BRITISH STANDARD

BS 8666:2005
Incorporating Amendment No. 1

Scheduling, dimensioning, bending and cutting of steel reinforcement for concrete — Specification

ICS 77.140.15; 91:080.40

BSI British Standards

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee ISE/9, Steel for concrete reinforcement, to Subcommittee ISE/9/1, Bars, wire and fabric for concrete reinforcement, upon which the following bodies were represented:

British Coatings Federation

British Precast Concrete Federation

Concrete Society

Department of Transport — Highways Agency

Galvanizers Association

Institution of Structural Engineers

UK Certification Authority for Reinforcing Steels

UK Steel Association

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Amendments issued since publication

Amd No.	Date	Comments
Amendment No. 1	31 January 2008	Changes to Table 1.

The following BSI references relate to the work on this standard:
Committee reference ISE/9/1
Draft for comment 04/30109898 DC

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Contents

Foreword

This British Standard has been prepared by Subcommittee ISE/9/1. It supersedes BS 8666:2000, which is withdrawn.

The start and finish of text introduced or altered by Amendment No. 1 is indicated in the text by tags [A1] 〈A1〉.

The standard has been revised to incorporate:

— shape codes available under BS EN ISO 3766:2003;

— revised notation in accordance with BS 4449:2005 and BS EN 10080:2005;

— revisions to BS 4449:2005 (including the omission of grade 250 and grade 460 reinforcement), BS 4482:2005 and BS 4483:2005; the requirements of BS 4483:2005 have caused the withdrawal of standard fabrics A98 and B196, and changes to standard fabrics C503, C385 and C283;

— the provisions of BS EN 1992-1-1 (including the preclusion of wire to BS 4482:2004 for use for structural purposes);

— rationalization of notes to the table of standard shapes (Table 3);

— electronic data files;

— revisions to *fabrication and routine inspection*.

Assessed capability. Users of this British Standard are advised to consider the desirability of quality system assessment and registration against BS EN ISO 9001:2000 by an accredited third-party certification body (see Annex A).

This standard comes into effect on 1 January 2006.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 26, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

1 Scope

This British Standard specifies requirements for the scheduling, dimensioning, bending, and cutting of steel for the reinforcement of concrete conforming to BS 4449:2005, BS 4483:2005 and BS 6744, designed to BS EN 1992-1-1, BS EN 1992-2, BS EN 1992-3 and BS 8110.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 4449:2005*, Carbon steel bars for the reinforcement of concrete — Specification.*

BS 4483:2005*, Steel fabric for the reinforcement of concrete — Specification.*

BS 6744*, Austenitic stainless steel bars for the reinforcement of concrete — Specification.*

BS 8110-1*, Structural use of concrete — Code of practice for design and construction.*

BS EN 1992-1-1*, Eurocode 2: Design of concrete structures — Part 1.1: General rules and rules for buildings.*

BS EN 1992-2*, Eurocode 2: Design of concrete structures — Part 2: Concrete bridges — Design and detailing rules.*

BS EN 1992-3*, Eurocode 2: Design of concrete structures — Part 3: Liquid retaining and containment structures.*

BS EN ISO 216:2001*, Writing paper and certain classes of printed matter — Trimmed sizes. A and B series.*

BS EN ISO 3766:2003*, Construction drawings — Simplified representation of concrete reinforcement.*

3 Terms and definitions

For the purposes of this British Standard the following terms and definitions apply.

3.1
bar
steel product of any cross-section conforming to BS 4449:2005 or BS 6744

3.2
nominal size
nominal diameter
diameter of a circle, d, with an area equal to the effective cross-sectional area of the bar, sometimes referred to as its size

3.3
bar mark
fabric mark
identifying mark which cross-refers individual line entries on the schedule to the detailed drawing

NOTE The bar (or fabric) mark also appears on the delivery label.

3.4
shape code
two-digit coded designation of the reinforcement shape

NOTE See Table 3.

3.5
pitch
centre-to-centre spacing of bars in a sheet of fabric

3.6
mesh
rectangle defined by the pitch of the longitudinal bars and the pitch of the cross bars in a sheet of fabric

3.7
fabric
factory-made product consisting of welded bars conforming to BS 4483:2005

3.8
standard fabric
fabric reinforcement where the bar and mesh arrangement can be defined by an identifiable fabric reference

NOTE See Table 4.

3.9
purpose made fabric
fabric manufactured according to user's specific requirements

NOTE Purpose made fabric is therefore not included in Table 4. See Figure 3.

3.10
fabric reference
alpha numeric designation denoting fabric in accordance with Table 4

3.11
bar schedule
list of reinforcement types and sizes, quantities, shape codes, dimensions and bar mark numbers cross-referring to the detailed drawing

NOTE The preparation of the list is known as scheduling. See Figure 1.

3.12
fabric schedule
list of fabric types, dimensions, quantities, and fabric mark numbers cross-referring to a detailed drawing

NOTE See Figure 2.

3.13
link
bent bar used to resist shear

4 Notation

The type and grade of steel reinforcement shall be designated as follows:

Table 1 — Notation of steel reinforcement

Type of steel reinforcement	Notation
A1 For diameters ⩽ 12mm, Grade B500A, Grade B500B or Grade B500C conforming to BS 4449:2005 For diameters >12mm, Grade B500B or Grade B500C conforming to BS 4449:2005 A1	H
Grade B500A conforming to BS 4449:2005	A
Grade B500B or Grade B500C conforming to BS 4449:2005	B
Grade B500C conforming to BS 4449:2005	C
A specified grade and type of ribbed stainless steel conforming to BS 6744:2001	S
Reinforcement of a type not included in the above list having material properties that are defined in the design or contract specification.	X
A1 NOTE 1 In the Grade description B500A, etc., "B" indicates reinforcing steel. NOTE 2 Within the ranges given, the grades(s) supplied for notations H and B are at the supplier's discretion. A1	

5 Form of schedule

5.1 General

For bar reinforcement, a bar schedule shall be prepared in accordance with the example given in Figure 1. The information and the order in which it is presented shall follow this example, but details of presentation are left to the individual.

Standard fabric types (see Table 4) may be called up on bar schedules, in which case the word fabric shall be followed by the fabric reference and area in m^2 required across the width of the schedule.

NOTE Standard fabrics may also be scheduled in accordance with the example given in Figure 2.

The bar (or fabric) mark shall comprise simple and consecutive numbers or letters with a maximum of six characters. Where special end preparation is required (e.g. for couplers), the bar mark shall commence with "E". The bar (or fabric) mark shall be used for labelling purposes in accordance with Clause **6**.

Purpose made fabrics shall be scheduled in accordance with either Figure 2 or Figure 3.

In the "type and size" column of the schedule, the notations specified in Clause **4** for the type and grade of reinforcement shall be given and this shall be followed by the nominal size in millimetres.

The bar or fabric schedule shall include the statement "This schedule conforms to BS 8666:2005".

5.2 Paper-based schedules

For schedules that are not produced on a computer, the minimum width of the columns in the bar and fabric schedules shall be as shown in Figure 1 and Figure 2. For computer produced schedules, the column widths and the size of the schedule may vary from those shown in Figure 1 and Figure 2, but the sequence of columns shall be maintained. A schedule can consist of one or several sheets. Each sheet shall not be significantly larger than size A4 in accordance with BS EN ISO 216:2001.

The schedule reference shall be included at the top right-hand corner of the schedule form and shall be consecutively numbered. The schedule reference shall include:

— the last relevant characters of the relevant detailed drawing number or reference;

— up to two characters for the sheet number;

— one character for the revision;

— one character (if necessary) for the schedule status.

The styles "1 (of 6)" and "6 (and last)" may be used on manually prepared schedules but the words in parentheses shall not form part of the schedule reference. Where used, the status character shall be defined on the schedule (e.g. P — preliminary, T — tender, C — construction) but the character shall not form part of the schedule reference.

EXAMPLE

Schedule reference

Drawing No			0	4	6
Sheet No	0	3	Revision		A
			Status		C

Where a schedule revision is necessary, the line or lines affected shall be indicated by a suitable reference on the schedule, e.g. "A" at the right-hand side of the schedule in Figure 1. The single revision character in the schedule reference shall be revised in ascending order.

5.3 Electronic data files

By agreement, bar and fabric schedules may be in the form of electronic data files (compared to say digital images of paper based schedules); such files shall be prepared generally in accordance with **5.1** and **5.2** above.

Each file shall include identification of:

— the system, software or industry standard and version number being used;
— contract information;
— drawing reference;
— schedule reference;
— creator of the schedule (with contact details);
— date of preparation;
— checker;
— date of checking;
— reviser;
— revision number or revision letter;
— date of last revision;
— member identifiers or names;
— data for each bar mark.

The data for each bar mark shall be in the same sequence as the columns shown in Figure 1 and Figure 2.

Each file shall be considered as a single entity; any revision should require the whole file to be issued as a new revision.

6 Form of bar or fabric label

The schedule reference and the mark given in the "bar (or fabric) mark" column of the schedule shall be put on the labels attached to the reinforcement.

EXAMPLE

Bar schedule reference	0	4	6	0	3		A
Bar mark							7

The labels shall be durable and securely tied to the reinforcement. Apart from any information required by the supplier for his own identification and internal system, no other information shall appear on the label.

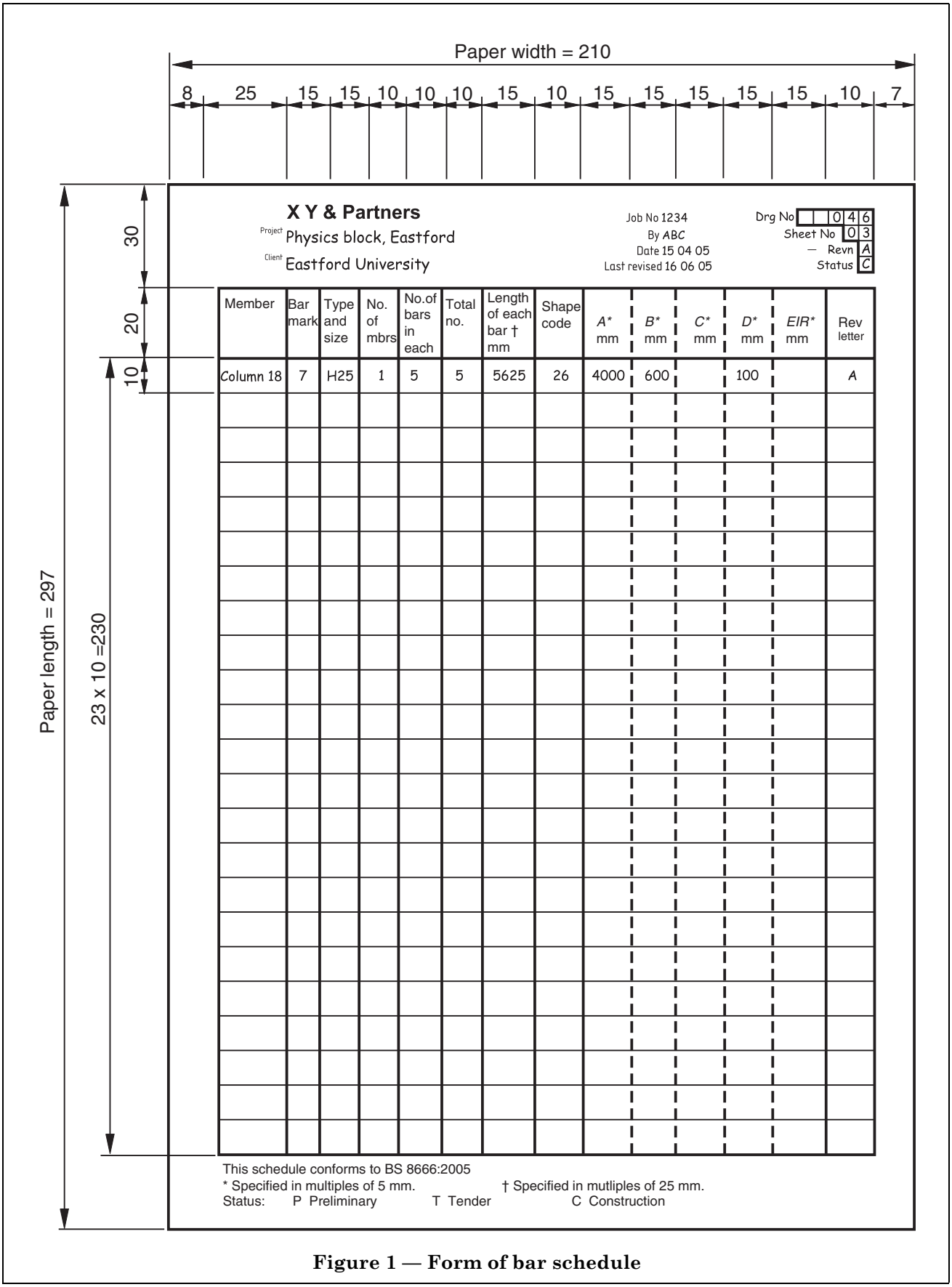


Figure 1 — Form of bar schedule

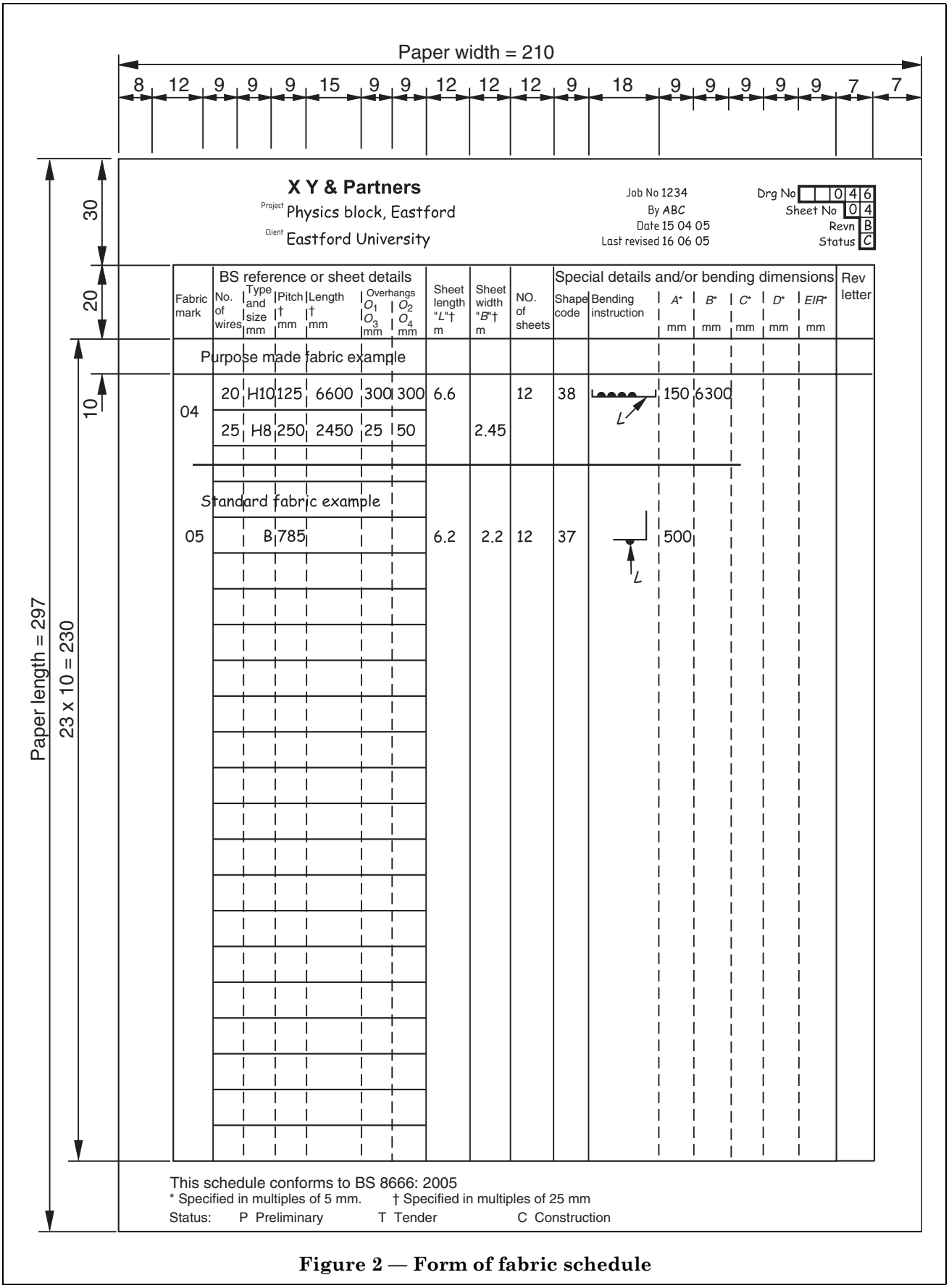
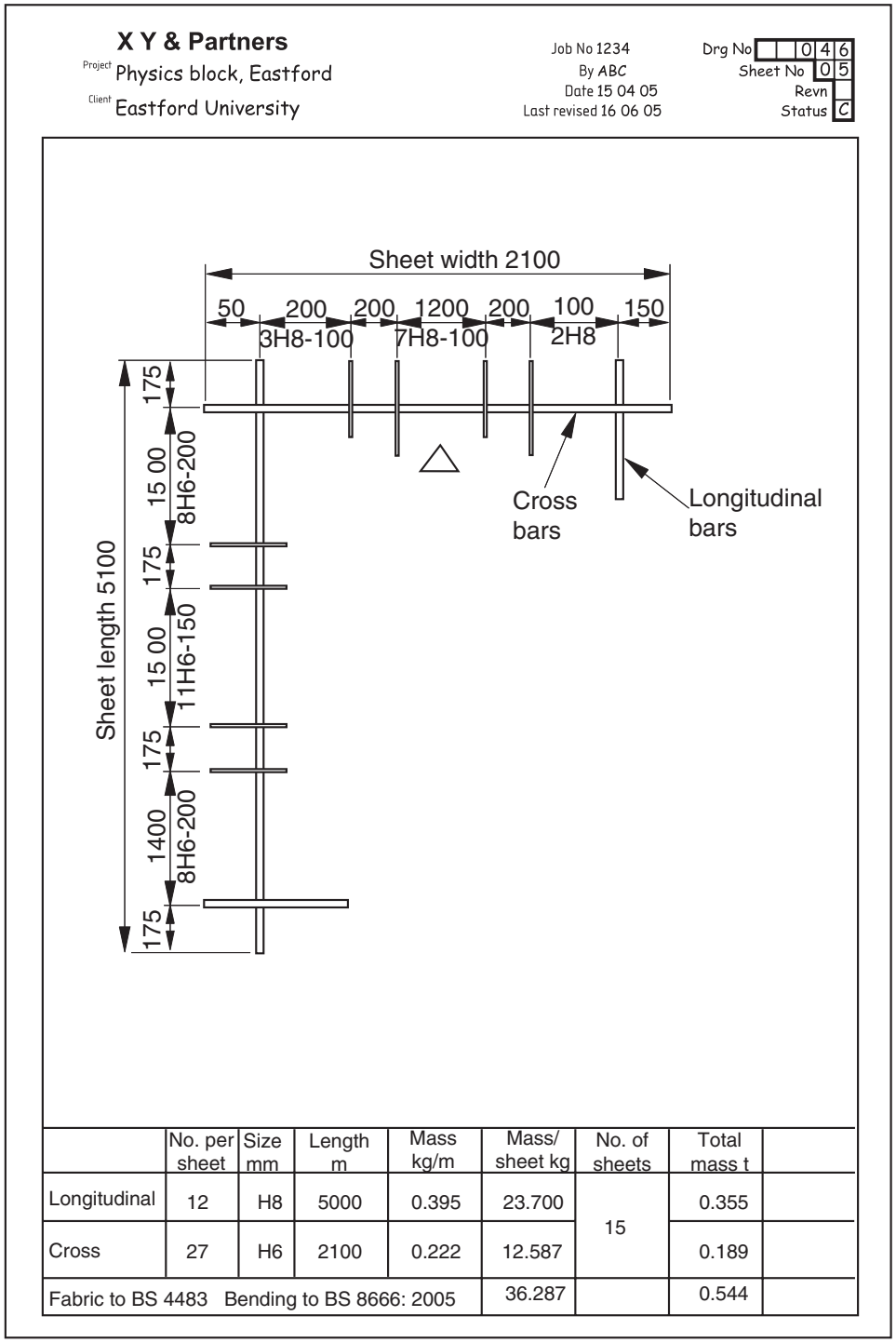


Figure 2 — Form of fabric schedule



	No. per sheet	Size mm	Length m	Mass kg/m	Mass/ sheet kg	No. of sheets	Total mass t	
Longitudinal	12	H8	5000	0.395	23.700	15	0.355	
Cross	27	H6	2100	0.222	12.587		0.189	
Fabric to BS 4483 Bending to BS 8666: 2005					36.287		0.544	

Figure 3 — Purpose made fabric example

7 Dimensions

7.1 The dimensions given on the schedule shall be measured as shown in Table 3. For deformed reinforcement, the outside surface shall be the extremities of the ribs. The total length dimension specified on the schedule for each bar or for bars in each sheet or fabric shall be rounded up to a multiple of 25 mm.

7.2 The bending dimensions of reinforcement shall be in accordance with Table 2.

For bends (bobs) and hooks the minimum straight length beyond the end of the curved portion shall be $5d$. For shear links, for bends less than 150°, the minimum straight free length beyond the end of the curved portion shall be $10d$, but ≥ 70 mm. The values of minimum end dimension P given in Table 2 include $5d$ or $10d$ of straight length beyond a bend of minimum radius, r, or minimum practical limits for cutting.

Minimum scheduling radius, former diameter and bend allowances for type and grade X shall be specified in contract documentation.

Unless otherwise specified on the schedule, the minimum bending former size shall be used in the production of reinforcement.

7.3 The dimensions for the scheduling of reinforcement bounded by two concrete faces shall allow for the permissible deviations.

7.4 The dimensions for the scheduling of reinforcement requiring special end preparation shall take into account the system to be used.

7.5 To facilitate transportation, each bent bar shall be contained within a rectangular area, the shorter side of which should not be longer than 2 750 mm.

NOTE Normally the total length of the bar should not exceed 12 m. Longer lengths may be obtained by agreement with the supplier. In such cases, the upper limit is determined by handling and transportation and should not exceed 18 m.

7.6 The value for minimum end projection P, as specified in Table 2, shall apply to all shape codes.

The values for minimum radius r, as specified in Table 2, shall apply to all shape codes apart from shape codes 12, 13, 22, 33 and 67 where the actual radius shall not be less than the minimum radius r.

8 Scheduling

8.1 Each bar or sheet of fabric shall be scheduled completely and without reference to earlier schedules. Such descriptions as “see schedule 12” or “as above” shall not be used.

8.2 Shape codes shall be in accordance with Table 3. Standard fabrics shall be in accordance with Table 4.

NOTE In practice there might be physical restrictions on certain shape codes for particular bar diameters, especially where the shape has overlapping sections, for example shape code 33. Consideration should be given to using alternative detailing arrangements which are safer to manufacture, for example the use of two shape codes 13 instead of shape code 33.

8.3 For shape codes 11 to 98, if the free variable dimension (the dimension shown in parentheses in Table 3) does not conform to the requirements specified, then the shape shall be drawn and given the shape code 99.

8.4 No dimension specified in Table 3 shall be given a zero value, as this changes the basic shape.

8.5 Shapes with shape code 99 shall be drawn on the schedule over columns A to E using two parallel lines to indicate the reinforcement thickness. The origin of projected surface intersection lines shall be used for dimensions. The methods of measurement shall be in accordance with those shown in Table 3. The total length shall be given, and one bending dimension shall be indicated in parentheses as the free dimension to allow for the permissible deviations. The tolerances given in Table 5 shall also apply to shape code 99.

8.6 If the angle between two portions of the shape meeting at a bend is not a right angle, it shall be defined by co-ordinates and not by degrees of arc or radians.

8.7 When dimensioning an acute angle the tangential lines shown in Figure 4 shall be used.

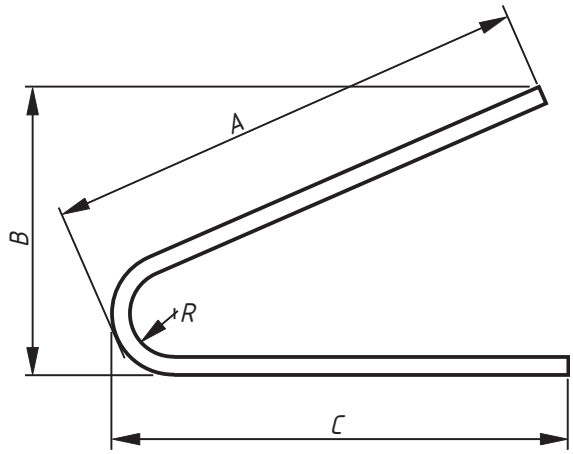


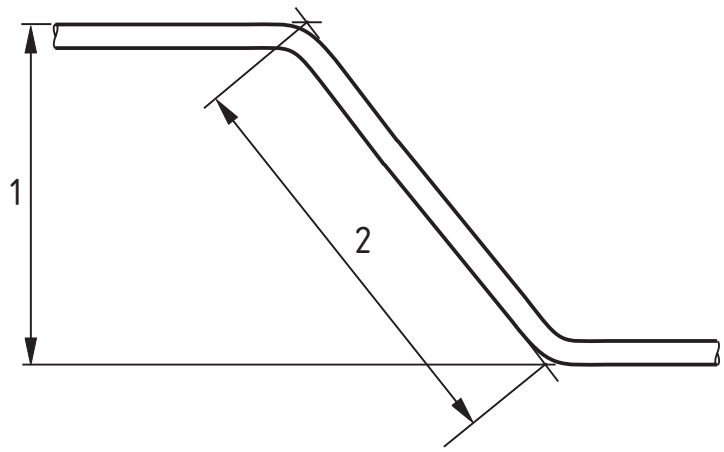
Figure 4 — Dimensioning of an acute angle

8.8 Apart from shape code 98, bars bent in two planes shall be sketched isometrically or shown in two elevations, using first angle projection. The words "bent in two planes" or "isometric sketch" shall appear on the schedule adjacent to the sketch.

8.9 The overall offset dimension of a crank shall be not less than twice the size of the bar. The angled length (see Figure 5) shall be not less than:

a) 10*d* for bars not exceeding a nominal size of 16 mm;

b) 13*d* for nominal sizes greater than 16 mm.



Key

1 Off-set dimension

2 Angle length

Figure 5 — Dimensioning of cranked bars

8.10 For all shapes with two or more bends in the same or opposite directions (whether in the same plane or not), the overall dimension given on the schedule shall always include a minimum straight of 4*d* between the curved portion of the bends, as shown in Figure 6. The value of *x* in Figure 6 shall be not less than the following:

a) 10*d* for bars not exceeding a nominal size of 16 mm;

b) 13*d* for nominal sizes greater than 16 mm.

NOTE The minimum values of *x* are expressed in terms of the nominal size of the reinforcement. In practice, rolling and bending tolerances, and the fact that the circumscribing diameter of deformed reinforcement may be up to 10 % greater than the nominal size, should be considered.

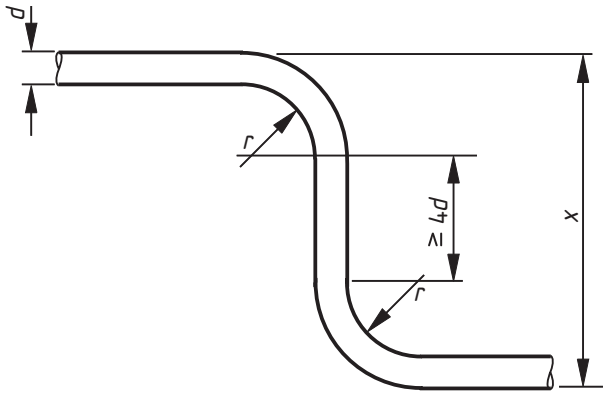
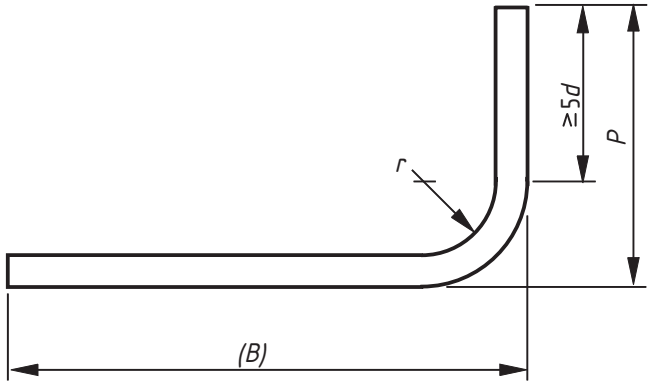


Figure 6 — Example of bar with more than one bend

Table 2 — Minimum scheduling radii, former diameters and bend allowances



Nominal size of bar, *d*	Minimum radius for scheduling, *r*	Minimum diameter of bending former, *M*	Minimum end projection, *P*	
			General (min 5*d* straight), including links where bend ≥150°	Links where bend <150° (min 10*d* straight)
mm	mm	mm	mm	mm
6	12	24	110[a]	110[a]
8	16	32	115[a]	115[a]
10	20	40	120[a]	130
12	24	48	125[a]	160
16	32	64	130	210
20	70	140	190	290
25	87	175	240	365
32	112	224	305	465
40	140	280	380	580
50	175	350	475	725

[a] The minimum end projections for smaller bars is governed by the practicalities of bending bars.

NOTE 1 Due to "spring back" the actual radius of bend will be slightly greater than half the diameter of former.

NOTE 2 BS 4449:2005 grade B500A in sizes below 8 mm does not conform to BS EN 1992-1.1:2004.

Table 3 — Standard shapes, their method of measurement and calculation of length

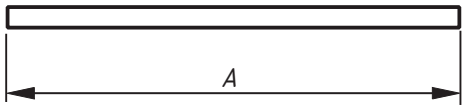
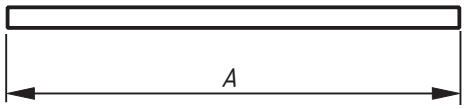
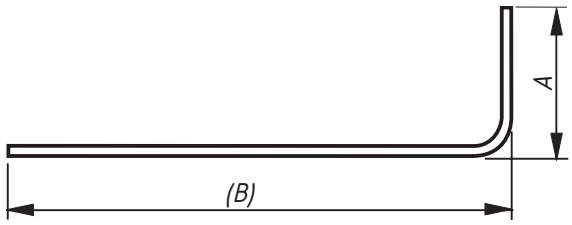
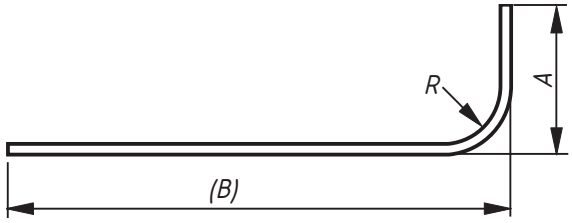
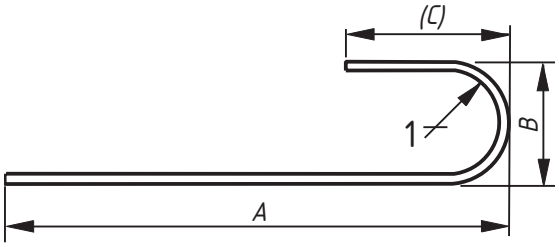
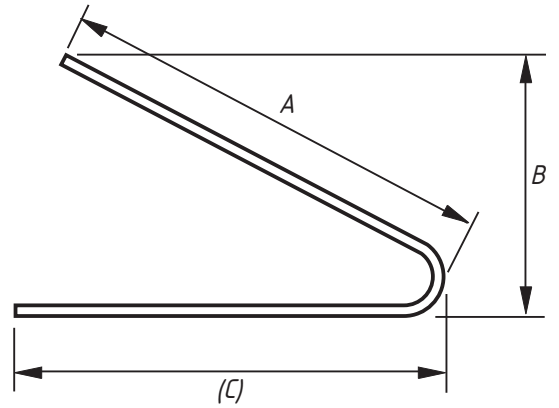
Shape code	Shape	Total length of bar, *L* measured along centre line
00		*A*
01		*A* Stock lengths. See Note 4.
11		$A + (B) - 0.5r - d$ Neither *A* nor *B* shall be less than *P* in Table 2
12		$A + (B) - 0.43R - 1.2d$ Neither *A* nor *B* shall be less than *P* in Table 2 nor less than $(R + 6d)$
13	 **Key** 1 Semi-circular	$A + 0.57B + (C) - 1.6d$ *B* shall not be less than $2(r + d)$. Neither *A* nor *C* shall be less than *P* in Table 2 nor less than $(B/2 + 5d)$. See Note 3.
14		$A + (C) - 4d$ Neither *A* nor (*C*) shall be less than *P* in Table 2. See Note 1.

Table 3 — Standard shapes, their method of measurement and calculation of length (*continued*)

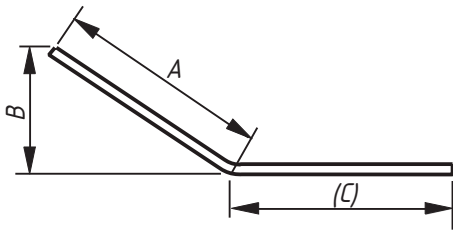
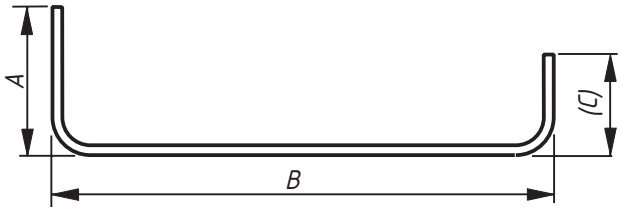
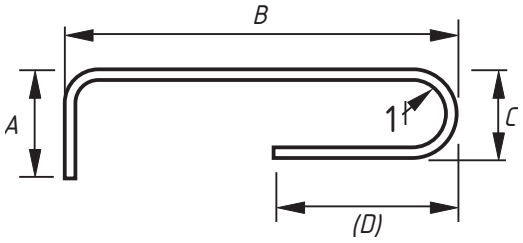
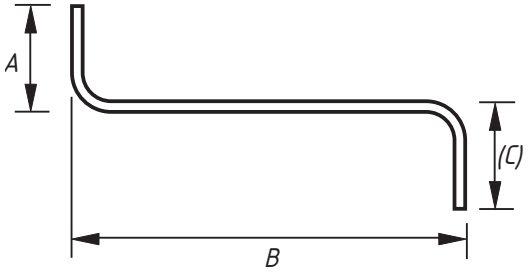
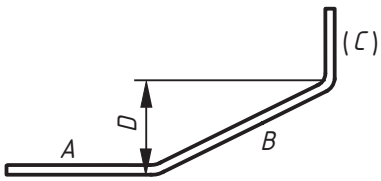
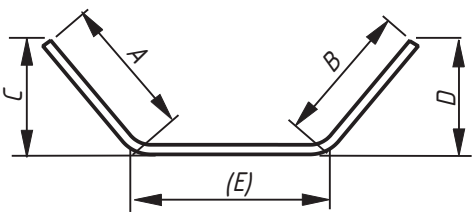
Shape code	Shape	Total length of bar, *L* measured along centre line
15		$A + (C)$ Neither A nor (C) shall be less than P in Table 2. See Note 1.
21		$A + B + (C) - r - 2d$ Neither A nor (C) shall be less than P in Table 2.
22	 **Key** 1 Semi-circular	$A + B + C + (D) - 1.5r - 3d$ C shall not be less than $2(r + d)$. Neither A nor (D) shall be less than P in Table 2. (D) shall not be less than $C/2 + 5d$.
23		$A + B + (C) - r - 2d$ Neither A nor (C) shall be less than P in Table 2.
24		$A + B + (C)$ A and (C) are at 90° to one another.
25		$A + B + (E)$ Neither A nor B shall be less than P in Table 2. If E is the critical dimension, schedule a 99 and specify A or B as the free dimension. See Note 1.

Table 3 — Standard shapes, their method of measurement and calculation of length (*continued*)

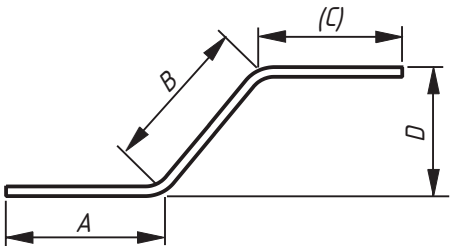
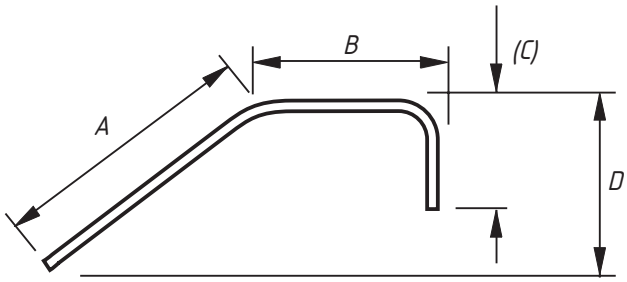
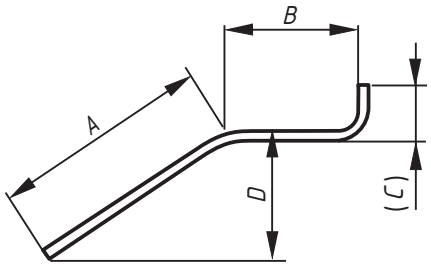
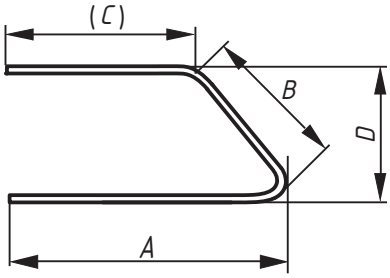
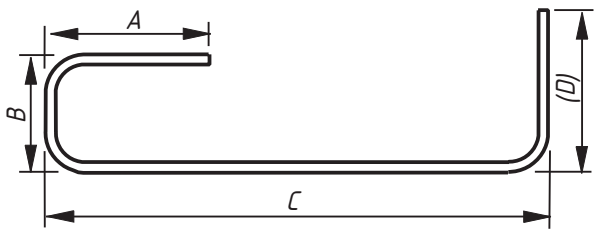
Shape code	Shape	Total length of bar, *L* measured along centre line
26		$A + B + (C)$ Neither A nor (C) shall be less than P in Table 2. See Note 1.
27		$A + B + (C) - 0.5r - d$ Neither A nor (C) shall be less than P in Table 2. See Note 1.
28		$A + B + (C) - 0.5r - d$ Neither A nor (C) shall be less than P in Table 2. See Note 1.
29		$A + B + (C) - r - 2d$ Neither A nor (C) shall be less than P in Table 2. See Note 1.
31		$A + B + C + (D) - 1.5r - 3d$ Neither A nor (D) shall be less than P in Table 2.

Table 3 — Standard shapes, their method of measurement and calculation of length (*continued*)

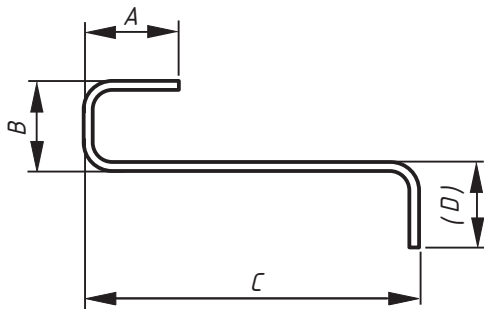
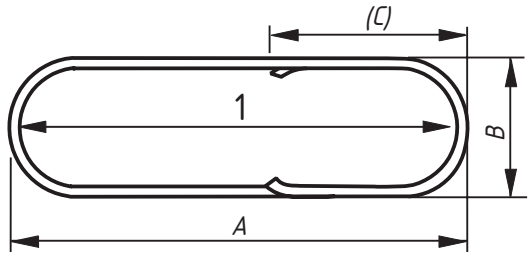
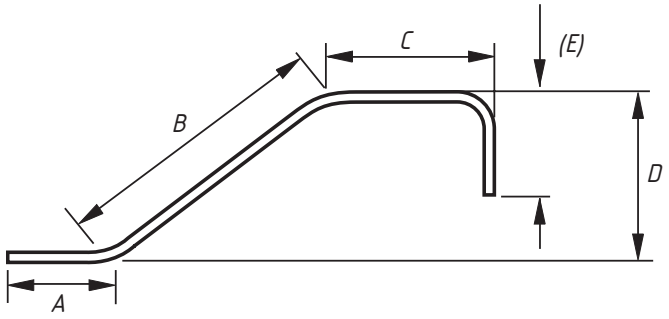
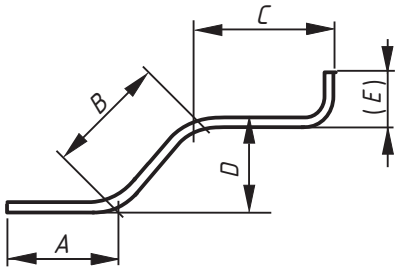
Shape code	Shape	Total length of bar, *L* measured along centre line
32		$A + B + C + (D) - 1.5r - 3d$ Neither A nor (D) shall be less than P in Table 2.
33	 **Key** 1 Semi-circular	$2A + 1.7B + 2(C) - 4d$ A shall not be less than $12d + 30$ mm. B shall not be less than $2(r + d)$. (C) shall not be less than P in Table 2, nor less than $B/2 + 5d$. See Note 3.
34		$A + B + C + (E) - 0.5r - d$ Neither A nor (E) shall be less than P in Table 2. See Note 1.
35		$A + B + C + (E) - 0.5r - d$ Neither A nor (E) shall be less than P in Table 2. See Note 1.

Table 3 — Standard shapes, their method of measurement and calculation of length (*continued*)

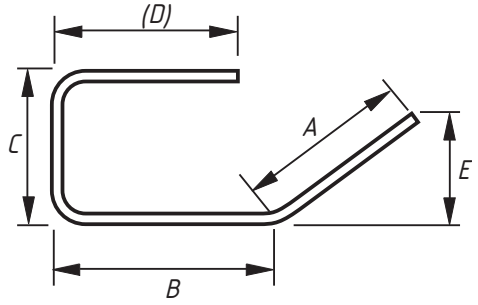
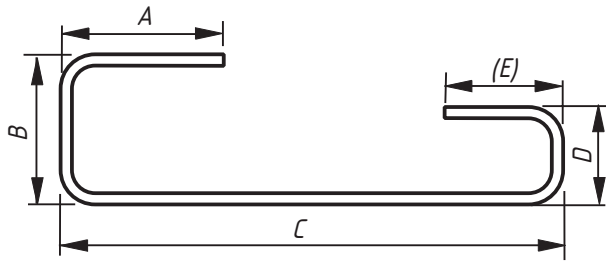
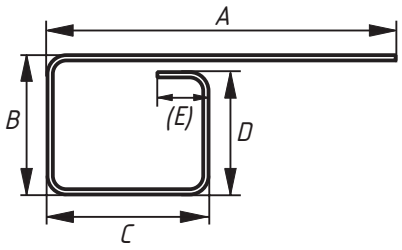
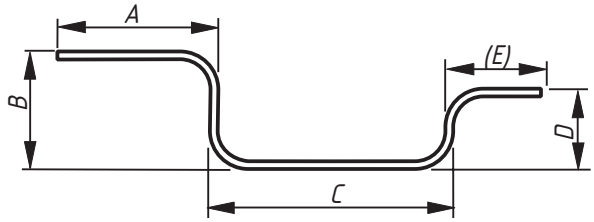
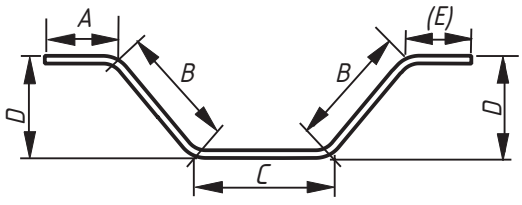
Shape code	Shape	Total length of bar, *L* measured along centre line
36		$A + B + C + (D) - r - 2d$ Neither *A* nor (*D*) shall be less than *P* in Table 2. See Note 1.
41		$A + B + C + D + (E) - 2r - 4d$ Neither *A* nor (*E*) shall be less than *P* in Table 2. May also be used for flag link viz: 
44		$A + B + C + D + (E) - 2r - 4d$ Neither *A* nor (*E*) shall be less than *P* in Table 2.
46		$A + 2B + C + (E)$ Neither *A* nor (*E*) shall be less than *P* in Table 2. See Note 1.

Table 3 — Standard shapes, their method of measurement and calculation of length (*continued*)

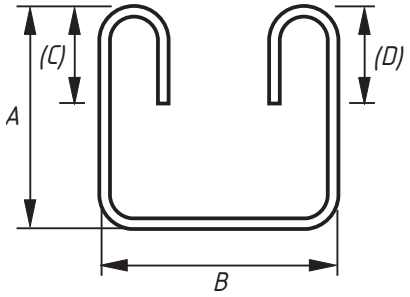
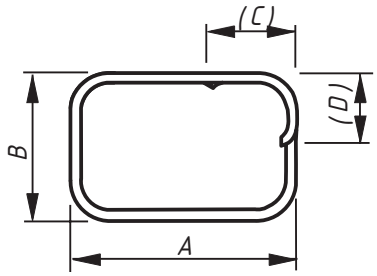
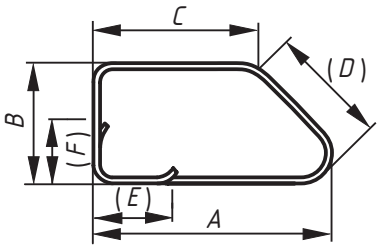
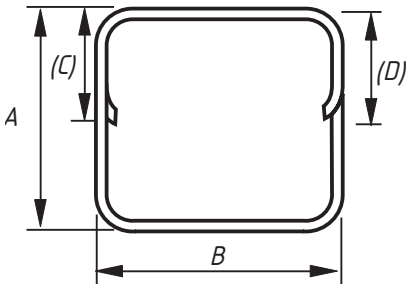
Shape code	Shape	Total length of bar, *L* measured along centre line
47		$2A + B + 2C + 1.5r - 3d$ (*C*) and (*D*) shall be equal and not more than *A* nor less than *P* in Table 2. Where (*C*) and (*D*) are to be minimized the following formula may be used: $L = 2A + B + \max(21d, 240)$
51		$2(A + B + (C)) - 2.5r - 5d$ (*C*) and (*D*) shall be equal and not more than *A* or *B* nor less than *P* in Table 2. Where (*C*) and (*D*) are to be minimized the following formula may be used: $L = 2A + 2B + \max(16d, 160)$
56		$A + B + C + (D) + 2(E) - 2.5r - 5d$ (*E*) and (*F*) shall be equal and not more than *B* or *C*, nor less than *P* in Table 2.
63		$2A + 3B + 2(C) - 3r - 6d$ (*C*) and (*D*) shall be equal and not more than *A* or *B* nor less than *P* in Table 2. Where (*C*) and (*D*) are to be minimized the following formula may be used: $L = 2A + 3B + \max(14d, 150)$

Table 3 — Standard shapes, their method of measurement and calculation of length (*continued*)

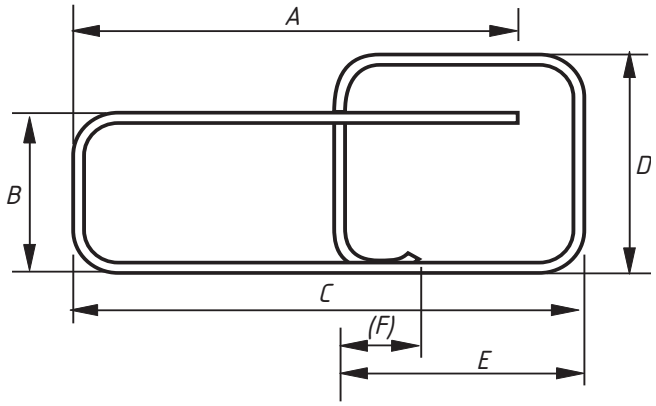
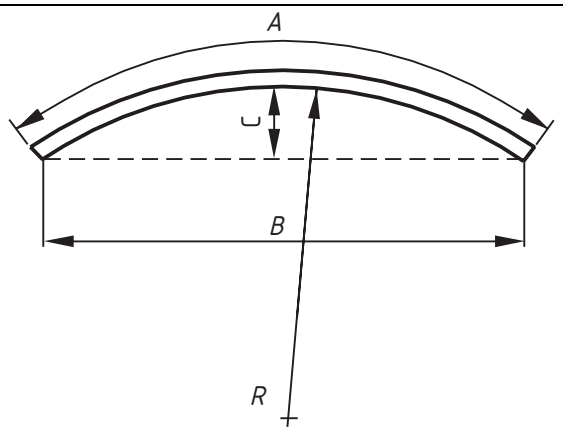
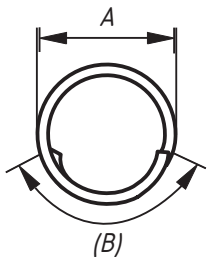
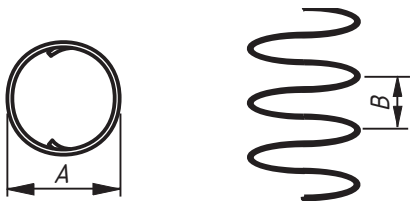
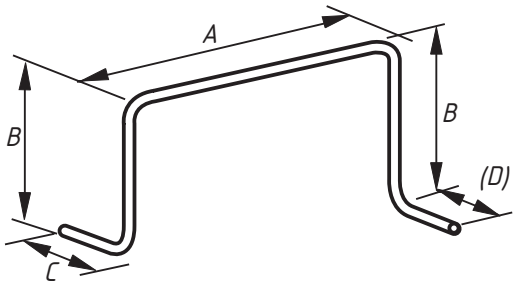
Shape code	Shape	Total length of bar, *L* measured along centre line
64		$A + B + C + 2D + E + (F) - 3r - 6d$ Neither *A* nor (*F*) shall be less than *P* in Table 2. See Note 2.
67		*A* See Clause **10**.
75		$\pi (A - d) + B$ Where *B* is the lap
77	 C = number of turns	$C\pi(A - d)$ Where *B* is greater than *A*/5 this equation no longer applies, in which case the following formula may be used: $L = C((\pi(A - d))^2 + B^2)^{0.5}$

Table 3 — Standard shapes, their method of measurement and calculation of length (*continued*)

Shape code	Shape	Total length of bar, *L* measured along centre line
98		$A + 2B + C + (D) - 2r - 4d$ Isometric sketch. Neither *C* nor (*D*) shall be less than *P* in Table 2.
99	All other shapes where standard shapes cannot be used. No other shape code number, form of designation or abbreviation shall be used in scheduling. A dimensioned sketch shall be drawn over the dimension columns *A* to *E*. Every dimension shall be specified and the dimension that is to allow for permissible deviations shall be indicated in parenthesis, otherwise the fabricator is free to choose which dimension shall allow for tolerance.	To be calculated See Note 2.

The values for minimum radius and end projection, *r* and *P* respectively, as specified in Table 2, shall apply to all shape codes (see **7.6**).

The dimensions in parentheses are the free dimensions. If a shape given in this table is required but a different dimension is to allow for the possible deviations, the shape shall be drawn out and given the shape code 99 and the free dimension shall be indicated in parentheses.

The length of straight between two bends shall be at least 4*d*, see Figure 6.

Figure 4, Figure 5 and Figure 6 should be used in the interpretation of bending dimensions.

NOTE 1 The length equations for shape codes 14, 15, 25, 26, 27, 28, 29, 34, 35, 36 and 46 are approximate and where the bend angle is greater than 45º, the length should be calculated more accurately allowing for the difference between the specified overall dimensions and the true length measured along the central axis of the bar. When the bending angles approach 90º, it is preferable to specify shape code 99 with a fully dimensioned sketch.

NOTE 2 Five bends or more might be impractical within permitted tolerances.

NOTE 3 For shapes with straight and curved lengths (e.g. shape codes 12, 13, 22, 33 and 47) the largest practical mandrel size for the production of a continuous curve is 400 mm. See also Clause **10**.

NOTE 4 Stock lengths are available in a limited number of lengths (e.g. 6 m, 12 m). Dimension *A* for shape code 01 should be regarded as indicative and used for the purpose of calculating total length. Actual delivery lengths should be by agreement with the supplier. See also the footnote to Table 5.

Table 4 — Standard fabric types and stock sheet size

Fabric reference	Longitudinal bars			Cross bars			Mass
	Nominal bar size	Pitch	Area	Nominal bar size	Pitch	Area	
	mm	mm	mm^2/m	mm	mm	mm^2/m	kg/m^2
Square fabric:							
A393	10	200	393	10	200	393	6.16
A252	8	200	252	8	200	252	3.95
A193	7	200	193	7	200	193	3.02
A142	6	200	142	6	200	142	2.22
Structural fabric:							
B1131	12	100	1131	8	200	252	10.90
B785	10	100	785	8	200	252	8.14
B503	8	100	503	8	200	252	5.93
B385	7	100	385	7	200	193	4.53
B283	6	100	283	7	200	193	3.73
Long fabric:							
C785	10	100	785	6	400	70.8	6.72
C636	9	100	636	6	400	70.8	5.55
C503	8	100	503	6	400	49	4.51
C385	7	100	385	6	400	49	3.58
C283	6	100	283	6	400	49	2.78
Wrapping fabric:							
D98	5	200	98	5	200	98	1.54
D49	2.5	100	49	2.5	100	49	0.77

Tolerances shall be in accordance with Table 5.

For standard fabric the type of bar shall be designated as a suffix to the fabric reference as illustrated in the example in Figure 2.

Standard lengths and widths shall be 4.8 m and 2.4 m respectively, giving a sheet area of 11.52 m^2.

Shear forces of welded joints shall conform to BS 4483:2005 **7.2.4.**

NOTE BS 4449:2005 grade B500A in sizes below 8 mm does not conform to BS EN 1992-1.1:2004.

9 Tolerances on cutting and bending dimensions

The tolerances for cutting and/or bending dimensions shall be in accordance with Table 5 and shall be taken into account when completing the schedule. The end anchorage or the dimension in parentheses in the shape codes specified in Table 3 shall be used to allow for any permissible deviations resulting from cutting and bending.

Table 5 — Tolerances

Cutting and bending processes	Tolerance mm
Cutting of straight lengths (including reinforcement for subsequent bending)[a]	+25, –25
Bending:	
≤ 1 000 mm	+5, –5
>1 000 mm to ≤ 2 000 mm	+5, –10
>2 000 mm	+5, –25
Length of bars in fabric	±25 or 0.5 % of the length (whichever is greater)

[a] Tolerances for shape code 01, stock lengths, shall be subject to the relevant product standard, e.g. BS 4449:2005.

10 Radius of bending

Reinforcement to be formed to a radius exceeding that specified in Table 6 shall be supplied straight.

Table 6 — Maximum limit for which a preformed radius is required

Bar size mm	Radius m
6	2.5
8	2.75
10	3.5
12	4.25
16	7.5
20	14.0
25	30.0
32	43.0
40	58.0

NOTE 1 The required curvature may be obtained during placing.

NOTE 2 For shapes with straight and curved lengths (e.g. shape codes 12, 13, 22 and 33) the largest practical radius for the production of a continuous curve is 200 mm, and for larger radii the curve may be produced by a series of short straight sections.

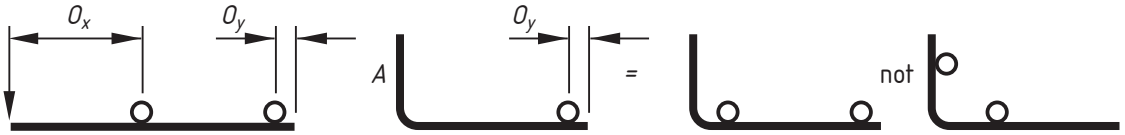
11 Bending of fabric reinforcement

NOTE The schedule for fabric reinforcement (see Figure 2) includes a column headed "bending instruction" for the additional information that is required when specifying bent fabric. The three-dimensional characteristic of fabric reinforcement can give rise to ambiguities that are best overcome by means of a simple sketch in the "bending instruction" column.

The sketch in the bending instruction column shall indicate the following:

a) The direction of bending relative to the transverse wirebars

b) The direction of the longitudinal wirebars of the sheet to ensure bending about the correct axis



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

Figure 7 — Bending instruction sketches

For all bent fabric reinforcement, the bending dimensions shall avoid welded transverse bars occurring within four diameters of the start of a bend, see Figure 8.

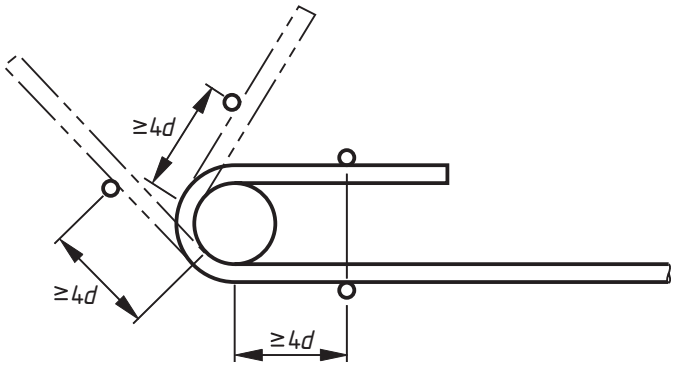


Figure 8 — Position of welded transverse bars

12 Fabrication and routine inspection

12.1 Fabrication

12.1.1 Where production is from coil, the automatic machines used to decoil or straighten bar shall be set up and maintained to ensure decoiled product conforms with the tensile and surface geometry requirements of the relevant product standard.

12.1.2 Cutting to length shall be carried out using purpose-made bar shearing equipment or on automated machinery for producing straight lengths from coil. The tolerances specified in Table 5 shall apply to each length.

12.1.3 Bending shall be carried out on power bending machines or on automated machinery that produces bent items direct from coil. Plain smooth surfaces or rolls that do not offer resistance to longitudinal movement to the bars or fabric being bent shall be provided to ensure adequate support.

12.1.4 All machine operatives shall be trained in the skills necessary to produce cut and bent products of consistent quality within the permissible size deviations. A formal operative approval and testing system shall be implemented and operatives shall have been certified competent.

12.1.5 Upon setting up of the machine for a new bar mark, a sample of the initial output shall be checked according to the appropriate parameters in **12.2.1**. Non-conforming samples shall be discarded.

12.2 Routine inspection of product

12.2.1 *Parameters to be measured*

The fabricator shall carry out inspections of the following parameters of the schedules and of specimens of cut lengths and bent items at a frequency in accordance with **12.2.2**. The results of the inspections shall be recorded.

a) *Cut lengths*

1) The bar (or fabric) mark (see **5.1**).

2) The type and size of the specimens and the type and size given on the schedule (see **5.1**).

3) The length of the specimens shall meet the specified requirements as stated on the schedule (see Clause **9**).

b) *Bent items*

1) The bar (or fabric) mark (see **5.1**).

2) The type and size of the specimens and the type and size specified on the schedule (see **5.1**).

3) The shape of the specimens and the shape code specified on the schedule (see **8.2** to **8.10**).

4) The diameter of former used shall be checked and recorded.

5) The length of the specimens shall meet the specified requirements as stated on the schedule (see Clause **9**).

12.2.2 *Frequency of inspection*

Daily inspections shall be carried out and inspection records shall be retained for 12 months. Production records shall be maintained.

During production, samples shall be subject to inspection. The samples shall be selected at random from a representative range of output items from all producing machines. The frequency of inspection shall be as specified in Table 7.

Table 7 — Frequency of inspection

Average daily output of the fabrication unit over the preceding twelve week period *t*	Minimum number of specimens to be taken per day
Less than 5	5
5 to 10	10
10 to 15	15
15 to 20	20
20 to 30	25
Greater than 30	30

If any sample is found to have any parameter that does not conform to the appropriate requirement, all the other bars or fabrics with the same mark shall be inspected or discarded. Non-conforming samples shall be discarded.

12.3 Processed coil product — Evaluation of conformity

The fabricator shall ensure the conformity of processed coil product by undertaking an initial type test and product audit tests.

The initial type test shall consist of testing five samples before processing and five samples after processing for each machine type (e.g. spinner or roller), steel grade, diameter and steel manufacturing process route.

The product audit tests shall consist of testing one sample before processing and one sample after processing, at a frequency of at least once per 200 t or once per two months, whichever is sooner, per fabrication unit. The samples shall be selected so that all combinations of machine type (e.g. spinner or roller), steel grade, diameter and steel manufacturing process route are covered over a 12 month period.

Testing of the samples for tensile properties, surface geometry and mass per metre shall be in accordance with the relevant product standard. The tensile properties, surface geometry and mass per metre shall conform to the requirements of the relevant product standard.

Additionally, the in-process inspection procedure of the fabricator shall ensure that a visual surface geometry inspection is performed at least once for every coil processed or at each coil change.

Records of all test results shall be maintained.

Annex A (informative)
Third party certification and batch testing

A.1 Fabricated material covered by a third party product certification scheme

A.1.1 *Consistency of production*

For the purposes of determining the consistency of production, the long-term quality level should be assessed at quarterly intervals. No conclusions regarding compliance with this British Standard should be made on the basis of this assessment.

A.1.2 *Determination of the long-term quality level*

The third party certification authority should assess the long-term consistency of production (fabrication) by examining the fabricator's inspection records. No more than 5 % of the items inspected should have failed to conform to the specified requirements.

A.2 Batch testing

A.2.1 *General*

Where material is subjected to batch testing, it is recommended that the following sampling, inspection and testing should be undertaken.

A.2.2 *Extent of sampling and inspection/testing*

For the purposes of inspection/testing, the delivery should be subdivided into tests units with a maximum mass of 5 t. Specimens should be selected at random from a representative range of output items at the following frequency.

Specimens should be taken from each test unit as follows:

a) 15 specimens (if appropriate 60 specimens) of cut lengths;

b) 15 specimens (if appropriate 60 specimens) of bent items.

A.2.3 *Inspection by attributes*

The following parameters of the schedule and of the specimens taken in accordance with **A.2.2** should be inspected. The results of the inspections should be recorded.

a) *Cut lengths*

1) The bar (or fabric) mark (see **5.1**).

2) The type and size of the specimens and the type and size specified on the schedule (see **5.1**).

3) The length of the specimens should meet the specified requirements as stated on the schedule (see Clause **9**).

b) *Bent items*

1) The bar (or fabric) mark (see **5.1**).

2) The type and size of the specimens and the size specified on the schedule (see **5.1**).

3) The shape of the specimens and the shape code specified on the schedule (see **8.2** to **8.10**).

4) The diameter of former used should be checked and recorded.

5) The length of the specimens should meet the specified requirements as stated on the schedule (see Clause **9**).

A.2.4 ***Evaluation of results***

All the parameters inspected in accordance with **A.2.3** for all the 15 specimens should conform to the appropriate requirements.

If a maximum of two of the 15 results do not conform, a further 45 specimens should be assessed so that a total of 60 specimens is assessed. The test unit should be deemed to conform to this standard if no more than two of the 60 results do not conform to the appropriate requirements.

A.2.5 ***Inspection report***

An inspection report should be produced containing the following data:

a) the name of the fabricator;

b) location of the fabricator's works, yard or site;

c) the cast number(s) of the reinforcing steels used for each bar or fabric mark;

d) the name and address of the manufacturer of the reinforcing steels used;

e) the date of the inspection;

f) the mass of the test unit;

g) the individual results as specified in **A.2.3**.

blank

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