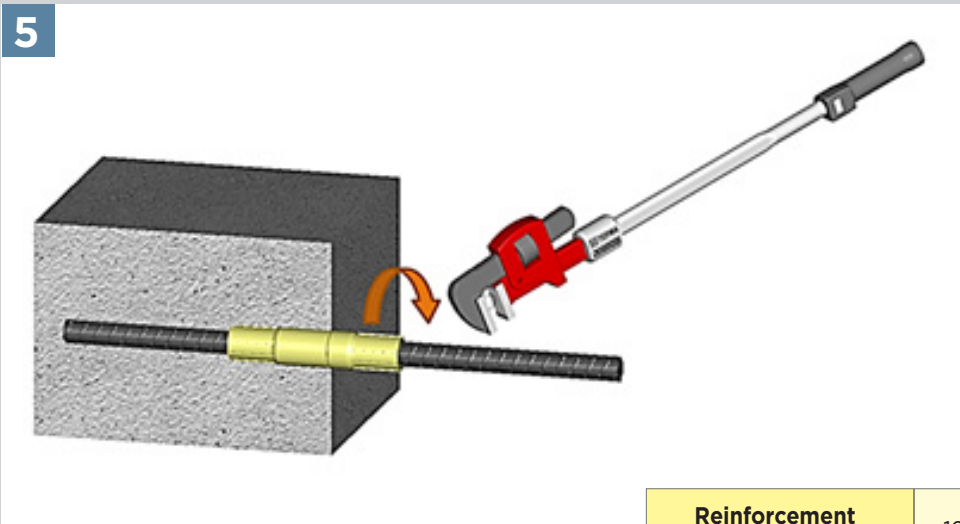
Use a special torque wrench made by TERWA to tighten the connection. The necessary torque for each type of rebar is shown in table 6 below.

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

Table 6



Place and rotate by hand the second PSA coupler until the couplers are fastened.



The connection is finished by using a special torque wrench made by TERWA to tighten the connection. The connection must be sufficiently tight to prevent movement during concrete placement. The necessary torque for each type of rebar is shown in table 7 below.

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

Table 7



5 Safety Considerations

Couplers are supplied in standardised wooden pallet boxes and have a maximum weight of 750 kg and must be handled with appropriate lifting equipment. It is advisable to wear suitable protective gloves during handling the wooden pallet boxes, couplers and reinforcement during coupler installation.

6 Product Testing and Evaluation

Terwa PSA/TSE Standard Couplers have been tested to satisfy the requirements of CARES Appendix TA1-B for Couplers with reinforcing bars to BS4449 Grade B500B and B500C.

Terwa PSA/PSC Standard Couplers have been tested to satisfy the requirements of CARES Appendix TA1-B for Couplers with reinforcing bars to BS4449 Grade B500B.

The testing for Terwa PSA/TSE and PSA/PSC Standard couplers comprised the following elements:

- Tensile Strength
- Permanent Deformation

7 Quality Assurance

Terwa PSA/TSE and PSA/PSC Standard Couplers are produced under an EN ISO 9001 quality management system certified by CARES. The quality management system scheme monitors the production of the couplers and ensures that materials and geometry remain within the limits of this technical approval.

The products are also subject to a programme of periodic testing.

8 Building Regulations

8.1 The Building Regulations (England and Wales)

Structure, Approved Document A

PSA/TSE and PSA/PSC Standard Couplers, 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 PSA/TSE and PSA/PSC Standard Couplers comply with the material requirements of EC2.

8.2 The Building Regulations (Northern Ireland)

Materials and Workmanship

This technical approval gives assurance that PSA/TSE and PSA/PSC Standard Couplers comply 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 that PSA/TSE and PSA/PSC Standard Couplers comply with the material requirements of EC2 by virtue of *Clause 0.8.*

Structure

PSA/TSE and PSA/PSC Standard Couplers, when used in EC2 based designs using the data contained within this technical approval, satisfy 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: 2004 Eurocode 2 Design of concrete structures- Part 1-1: General rules for buildings.
- 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 for BS8110 and EN1992-1-1 Applications for Static Loading in Tension or Tension and Compression.

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 provided 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 etc 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 5058. Confirmation that this technical approval is current can be obtained from CARES.





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