The CARES Guide to Product Certification

Part 7
2025

Welded reinforcement **fabric (mesh)**

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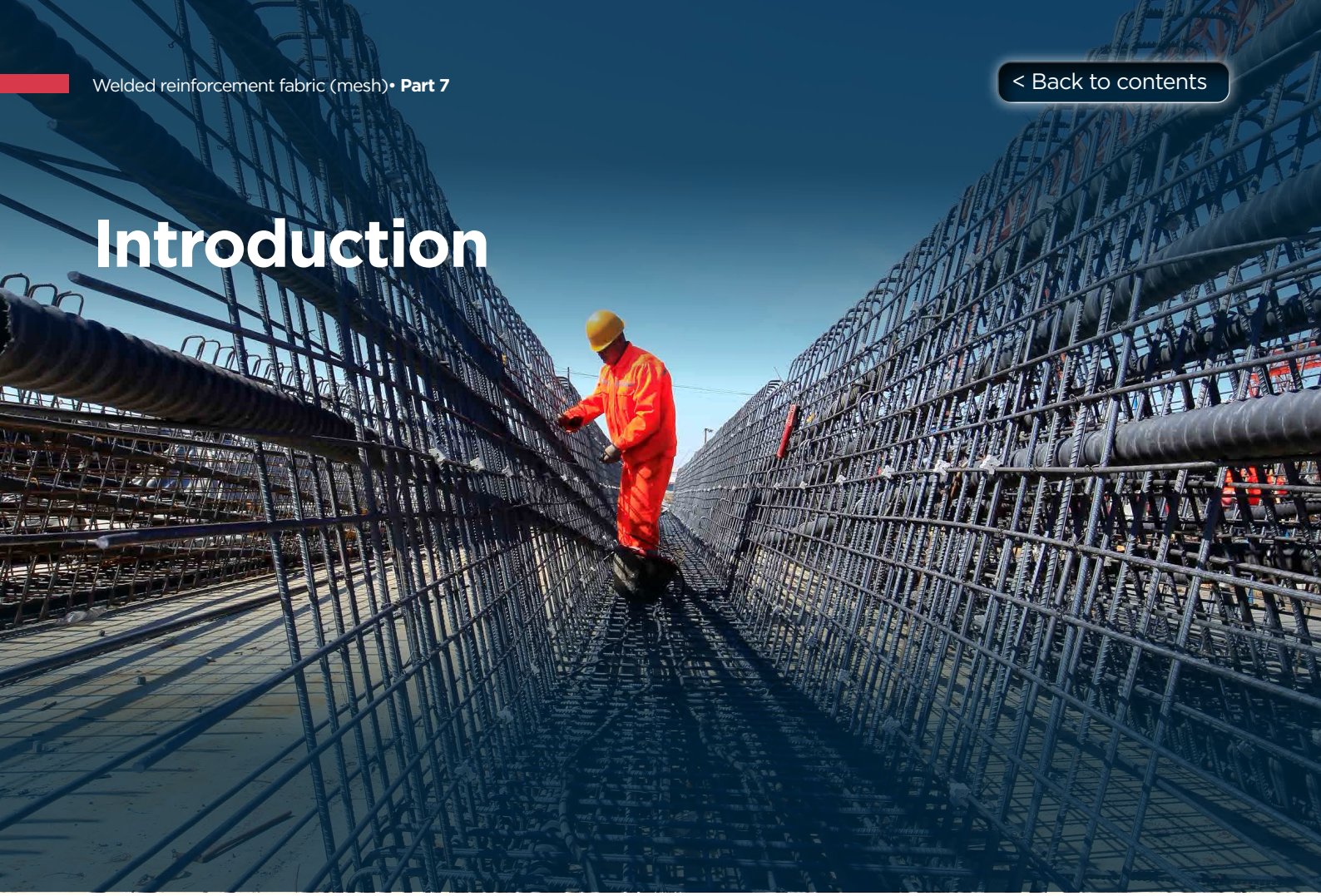
Introduction



Welded fabric, often referred to as mesh, is a machine welded grid arrangement of reinforcing bars or wires. It is covered by British Standard BS4483. This was revised in 2025 and introduces a grade of bars, F500A, for use only for the manufacture of fabric to be used for predominantly static loading, whereas fabric manufactured from bars meeting the requirements of BS 4449 may be considered as welded bars for fatigue assessment purposes.

BS 4483 defines welded fabric as:

"an arrangement of longitudinal and transverse bars or wires of the same or different diameter and length, arranged substantially at right angles to each other and welded together using factory electrical resistance implemented by automatic machines at all points of intersection."

Welded fabrics contain reinforcing steel bars (to BS4449) or (to BS4483 F500A), normally from 6-12mm in diameter. Some special fabrics are available, containing bars up to 16mm in diameter. The bars are welded together at their points of contact, to provide joints of specified shear strength.

Approximately 20-25% of all reinforcing steel used in the UK is supplied in the form of welded fabric. In some European countries, the use of welded fabric is more developed than in the UK, and the proportion of welded fabric consumed is significantly higher. Welded fabric is the most common form of pre-fabrication. Its main advantage is the speed of fixing, which can be 4 to 5 times faster than conventional loose bar. Welded fabric is particularly suitable for flat slab applications, but may also be suitable for raft foundations, pile caps, retaining walls, beams and columns.

Welded fabric may be used as structural reinforcement, for example in suspended slabs, or may be used in order to control shrinkage or thermal cracking in ground supported slabs, which is its major market. Welded fabric can be used as a substitute for loose reinforcement in certain applications. Some manufacturers have the capability of supplying purpose-made fabrics designed to substitute for loose reinforcement in the most efficient way possible. Welded fabric is however not used in applications such as bridge decks, where fatigue is an important consideration.

Welded fabric is generally manufactured by specialist companies. Many of these manufacturers are also fabricators of cut and bent reinforcement. It may be supplied direct from the manufacturers, or via stockholders.

The CARES Steel for the Reinforcement of Concrete scheme includes a quality and operations assessment schedule for the manufacture of welded fabric. As with standard reinforcing bar products, this scheme, provides specifiers and purchasers with an independent verification of material quality.

Welded fabric products

BS 4483, Steel fabric for the reinforcement of concrete, distinguishes between standard and purpose-made fabrics. A standard fabric has a defined mesh arrangement and bar sizes. A purpose made fabric may be specified by the customer, and may have non-standard mesh arrangements and bar sizes.

Standard Fabrics

The requirements for welded fabric are specified in BS 4483. Figure 1, taken from BS4483:2025, shows the notation used for the geometrical arrangement of a welded fabric.

Figure 1. Fabric notation.

KEY

L is the length of the longitudinal wires (which are not necessarily the longer wires in the sheet)

B is the length of the cross wires

O_1 and O_2 are the overhangs of the longitudinal wires

O_3 and O_4 are the side overhangs of the cross wires

P_L is the pitch of the longitudinal wires

P_C is the pitch of the cross wires

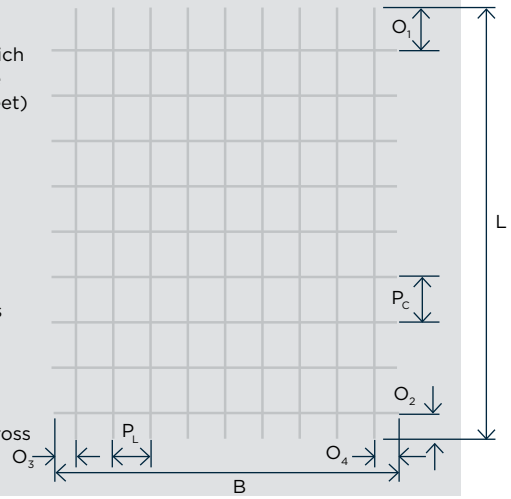


Table 1. Notation for reinforcing steels (from BS 4483:2025)

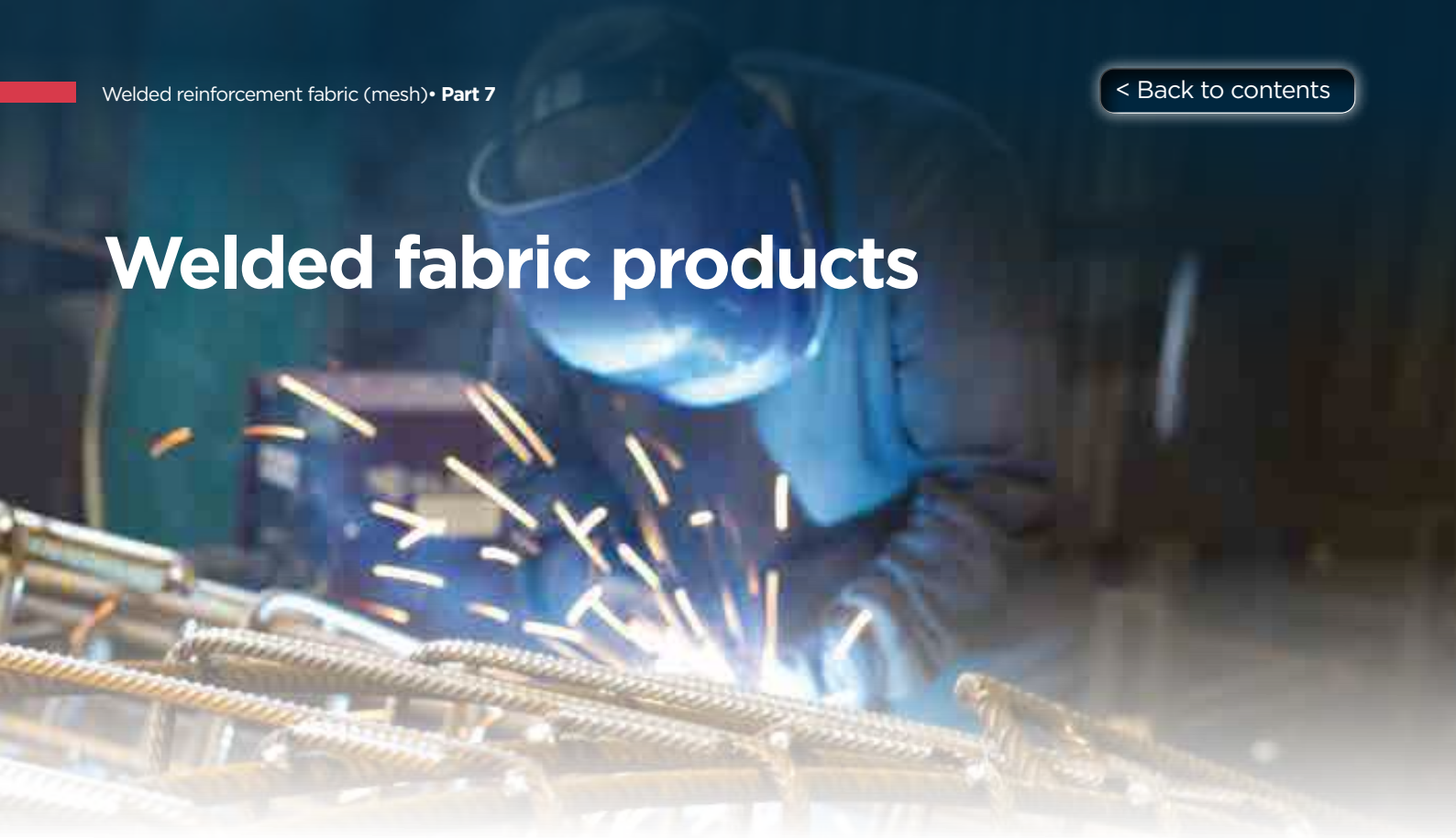
Fabric Reference	Longitudinal Wires					Transverse Wires					Mass	Nominal Weight per sheet
	Nominal wire size (mm)	Pitch (mm)	Area (mm/m)	Overhang (top/ bottom)	Bars per sheet	Nominal wire size (mm)	Pitch (mm)	Area (mm)	Overhang (Side/ Side2)	Bars per sheet	(kg/m)	(kg/m)
Square Mesh												
A393	10	200	393	100/100	12	10	200	393	100/100		6.16	71.08
A252	8	200	252	100/100	12	8	200	252	100/100		3.95	45.50
A193	7	200	193	100/100	12	7	200	193	100/100		3.02	34.79
A142	6	200	142	100/100	12	6	200	142	100/100		2.22	25.57
Structural Mesh												
B1131	12	100	1131	100/100	24	8	200	252	50/50	24	10.9	125.05
B785	10	100	785	100/100	24	8	200	252	50/50	24	8.14	93.83
B503	8	100	503	100/100	24	8	200	252	50/50	24	5.93	68.26
B385	7	100	385	100/100	24	7	200	193	50/50	24	4.53	52.19
B283	6	100	283	100/100	24	7	200	193	50/50	24	3.73	42.97
Long Mesh												
C785	10	100	785	200/200	24	6	400	70.8	50/50	12	6.72	77.47
C636	9	100	636	200/200	24	6	400	70.8	50/50	12	5.55	63.88
C503	8	100	503	200/200	24	5	400	49	50/50	12	4.34	51.90
C385	7	100	385	200/200	24	5	400	49	50/50	12	3.41	41.18
C283	6	100	283	200/200	24	5	400	49	50/50	12	2.61	32.97
Wrapping Mesh												
D49	2.5	100	49	50/50	24	2.5	100	49	50/50	48	0.77	8.97
Stock sheet size:	Length 4.8m					Width 2.4m Sheet area 11.52 m^2						

Note 1: Stock sheet size: length 4.8m; width 2.4m, sheet area 11.52m^2

Note21: Due to the lack of use, C type fabrics are not produced by manufacturers for stock and might have to be ordered as a special requirement.

Continued...

Welded fabric products



This includes four different types of fabrics, for use in different design situations:

This includes four different types of fabrics, for use in different design situations:

Type A: These are called square mesh fabrics, and have the same diameter reinforcement in both longitudinal and transverse directions. The spacing is 200mm centres in both directions. These are used where the same area of reinforcement is required in both directions, typically in slabs and walls. These are the most widely used welded fabrics.

Type B: These are called structural mesh fabrics. They are used where the main reinforcement is in one direction. Only a minimum reinforcement area according to the design code is supplied in the transverse direction. The spacing of the transverse wires is greater, and the transverse wire sizes may be different to the longitudinal wires.

Type C: These are called long meshes. These are used where reinforcement is only required in one direction. The transverse wires are only to hold the fabric together. They do not perform a structural function.

Type D: This is wrapping fabric. This is mainly used for fire protection, and for links in beam cages.

Standard fabrics are designated by their mesh type, and the area of the longitudinal reinforcement contained within, measured in mm/m. Thus A252 is an A type mesh, with a nominal area of longitudinal wires of 252 mm/m.

The standard size of welded fabric sheets is 4.8m x 2.4m. Merchant size sheets are also available in a standard size of 3.6 x 2.0m. Special fabrics may be manufactured up to sizes of 12.0 x 3.3m.

BS 4483:2025 allows for bars used for the longitudinal and transverse reinforcement in welded fabrics to be to the following specifications:

BS 4449 Grade B500A, B or C or BS 4483 Grade F500A

The only exception is for D49 wrapping mesh, where a 2.5mm wire with a minimum yield strength of 250 N/mm2 is specified.

In practice, almost all of the welded fabric used in the UK is made of cold reduced steel. The majority of this material is produced by the cold rolling process route (see Part 2 of this Guide). This material is ribbed, generally with three rows of transverse ribs, (Figure 2).

(Figure 2). Example of ribbed cold rolled wire

For standard fabrics, the same steel type and grade must be used in both directions (longitudinal and transverse wires).

It is a requirement of BS 4483, that all fabric should be electrical resistance welded. A minimum weld shear strength is specified at the welded intersection. In addition, the welded wires must meet the tensile and rebend properties specified in the parent material specification.

Purpose-made fabrics

In addition to the standard fabrics listed in Table 1, BS 4483 also makes provision for purpose-made fabrics. These may have any combination of wire sizes and spacing in either direction. In addition, bars or wires in these fabrics may be staggered. It is an important requirement that the same grade of reinforcing steel should be used in each direction.

Manufacturers may use different terms to describe purpose-made fabrics. In practice, they may be sub-divided into two categories. These are:

a) Special fabrics (also called semi-standard or scheduled fabrics).

b) Bespoke fabrics (also called detailed fabric mats).

Special fabrics consist of the standard wire size combinations, but with non-standard sheet dimensions or overhangs. A particular group of products in this category are fabrics with so-called flying ends (Figure 3).

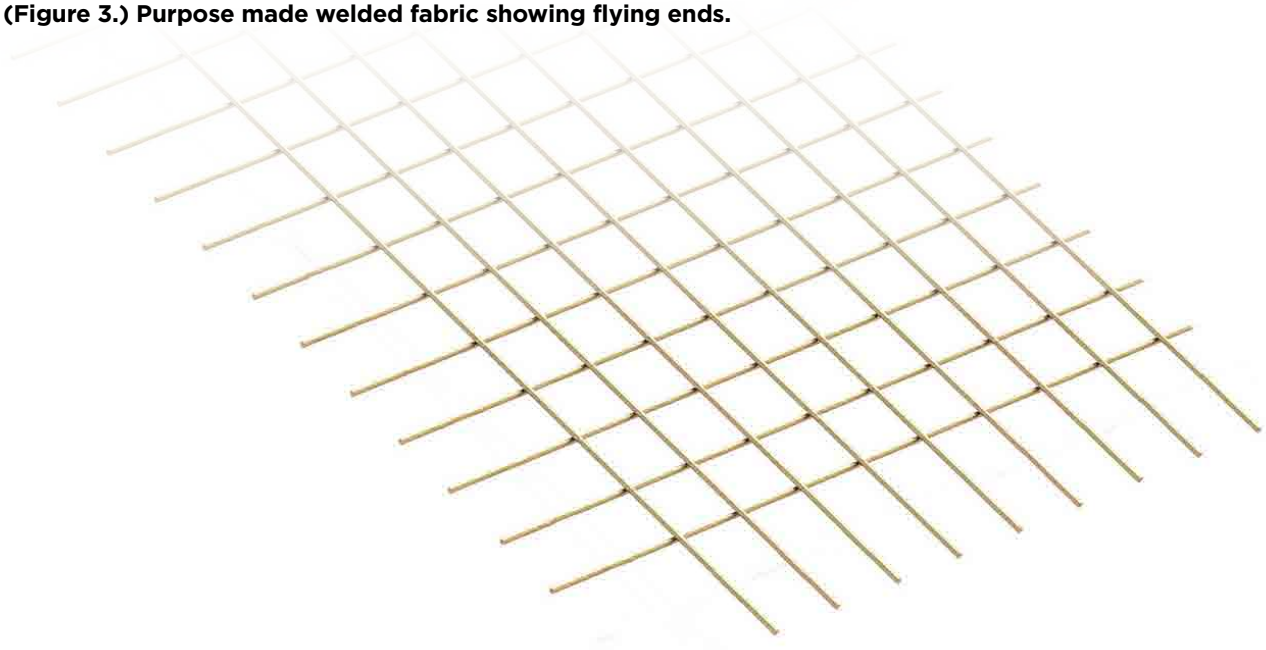
These fabrics are designed so that less steel is provided in the lapped area between sheets. The lap length is designed to give a minimum 40d lap, i.e. in excess of that required for grade C25 concrete. The use of flying ends eases congestion, and prevents encroachment of the reinforcement into the concrete cover, which could occur if standard fabrics are lapped. As an alternative, some manufacturers incorporate finer wires into the edge of the fabric to assist with lapping.

Bespoke fabric is a more complex arrangement in which a whole range of different combinations of wire sizes, spacings and lengths can be specified, and bars or wires are often staggered. These products are tailor made for each contract as a replacement for conventional loose bar and they are often referred to as bar mats.

These bespoke fabrics tend to be in the larger wire sizes (12 and 16mm), and they may be made by arc welding techniques, rather than electric resistance welding. In this case, the fabrics are not strictly made to BS 4483, which covers only electric resistance welding. Welding in such products is conducted to the requirements of BS EN ISO 17660.

Bespoke fabrics may be considered appropriate on contracts where there is a high degree of repeatability, and generally manufacturers would require a minimum tonnage order for commercial viability. Those fabricators who supply purpose-made fabric will generally provide the design assistance required to advise customers on appropriate specification.

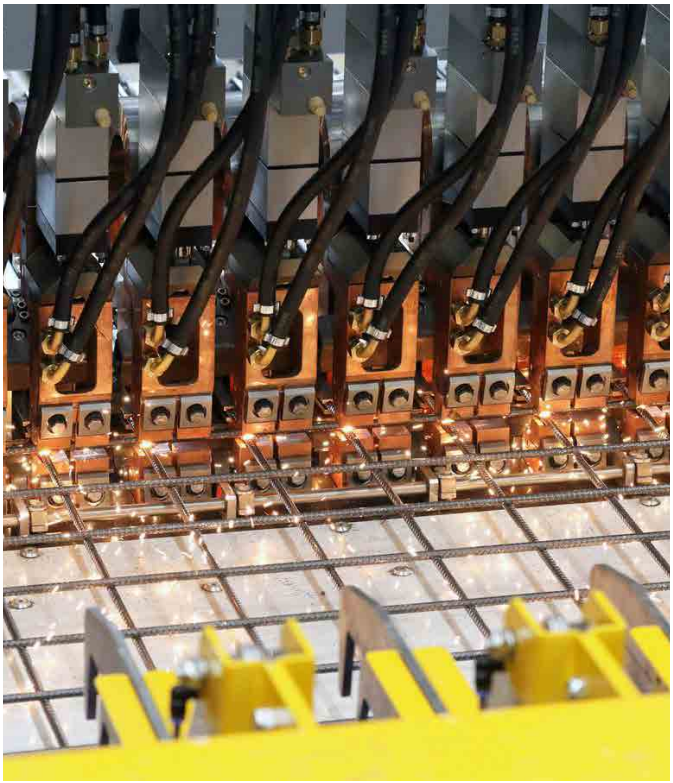
(Figure 3.) Purpose made welded fabric showing flying ends.



Process Routes

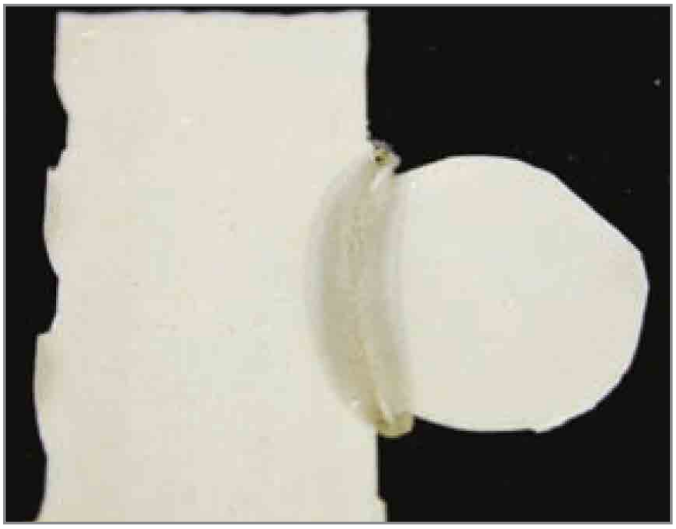
The manufacturing process route for bar to BS4449 or BS 4483 F500A has been described in Part 2 of this Guide. Since welded fabric is generally produced only in sizes up to 16mm diameter, the feedstock for the fabric making process is normally reinforcing bar in coil. Fabric manufacturers in the UK normally have their own cold rolling operation, in which plain hot rolled rod is rolled to ribbed bar. The coil may be fed directly into the fabric-welding machine from spools, for both the longitudinal and transverse bars. This may be regarded as the common method for standard fabrics. Alternatively, the coil may be straightened off-line, usually by decoiling, and cut to length. The cut lengths are then fed to the welding machine from hoppers. A standard welding machine may have up to 24 longitudinal wires (Figure 4). The spacing of both transverse and longitudinal wires is adjustable.

(Figure 4.) A picture of a fabric-welding machine.



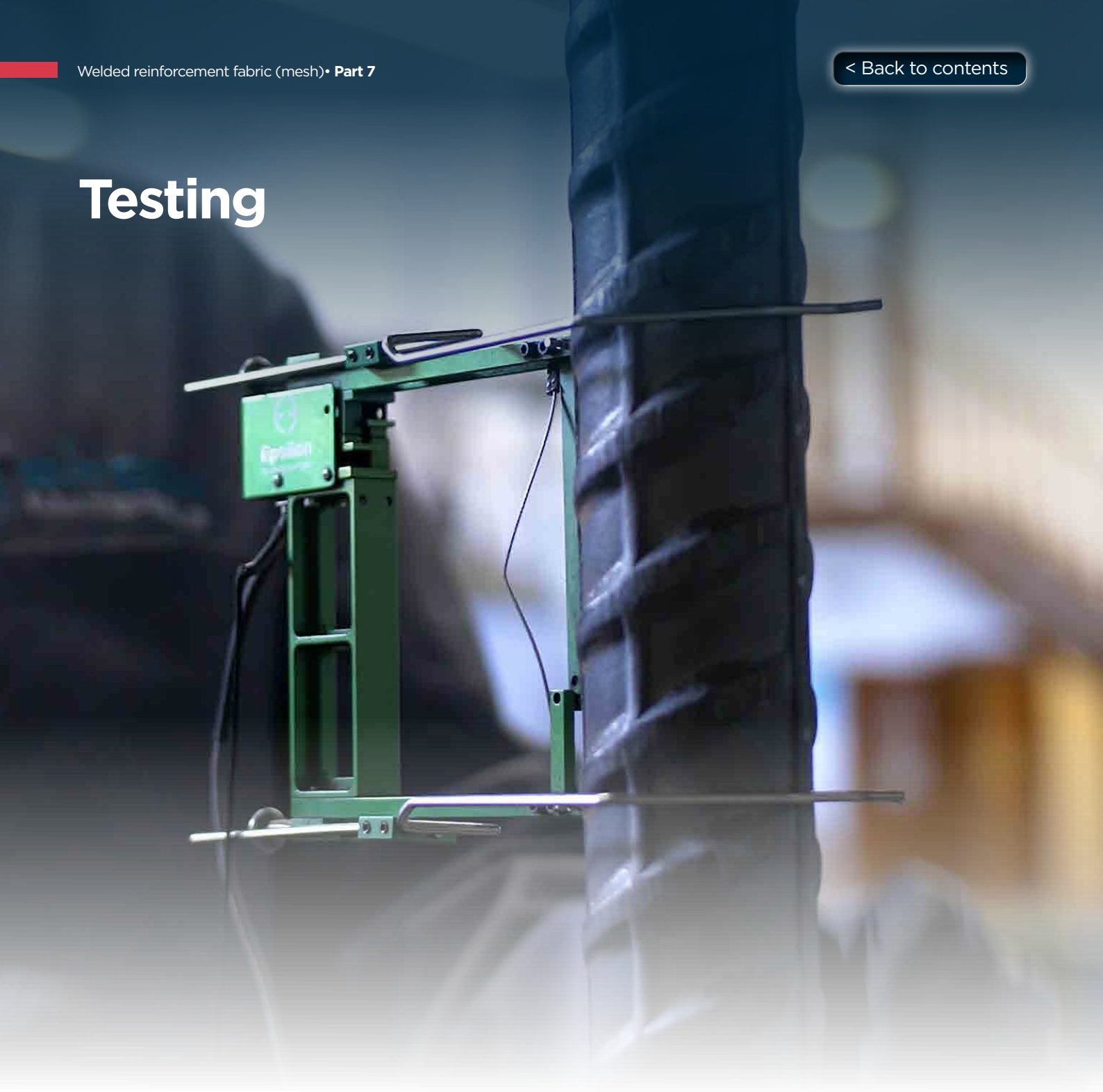
The longitudinal and transverse wires are fed into position under the welding heads, which consist of Cu/Cr electrodes. These clamp the bars, and then pass the welding current. The electrical resistance at the interface between the two bars causes local heating due to the Joule effect. The combination of the heat produced and the pressure applied produces a solid-state weld i.e. where no melting of material takes place. An example of a typical electric resistance weld is given in Figure 5. The process is fully automated, and a modern machine may weld at a rate of 120 transverse bars per minute, with up to 24 welds per bar.

(Figure 5.) Cross section of an electric resistance weld.



After welding, coil fed fabrics are sheared to length, and then stacked. Normally each alternate sheet is inverted, in order to 'nest' the sheets, so that the volume for transportation is reduced. After stacking, bundles are tied, normally with tying wire, labelled, and then despatched. Bundles are normally 1.5 tonnes in weight. They are generally wire tied. It is vitally important, including from a Health and Safety point of view, that the bundles are lifted with slings and not by the ties, which are not designed for lifting purposes.

Testing



In addition to testing conducted on the constituent bars, welded fabric is tested according to the requirements of BS 4483 for tensile properties, rebend properties and weld shear strength.

The test unit is 50 tonnes of the same type of fabric from a single welding machine. Tests are performed on one longitudinal wire and one transverse wire from the test unit. The tensile properties are measured on samples containing at least one welded intersection in the gauge length. This ensures that the presence of the weld has not led to deterioration in the properties of the parent wire.

As with the parent materials, there is a requirement for the long-term quality level to be assessed. The characteristic value of tensile properties measured over 3 months production must meet the long-term characteristic requirement. Under the CARES Product Certification Scheme, these results are verified by CARES.

If required by the customer, manufacturers of welded fabric may issue a certificate of conformity for the batch, although the CARES approved status of fabric producers obviates the need for such a provision, as this capability is required by CARES and is audited at regular intervals.

Bending of fabric

Sheets of welded fabric can be bent by the reinforcement fabricator. The shape codes applied to the bending of fabric in BS 8666 are the same as those for the bending of bar. Almost all shapes can be supplied in fabric, but care must be taken when specifying "closed" shapes.

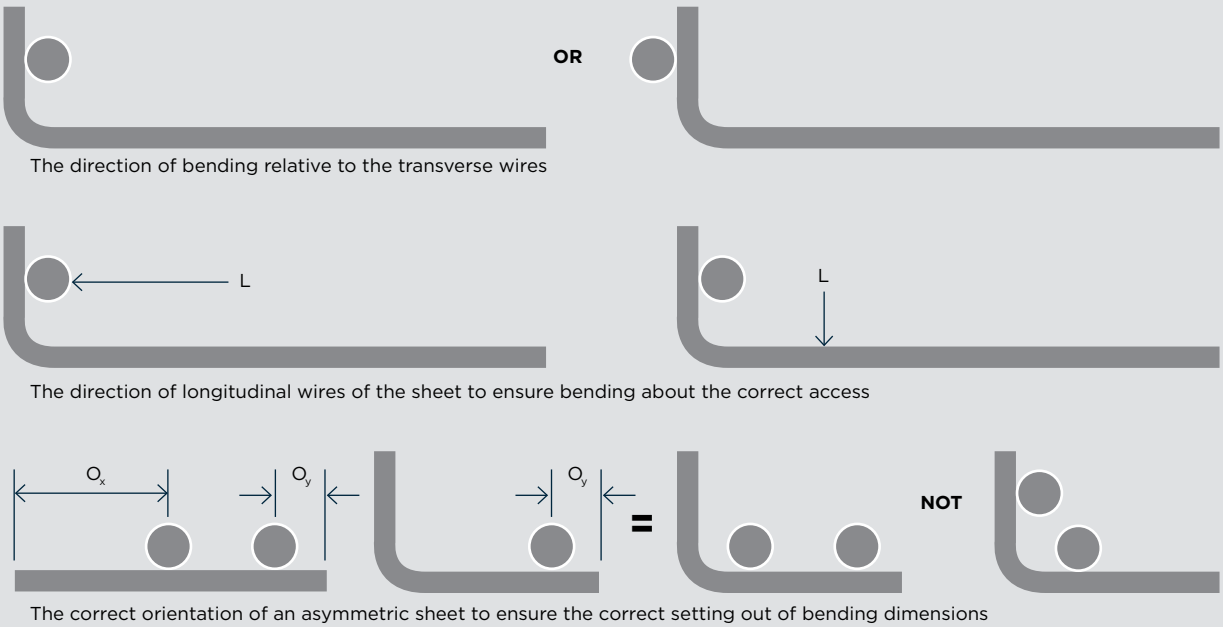
Scheduling

BS 8666 gives requirements for the scheduling of standard and purpose-made fabric.

Standard fabrics are ordered by their designation in BS 4483, e.g. A193. If a specific grade of bar is required, then this should be added after the standard designation, using the notation of BS 8666 (see part 4 of the Guide).

Where bent fabric is to be scheduled, a sketch should be included on the schedule to show the orientation of the bend with respect to the welds. For example, the transverse wires may be on the inside or outside of the bend (Figure 6). BS 8666 specifically requires that bends are at least 4 wire diameters away from the nearest welded intersection.

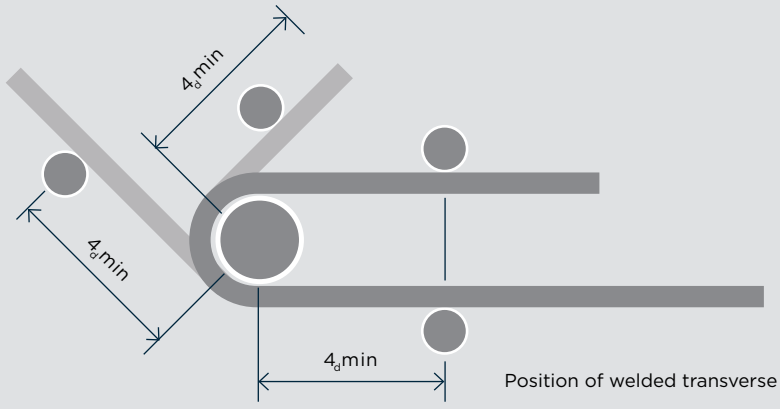
(Figure 6.) Figures from Section 11 of BS 8666.



The direction of bending relative to the transverse wires

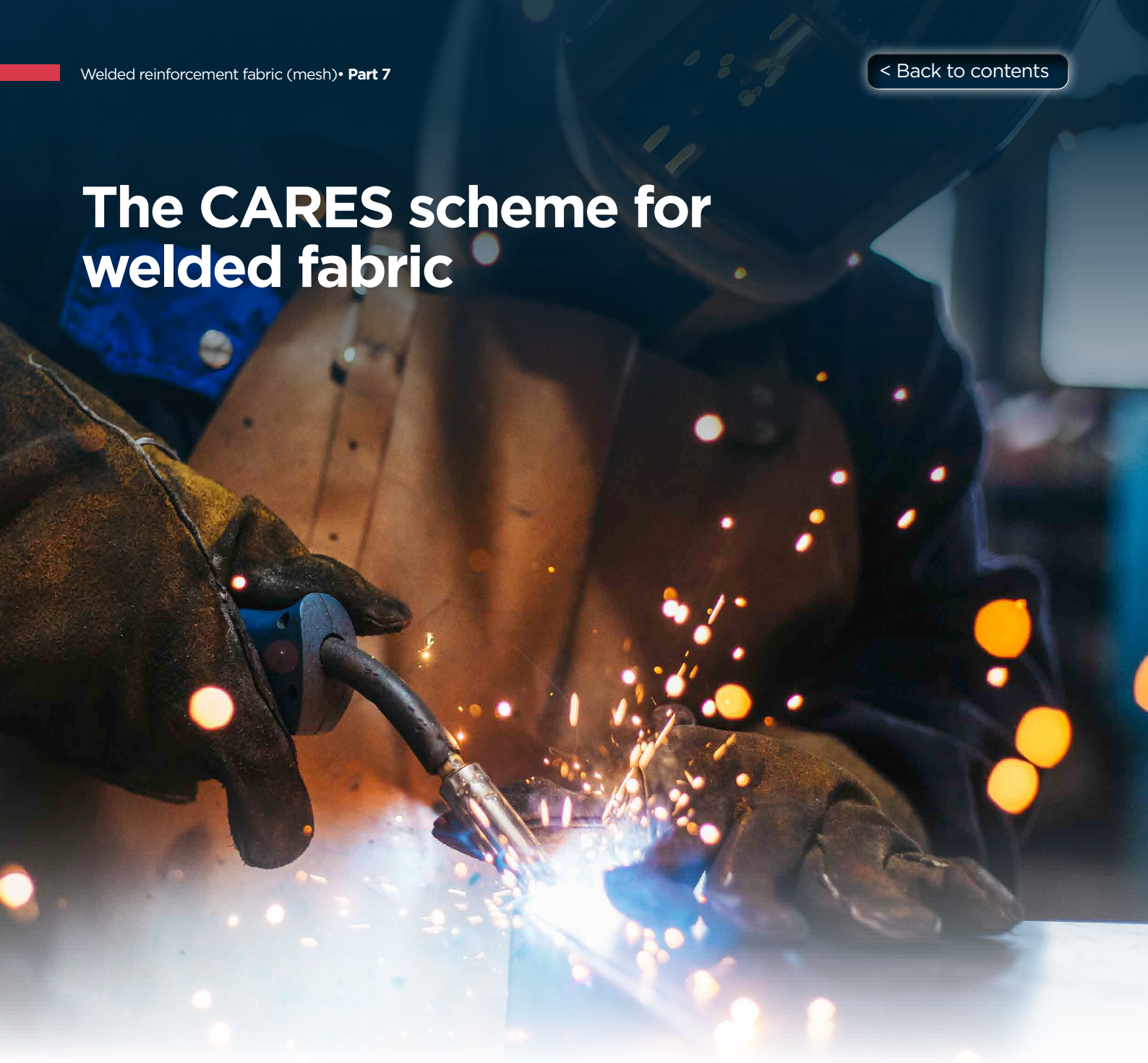
The direction of longitudinal wires of the sheet to ensure bending about the correct access

The correct orientation of an asymmetric sheet to ensure the correct setting out of bending dimensions



Position of welded transverse wires

The CARES scheme for welded fabric



The operation of the CARES Steel for the Reinforcement of Concrete scheme has been described in Part 1 of this Guide. The scheme operates in a similar way for welded fabric to that described for reinforcing bars, incorporating quality systems assessment, independent product testing, and full traceability throughout the supply chain.

The CARES list of approved manufacturers, which appears on the CARES web-site (www.carescertification.com), includes a list of approved manufacturers of welded fabric, along with details of their scope of approval.

As with the other schemes, specification of CARES approved welded fabric gives specifiers and users the confidence that the material complies with the purchase specification. The requirements for costly batch acceptance testing are avoided.

Handling of fabric

It is vitally important, both from a quality and safety point of view that reinforcing fabric is handled correctly at all points in the supply chain but particularly from delivery vehicles at construction sites. Poor handling can damage wires and the welds between them and create problems when fixing. From a safety point of view, the movement of reinforcement fabric should be the subject of risk assessment and safe system of work. It is not the purpose of this guide to expand on this. A code of practice for users, hauliers and suppliers has been produced by the UK fabric producers however, under the trade association, BAR. A copy of this can be obtained via BAR members.

Your guide to specifying Learn how to procure CARES certified steel products

To specify CARES certification that meets government and private sector quality assurance and responsible sourcing requirements use the text from the guide in your project specifications.

specification guide

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9) "The CARES guide to reinforcing steels: Part 1 The product certification scheme for steel for the reinforcement of concrete".

10) "The safe off-loading of Reinforcement Fabric". A code of practice for users, hauliers and suppliers. BAR.

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