

# CARES Technical Approval Report TA1-B 5078



Issue 2



## Terwa TSE/TEC, PSE/TEC and PSA-PSC/TEC End Anchors

Assessment of the  
Terwa TSE/TEC, PSE/TEC  
and PSA-PSC/TEC  
End Anchor Product  
and Quality System  
for Production



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# Product

## TSE/TEC, PSE/TEC and PSA-PSC/TEC End Anchors for reinforcing steel

### Product approval held by:

Terwa Group  
Kamerlingh Onneslaan 1-3  
3401 MZ IJsselstein  
the Netherlands  
Tel: +31 (0)30 6991329  
Fax: +31 (0)30 6993854  
Email: [info@terwa.com](mailto:info@terwa.com) Web: [www.terwa.com](http://www.terwa.com)

## 1 Product Summary

Terwa TSE/TEC, PSE/TEC and PSA-PSC/TEC End Anchors for reinforcing steel 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.

### 1.1 Scope of Application

Terwa TSE/TEC, PSE/TEC and PSA-PSC/TEC End Anchors in the size range as detailed in tables 1 to 7 have been evaluated for use as follows:

TA1-B: Reinforcement Anchors for EN1992-1-1 applications for Static Loading with BS4449 Grade B500B reinforcement in tension.

### 1.2 Design Considerations

Eurocode 2, Clause 8.4 Anchorage of longitudinal reinforcement requires:

8.4.1 General (1) Reinforcing bars, wires or welded mesh fabrics shall be so anchored that the bond forces are safely transmitted to the concrete avoiding longitudinal cracking or spalling. Transverse reinforcement shall be provided if necessary.

8.4.1 (5) Where mechanical devices are used the test requirements should be in accordance with the relevant product standard or a European Technical Approval.



### 1.3 Conclusion

It is the opinion of CARES that TERWA TSE/TEC, PSE/TEC and PSA-PSC/TEC End Anchors in the size range as detailed in tables 1 to 7 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

### 2.1 General

The function of TERWA TEC End Anchors is to provide a full strength connection to deformed reinforcing steel bars complying with BS4449 Grade B500B and thereby enabling anchorage of reinforcing steel.

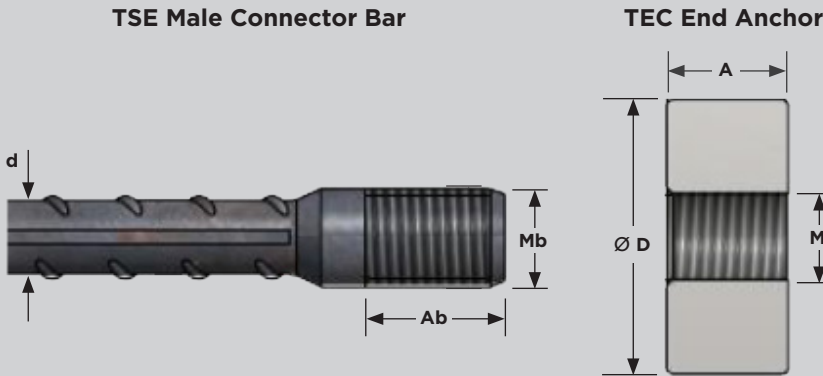
**The End Anchor features the following advantages:**

- Minimises the length of the rebar and reduces the congestion inside the concrete element.
- Eliminates the need for hooked rebar.
- Faster, simpler installation.
- Simplifies the structural design.
- Better anchorage in the concrete element.

The Terwa TEC End Anchor consists of a threaded round steel plate, which may be fitted to the TSE, PSA-PSC or PSE rebar connections, Terwa End Anchors meet the ACI 318 and Eurocode 2 concerning the embedding lengths for reinforcement steel. The End Anchor is designed and tested to ensure proper embedding in concrete, having a contact area equal to 9 times the rebar cross section area, or a minimum diameter 3 times the rebar diameter.

## 2.2 TSE/TEC End Anchors

The 12mm - 32mm male connector bars TSE as dimensioned in Table 1 consists of a reinforcing bar with a male threaded end that is compatible with the threaded round steel plate of the end anchor. 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.



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

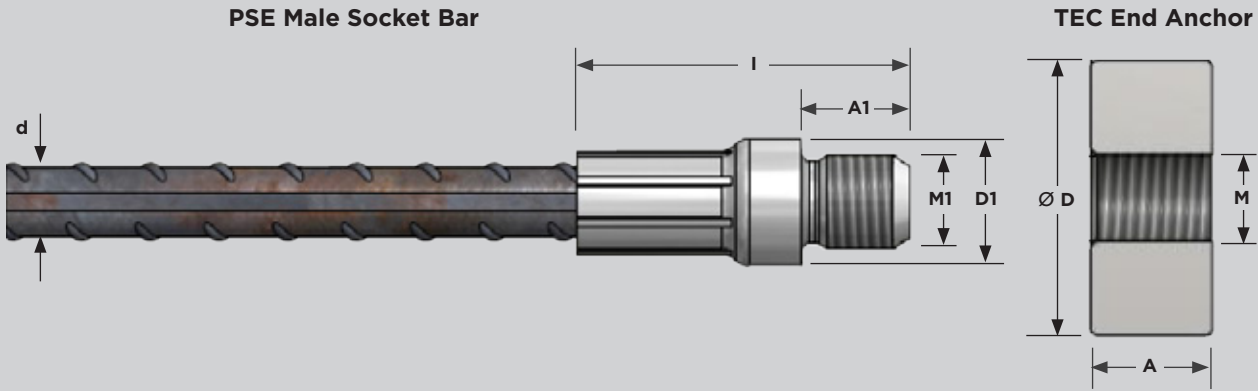
Table 1 - TSE male socket bar

Description	D mm	M mm	A mm
TEC - M16	45	16	12
TEC - M20	60	20	18
TEC - M24	75	24	20
TEC - M30	90	30	27
TEC - M42	120	42	35

Table 2 - TEC end anchor

### 2.3 PSE/TEC End Anchors

The 10mm - 32mm PSE/TEC anchor as dimensioned in table 3 and 4 comprises a PSE Male socket with metric bolt that is compatible with the threaded round steel plate of the end anchor.



Description	d mm	M1 mm	A1 mm	D1 mm	I mm
PSE 10 - M12	10	12	14	17.5	50
PSE 12 - M16	12	16	18.5	22	62
PSE 16 - M20	16	20	22.5	28	86
PSE 20 - M24	20	24	27	34	99
PSE 25 - M30	25	30	33.5	42.5	117
PSE 32 - M42	32	42	46	56	153

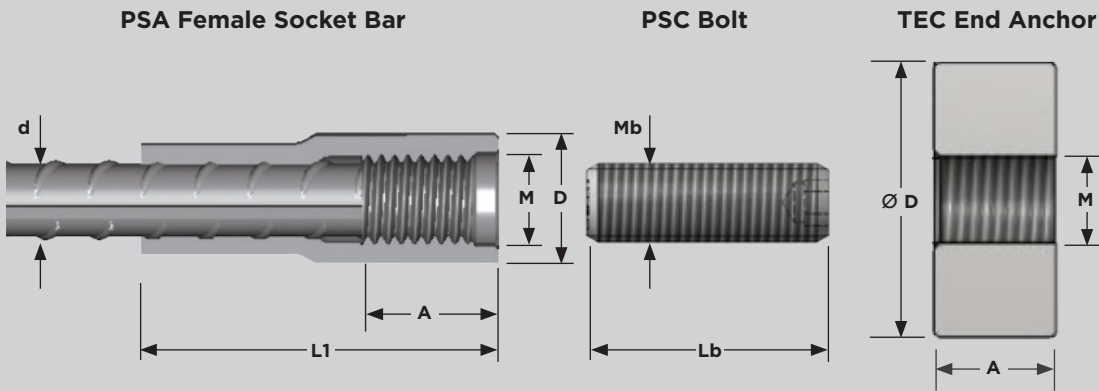
**Table 3 - PSE male socket bar**

Description	D mm	M mm	A mm
TEC - M12	38	12	10
TEC - M16	45	16	12
TEC - M20	60	20	18
TEC - M24	75	24	20
TEC - M30	90	30	27
TEC - M42	120	42	35

**Table 4 - TEC end anchor**

## 2.4 PSA-PSC/TEC End Anchors

The 10mm - 32mm PSA-PSC/TEC anchor as dimensioned in table 5,6 and 7 comprises a PSA female socket bar and a PSC metric bolt that is compatible with the threaded round steel plate of the end anchor.



Description	d mm	M mm	A mm	D mm	L1 mm
PSA 10 - M12	10	12	18	17.5	50
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 5 - PSA female socket bar

Description	Mb mm	Lb mm
PSC BOLT M12	12	35
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 6 - PSC bolt

Description	D mm	M mm	A mm
TEC - M12	38	12	10
TEC - M16	45	16	12
TEC - M20	60	20	18
TEC - M24	75	24	20
TEC - M30	90	30	27
TEC - M42	120	42	35

Table 7 - TEC end anchor

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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

#### **CARES APPENDIX TA1-B strength requirements**

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

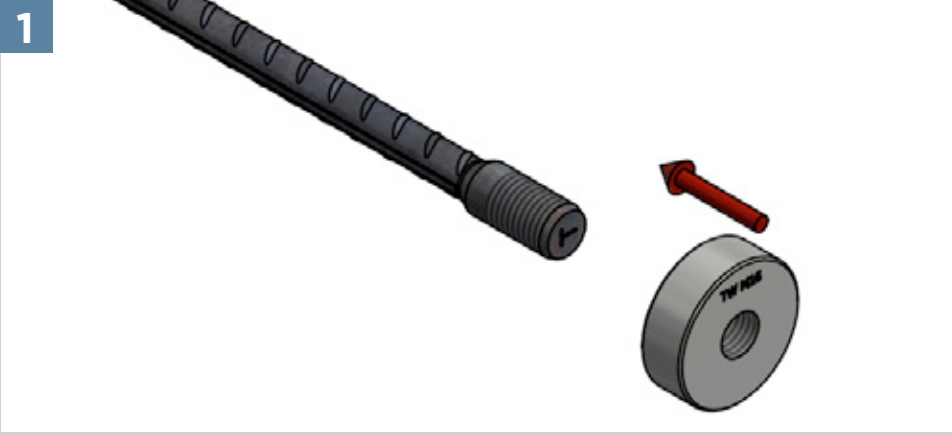
The evaluation considers the strength of the connection between the anchor and the reinforcing steel only and does not address aspects of anchor performance nor its connection to the structure which are matters for the designer or specifier.



## 4 Installation

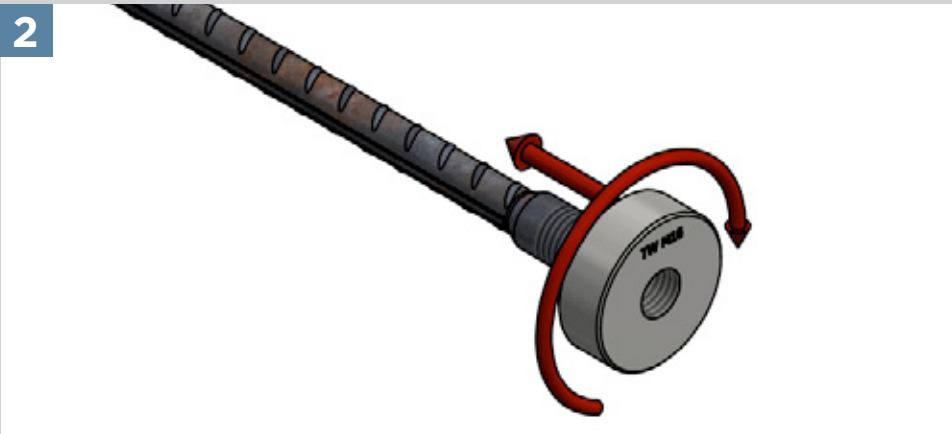
### TSE/TEC End Anchors installation

1



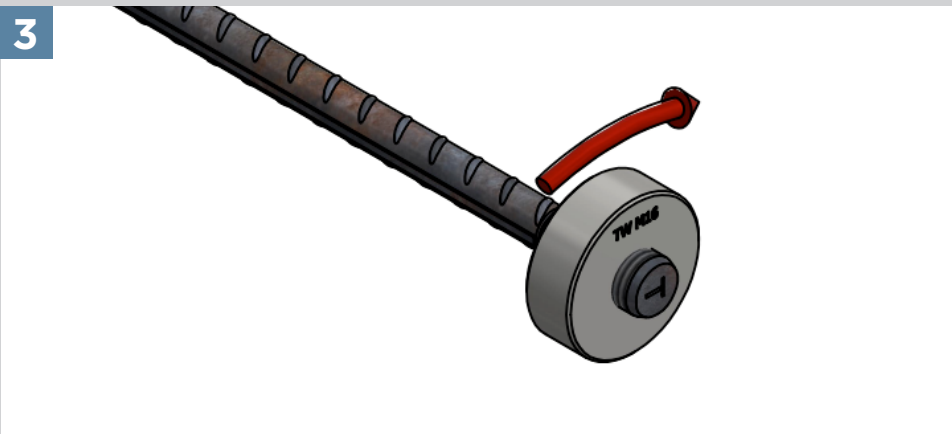
Align the TEC End coupler with TSE coupler.

2



Hand-tighten the TEC End coupler onto TSE coupler.

3



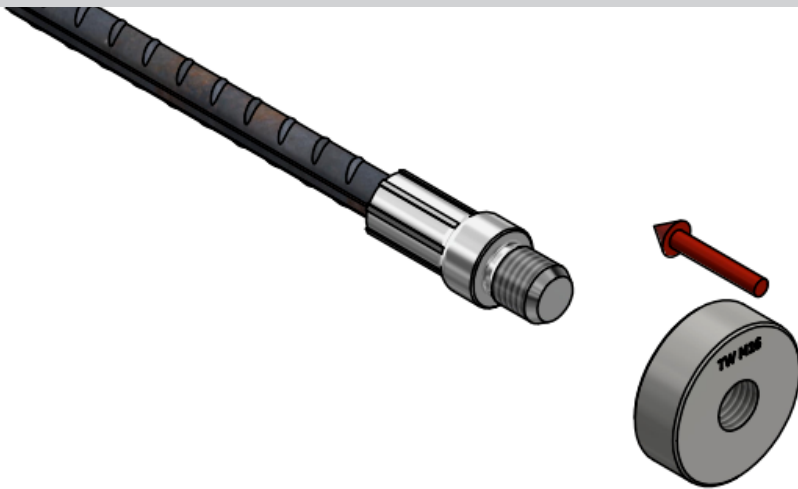
At the end of the TSE thread hand-tighten the TEC coupler with as much force as possible to make sure the coupler is fully engaged.

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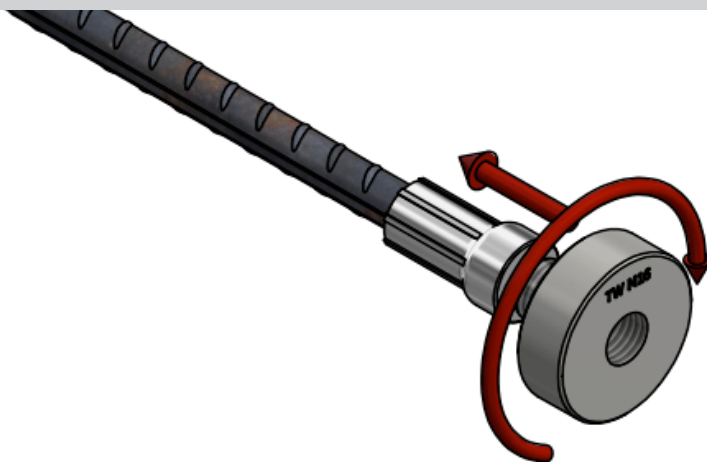
## PSE/TEC End Anchors installation

1



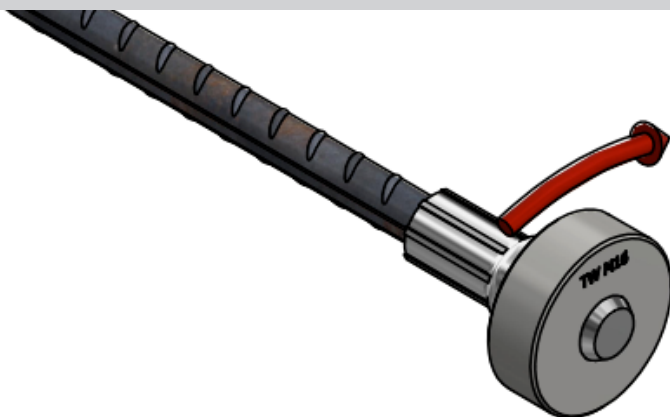
Align the TEC End coupler with PSE coupler.

2



Hand-tighten the TEC End coupler onto PSE coupler.

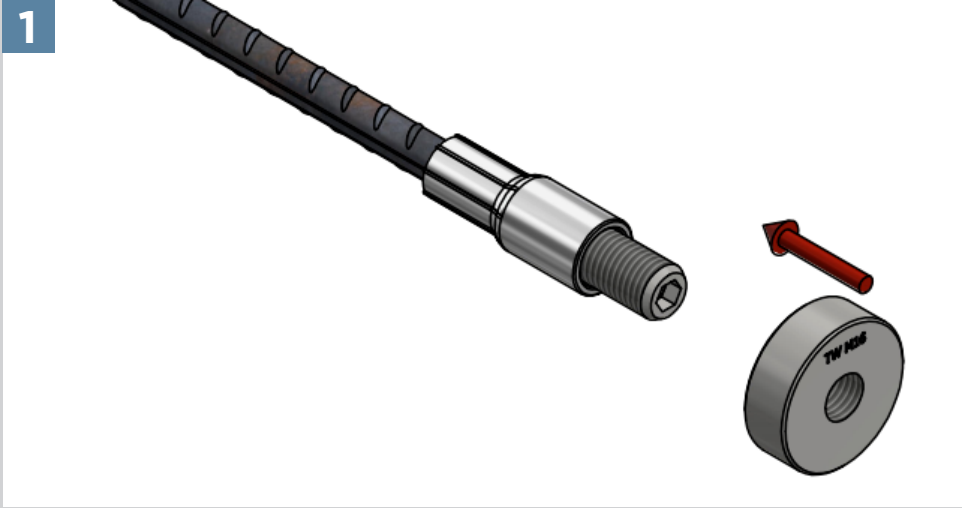
3



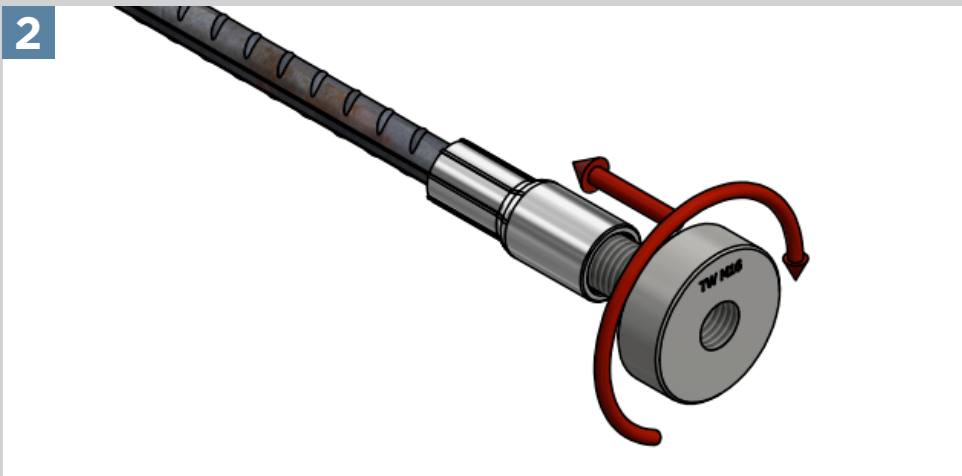
At the end of the PSE thread hand-tighten the TEC coupler with as much force as possible to make sure the coupler is fully engaged.

PSA-PSC/TEC End Anchors installation

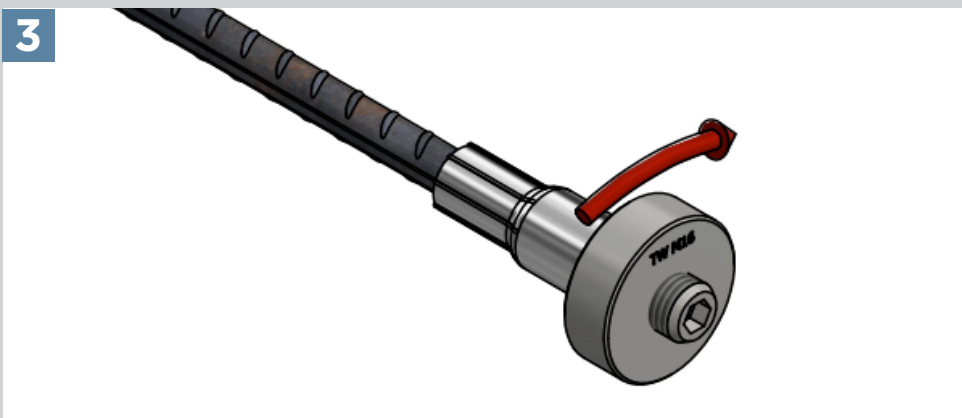
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Align the TEC End coupler with PSA-PSC coupler. The PSC Bolt should be fully engaged in the PSA coupler and tightened with an allen key.



Hand-tighten the TEC End coupler onto PSA-PSC coupler.



At the end of the PSC thread hand-tighten the TEC coupler with as much force as possible to make sure the coupler is fully engaged.

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Validate with the CARES Cloud App

## 5 Safety Considerations

Couplers and Anchors are supplied in cartons weighting up to 25kg, which may be handled manually with care. Heavier cases require the use of mechanical handling equipment. It is advisable to wear suitable protective gloves during handling the cartons, couplers and implementation, as well as during the cutting, upsetting and threading process.

## 6 Product Testing and Evaluation

TERWA TSE/TEC, PSE/TEC and PSA-PSC/TEC End Anchors have been tested to satisfy the requirements of CARES Appendix TA1-B for Couplers with reinforcing bars to BS4449 Grade B500B. The testing comprised the following elements:

- Tensile Strength
- Permanent deformation in tension

## 7 Quality Assurance

TERWA TSE/TEC, PSE/TEC and PSA-PSC/TEC End Anchors for reinforcing steel are produced under an EN ISO 9001 quality management system certified by CARES at locations agreed with CARES.

The quality management system scheme monitors the production of the Standard Couplers and Anchors and ensures that materials and geometry remain within the limits of this technical approval.

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

## 8 Building Regulations

### 8.1 The Building Regulations (England and Wales)

#### Structure, Approved Document A

TERWA TSE/TEC, PSE/TEC and PSA-PSC/TEC End Anchors, 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 TSE/TEC, PSE/TEC and PSA-PSC/TEC End Anchors comply with the material requirements of EC2.

### 8.2 The Building Regulations (Northern Ireland)

#### Materials and Workmanship

This technical approval gives assurance that TERWA TSE/TEC, PSE/TEC and PSA-PSC/TEC End Anchors 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 TERWA TSE/TEC, PSE/TEC and PSA-PSC/TEC End Anchors comply with the material requirements of EC2 by virtue of *Clause 0.8.*

#### Structure

TERWA TSE/TEC, PSE/TEC and PSA-PSC/TEC End Anchors, 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

- BS4449: 2005 Steel bars for the reinforcement of and use in concrete - Requirements and test methods.
- BS EN 1992-1-1:2004 Eurocode 2 Design of concrete structures - 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 and Reinforcement Anchors For BS8110 and EN1992-1-1 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 5078. Confirmation that this technical approval is current can be obtained from CARES.

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## CARES

Pembroke House  
21 Pembroke Road  
Sevenoaks  
Kent TN13 1XR

Phone: +44(0)1732 450000  
E-mail: [general@carescertification.com](mailto:general@carescertification.com)  
[www.carescertification.com](http://www.carescertification.com)



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