



## Ancon Building Products

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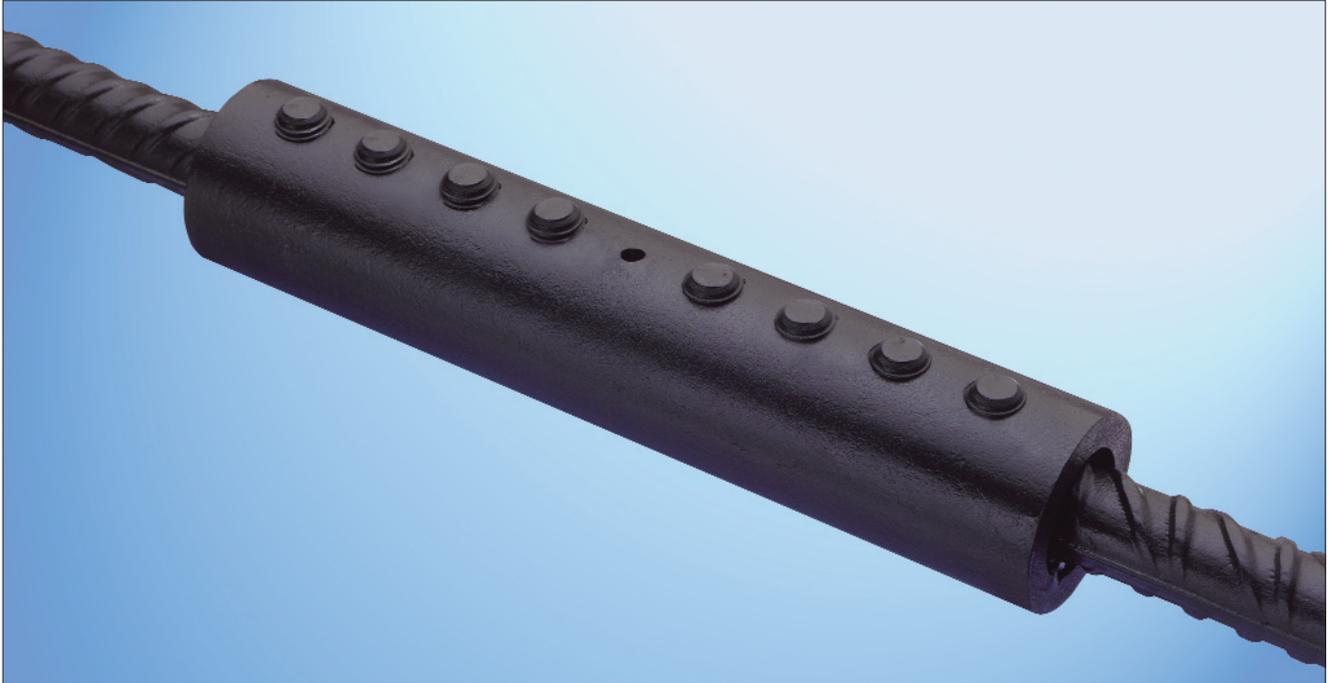
**Roads and Bridges  
Agrément Certificate  
No 98/R102**  
Third issue\*

Designated by Government  
to issue  
European Technical  
Approvals

## ANCON (MBT) ET-TYPE COUPLERS

Raccords pour armatures  
Verbindung für Armatur

## Product



• THIS CERTIFICATE REPLACES CERTIFICATE No 95/R089 AND RELATES TO ANCON (MBT) ET-TYPE COUPLERS.

• The couplers are for the mechanical connection of straight, deformed high yield carbon steel bars (grade 500) for the reinforcement of concrete to provide jointed bars that can be subjected to shear, compressive or tensile stresses.

• Reinforced concrete highway structures incorporating the couplers must be designed in accordance with the requirements of the Highways Agency (HA); acting on behalf of the Department for Transport, the Scottish Executive Development Department, the Welsh Assembly Government, and the Department for Regional Development, Northern Ireland; and the conditions set out in the Design Data and Installation parts of this Certificate.

• The couplers are installed using a hand ratchet, pneumatic or electric wrench.

## Highways Agency Requirements

### 1 Requirements

The requirements for proprietary mechanical joints in reinforcing bars are contained in the Manual of Contract Documents for Highway Works (MCHW):

- (a) Volume 1 *Specification for Highway Works* — Series 1700 *Structural Concrete*.
- (b) Volume 2 *Notes for Guidance on the Specification for Highway Works* — Series 1700 *Structural Concrete*.
- (c) Standard BD 24/92.

## Regulations

### 2 Construction (Design and Management) Regulations 1994 (as amended) Construction (Design and Management) Regulations (Northern Ireland) 1995 (as amended)

Information in this Certificate may assist the client, planning supervisor, designer and contractors to address their obligations under these Regulations.

See sections:

4 *Delivery and site handling* (4.1 to 4.4) and 7 *Practicability of installation*.

# Technical Specification

## 3 Description

3.1 Ancon (MBT) ET-Type Couplers are available for joining straight deformed high-yield carbon steel bars (grade 500) in accordance with BS 4449 : 2005.

3.2 The couplers comprise:

- steel sleeve — manufactured from hot-rolled, seamless steel tubing. Each sleeve is drilled and tapped for the appropriate number of bolts (see Table 1). Saddles (high-tensile steel strips with serrated faces) are tig welded at the saddle ends, two saddles per sleeve. Sleeves can also be supplied with a centre stop, fixed in position to provide accurate location of the coupler on the reinforcing bars.

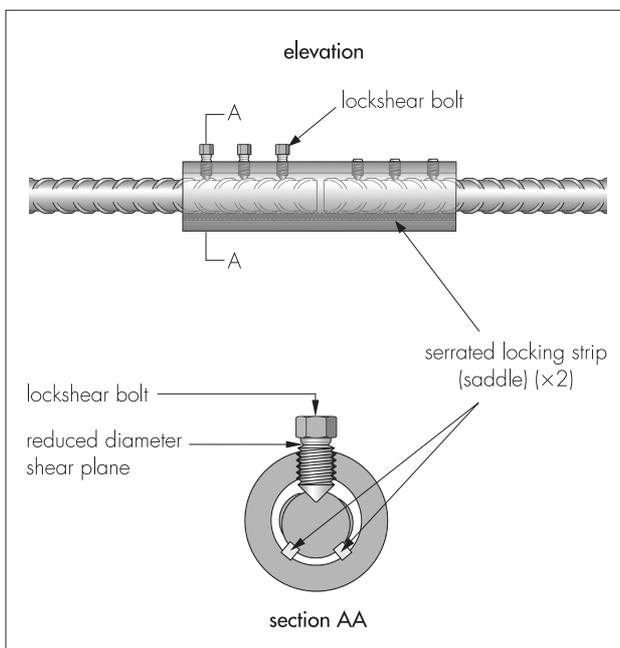
Table 1 Coupler specifications

Coupler reference	Nominal bar diameter (mm)	Coupler outside diameter (mm)	Overall length (mm)	Approx weight including bolts (kg)	No of bolts per sleeve	Minimum failure load 115% Cv <sup>(1)</sup> (kN)
ET10	10	33.4	100	0.52	4	45.1
ET12	12	33.4	140	0.71	6	65.0
ET16	16	42.2	160	1.25	6	115.6
ET20	20	48.3	204	2.03	8	180.6
ET25	25	54.0	258	3.00	8	282.3
ET32	32	71.0	312	6.50	10	462.3
ET40	40	81.0	484	11.30	14	722.8

(1) Characteristic strength (Cv) is that value of yield stress below which fall not more than 5% of the test results where tests are carried out in accordance with BS 4449 : 2005 : Annex E. Characteristic strength for grade 500 deformed high yield steel is 500 Nmm<sup>-2</sup>. For verification purposes, test specimen dimensions should comply with Ancon Building Products' specifications.

- lockshear bolts — steel bolts, incorporating hexagonal heads and reduced diameter shank shear planes and conical ends (see Figure 1).

Figure 1 Typical coupler



- centre stop pin (optional feature) — for bar location.

3.3 The range of assessed couplers with dimensions and characteristics is shown in Table 1.

### Locking mechanism

3.4 ET-Type couplers are designed so that, as bolts are tightened, they penetrate the reinforcing bar, simultaneously forcing the bar into the serrated surface of the two saddle strips (see Figure 1).

3.5 The bolt shank diameter is reduced to ensure that bolt heads will shear off at a predetermined torque. At this torque the required bite depth and thus, the required resistance to axial pull-out, are achieved.

3.6 Materials used in the manufacture of the couplers are listed in Table 2.

Table 2 Material specification

Component	Specification
Sleeve tube	minimum ultimate tensile strength 600 Nmm <sup>-2</sup> , elongation 18% minimum
Bolt	minimum tensile strength 525 Nmm <sup>-2</sup>
Saddle	minimum tensile strength 700 Nmm <sup>-2</sup>

3.7 Quality control checks include:

### Raw materials

#### sleeves and saddles

- Certificates of Conformity — with coupler specification

### Incoming goods

#### bolts

- mill certificates — with bolt specification
- shear torque<sup>(1)</sup>
- bolt body hardness<sup>(1)</sup>
- cone hardness<sup>(1)</sup>
- dimensional accuracy<sup>(1)</sup>

(1) Representative bolt samples selected in accordance with a predetermined sampling plan.

#### saddles

- visual inspection
- hardness of teeth
- dimensional accuracy

### Production

- visual checks
- dimensional accuracy
- periodic tensile testing.

## 4 Delivery and site handling

4.1 Couplers complete with bolts and installation instructions are supplied in polythene bags. The coupler type and batch number (eg ET32 667M) are recorded on the installation instructions. Each individual coupler sleeve is also hard stamped on the outside, at one end, with the same information.

4.2 Couplers must not be removed from packaging until ready for use. Couplers should not be left externally exposed to the effects of atmospheric corrosion prior to assembly.

4.3 The bolts supplied with each coupler are specifically for use with that coupler and, therefore, it is critical that only the bolts supplied with the couplers are used to join the reinforcing bars. In the event of loss of bolts, correct replacement bolts should be obtained only from the Certificate holder.

4.4 If any element of a completed joint is left exposed to conditions in which corrosion might occur, both ends of the coupler must be sealed by tape. Similarly, if there is a risk of ice forming within the coupler sleeve, this same precaution must be taken to prevent water retention within the joint.

## Design Data

### 5 General

5.1 Ancon (MBT) ET-Type Couplers are satisfactory for joining straight reinforcing bars in accordance with BS 4449 : 2005 for use in reinforced concrete structures designed in accordance with the DfT, HA requirements.

5.2 The completed joints are for use in locations where they will be subject to shear, compressive or tensile stress.

5.3 The design of any highway structure incorporating these reinforced couplers must be carried out by a chartered civil or structural engineer in accordance with the requirements of the overseeing organisation.

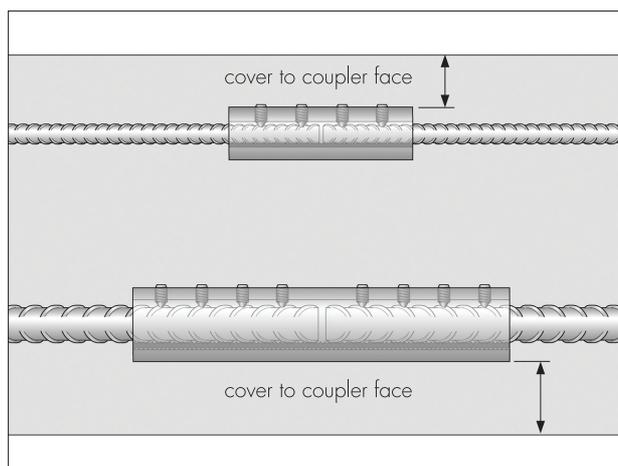
5.4 Cover (ie the distance from the sleeve face to the nearest concrete surface) must be provided in accordance with Table 13 of BS 5400-4 : 1990 and Departmental Standard BD 57/01.

5.5 When detailing, particular care must be taken to ensure that:

- the required nominal concrete cover is provided to the sleeve (see Figure 2). It may not always be possible to achieve the cover requirements and in such instances and at the discretion of the engineer responsible for the design, a coated protection may be applied to the tube to cater for reduced cover situations
- there is adequate spacing of the reinforcement in the splice area for the penetration of the concrete and for tightening the bolts; spacing between the coupler and the adjacent bar should be in accordance with Clause 5.8.8.1 of BS 5400-4 : 1990
- where possible, joints should be positioned away from points of high stress
- the positions of adjacent splices are staggered. It may not always be practical to stagger

couplers, therefore by taking into account the location and design stresses in the coupler, the requirement to stagger the couplers may be waived by the engineer responsible for the design.

Figure 2 Cover detail



### 6 Strength

#### Tensile strength

6.1 Tensile tests on assembled joints show that the couplers specified in Table 1 will satisfy the test requirement of the DfT, HA specification and, therefore, can be considered to have a strength of 100% of the bars being joined.

6.2 Tests carried out indicate that fatigue failure of assembled joints occurred above the Class D design curve given in BS 5400-10C : 1999. Joints using ET-Type couplers, therefore, can be classified as a Class D detail.

#### Crack widths

6.3 Tests carried out on concrete beams reinforced with reinforcing bars, joined using the couplers indicate that the crack widths measured are comparable with those of concrete beams with continuous reinforcement.

### 7 Practicability of installation

Provided the recommendations given in this Certificate are followed, the products can be installed without undue difficulty. Adequate site supervision must be provided to ensure that the couplers are installed correctly.

### 8 Durability

The couplers will not adversely affect the durability of the reinforced concrete member, provided good quality concrete is used with adequate cover to the coupler, and the crack width criteria of BS 5400-4 : 1990 are satisfied.

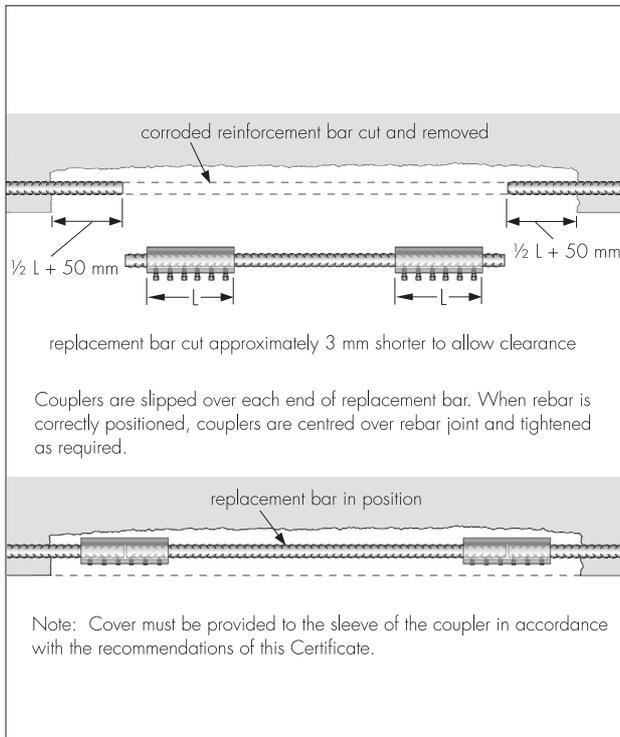
# Installation

## 9 General

9.1 Installation of Ancon (MBT) ET-Type Couplers must be carried out strictly in accordance with the manufacturer's instructions, DfT, HA requirements and this Certificate.

9.2 A typical installation is shown in Figure 3.

Figure 3 Typical installation



9.3 The ends of reinforcing bars to be coupled should be cut or sheared to normal practice. The surface condition of the bars should meet DfT, HA requirements.

9.4 The sleeve must be centrally located over the point of contact between the reinforcing bars.

9.5 Care must be taken when inserting reinforcing bars into the coupler sleeve, excess force may result in loss of or displacement of the serrated saddles and will compromise the connection efficiency.

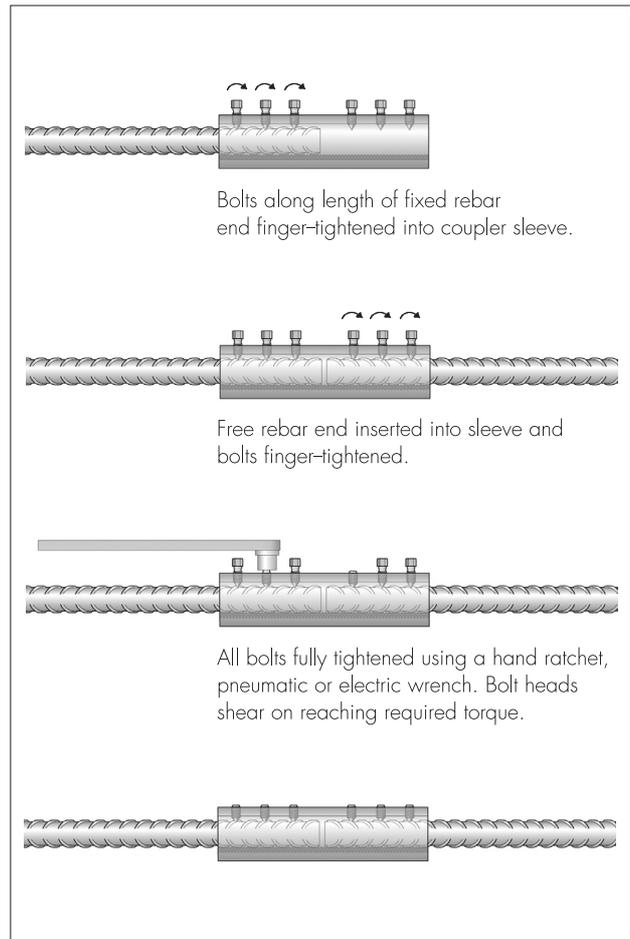
## 10 Procedure – bolt tightening

10.1 The coupler should be placed over the end of the fixed bar to a distance of a half coupler length [ $\pm 6$  mm or until centre pin (where supplied) butts against bar end]. The bolts are finger-tightened into the sleeve and alignment checked and adjusted if necessary (see Figure 4).

10.2 The second bar end is placed into the coupler until it butts against the fixed bar or coupler centre pin (where supplied), and the remaining bolts are secured finger-tight in position, again checking for alignment (see Figure 4).

10.3 The lockshear bolts are fully tightened using a hand ratchet, pneumatic or electric wrench until bolts shear off. Bolts can be tightened in any order (see Figure 4). Sheared bolt heads will vary between being approximately flush with the surface of the coupler sleeve and projecting up to 4 mm, dependent upon the coupler size and bolt location versus rebar rib location.

Figure 4 Installation procedure



10.4 A hand ratchet, pneumatic (air nut runner) or electric wrench delivering a steady force to the bolts should be used with the appropriate sockets. The wrench will have a square drive of  $\frac{3}{4}$ " for ET10, ET12, ET16 and ET20 and 1" for sizes ET25, ET32 and ET40. Where large numbers of couplers are being installed, the use of a pneumatic or electric wrench may be more efficient<sup>(1)</sup>. Thread failure can occur under the application of eccentric load, therefore the equipment used for installation must be in accordance with the recommendations of this Certificate.

(1) Details available from the Certificate holder.

10.5 Care must be taken to ensure excess water does not remain within the coupler prior to completion of the joint.

10.6 Where the target slump of the concrete is less than 100 mm the ends of the coupler should be filled with cement grout prior to casting to prevent any ingress of water.

## Technical Investigations

The following is a summary of the technical investigations carried out on Ancon (MBT) ET-Type Couplers.

### 11 Tests

Tests were carried out to determine:

- dimensional accuracy
- tensile strength of joints
- practicability of installation
- permanent deformation after loading to 0.6 times the specified reinforcement characteristic strength
- bolt shearing torque
- fatigue performance of the couplers when subjected to axial stress in air
- fatigue performance of concrete beams with reinforcing bars joined by the couplers.

### 12 Investigations

12.1 The manufacturing process was examined, including the methods adopted for quality control, and the quality and composition of the metals used were assessed. An evaluation was made relating to:

- stress/strain relationships
- cyclic tensile tests
- strength under compressive loading
- durability
- contamination of joints
- effect of creep
- performance of the loaded coupler under increased temperature conditions.

12.2 A site visit has been carried out to evaluate the practicability of installation.

12.3 An examination was made of Ancon Building Products' installation instructions, and of the products in relation to DfT, HA requirements.

12.4 Technical data were assessed by the Loss Prevention Council (LPC) on behalf of the BBA concerning the behaviour of the couplers under increased temperature.

## Bibliography

BS 4449 : 2005 *Steel for the reinforcement of concrete — Weldable reinforcing steel — Bar, coil and decoiled product — Specification*

BS 5400-4 : 1990 *Steel, concrete and composite bridges — Code of practice for design of concrete bridges*

BS 5400-10C : 1999 *Steel, concrete and composite bridges — Charts for classification of details for fatigue*

BD 24/92 : 1992 *The design of concrete highway bridges and structures use of BS 5400-4 : 1990*

BD 57/01 *Design for Durability*

Manual of Contract Documents for Highway Works, Volume 1 *Specification for Highway Works*, August 1998 (as amended)

Manual of Contract Documents for Highway Works, Volume 2 *Notes for Guidance on the Specification for Highway Works*, August 1998 (as amended)

## Conditions of Certification

### 13 Conditions

13.1 This Certificate:

- a) relates only to the product that is named, described, installed, used and maintained as set out in this Certificate;
- b) is granted only to the company, firm or person identified on the front cover — no other company, firm or person may hold or claim any entitlement to this Certificate;
- c) is valid only within the UK;
- d) has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective;
- e) is copyright of the BBA;
- f) is subject to English law.

13.2 References in this Certificate to any Act of Parliament, Regulation made thereunder, Directive or Regulation of the European Union, Statutory Instrument, Code of Practice, British Standard, manufacturers' instructions or similar publication, are references to such publication in the form in which it was current at the date of this Certificate.

13.3 This Certificate will remain valid for an unlimited period provided that the product and the manufacture and/or fabrication including all related and relevant processes thereof:

- (a) are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA;
- (b) continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine;

(c) are reviewed by the BBA as and when it considers appropriate; and

(d) remain in accordance with the requirements of the Highways Agency.

13.4 In granting this Certificate, the BBA is not responsible for:

- (a) the presence or absence of any patent, intellectual property or similar rights subsisting in the product or any other product;
- (b) the right of the Certificate holder to market, supply, install or maintain the product; and
- (c) the actual works in which the product is installed, used and maintained, including the nature, design, methods and workmanship of such works.

13.5 Any recommendations relating to the use or installation of this product which are contained or referred to in this Certificate are the minimum standards required to be met when the product is used. They do not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date of this Certificate or in the future; nor is conformity with such recommendations to be taken as satisfying the requirements of the 1974 Act or of any present or future statutory, common law or other duty of care. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the installation and use of this product.



In the opinion of the British Board of Agrément, Ancon (MBT) ET-Type Couplers are fit for their intended use provided they are installed, used and maintained as set out in this Certificate. Certificate No 98/R102 is accordingly awarded to Ancon Building Products.

On behalf of the British Board of Agrément

Date of Third issue: 9th December 2005

A handwritten signature in black ink, appearing to read 'G. A. Cooper', is written over a light grey background.

Chief Executive

*\*Original Certificate issued on 7th September 1998. This amended version includes a change to the grade of steel bars, updated standards, and reference to the revised Conditions of Certification.*

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**British Board of Agrément**

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