BRITISH STANDARD

BS 6946:1988

Incorporating Amendment No. 1

Specification for

Metal channel cable support systems for electrical installations

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Power Electrical Engineering Standards Committee (PEL/-) to Technical Committee PEL/80, upon which the following bodies were represented:

ASTA Certification Services

Association of Manufacturers Allied to the Electrical and Electronic Industry (BEAMA Ltd.)

Association of Supervisory and Executive Engineers

British Electrical Systems Association (BEAMA Ltd.)

Chartered Institution of Building Services Engineers

Confederation of British Industry

Electrical Installation Equipment Manufacturers' Association (BEAMA Ltd.)

Electricity Supply Industry in England and Wales

Gland Manufacturers Technical Committee

Light Metal Founders' Association

National Inspection Council for Electrical Installation Contracting

Rotating Electrical Machines Association (BEAMA Ltd.)

Zinc Development Association

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The following BSI references relate to the work on this standard:
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Contents

Foreword

This British Standard has been prepared under the direction of the Power Electrical Engineering Standards Committee. It is based on a proposal by the British Electrical Systems Association.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself 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 8, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

0 Introduction

The metal channels, brackets and other metal components of the system covered by this standard are used to make load-bearing frameworks. The assessment of load-bearing capabilities involves principles of analysis covered by BS 5950-5, as well as certain other considerations outlined in this standard.

The designer of an installation needs to know the properties of sections and strength of materials of the components used in manufacture. He also needs data on the performance characteristics of some components. All these data should be readily available from the supplier.

1 Scope

This British Standard specifies requirements and type tests for channels, brackets and other metal components used in metal channel systems intended for the mechanical support of cables, cable tray, cable ladder and other equipment in an electrical installation.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

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

2.1
channel

a formed component of regular cross section, the longitudinal edges of which are turned inwards through 180° to form a "U" shape (see standard sheet 1)

2.2
brackets

devices designed to provide mechanical strength to the joints when used to connect channel together to form framework

2.3
channel nut

an internally threaded device designed to fit inside the channel at any point along its length, providing a means of attachment

2.4
channel tee bolt

an externally threaded device designed to fit inside the channel at any point along its length, providing a means of attachment

2.5
axis X-X

the axis that passes through the centroid of the section and is parallel to the open face of the channel (see standard sheet 1)

2.6
axis Y-Y

the axis that passes through the centroid of the section and is perpendicular to the axis X-X (see standard sheet 1)

2.7
multiple configuration

an arrangement of single channels which are joined down their length (see Figure 1)

2.8
stainless steel

a steel having increased and inbuilt corrosion resistance in the uncoated state due to the properties imparted to the steel during manufacture by the addition of between 10 % and 35 % chromium

2.9
plain steel

a steel of the non-stainless type which has not been given a separately applied protective coating against corrosion

2.10
special finish

any finish except hot-dip or other zinc coating

3 Design data and calculation of safe working loads

3.1 General

The component data listed in **3.2** to **3.6** shall be provided by the manufacturer.

3.2 Channel

NOTE 1 The values will be either the nominal manufacturing dimensions or calculated from them.

NOTE 2 Where the section has holes along its length this should be taken into account.

a) Mass per unit length of section (in kg/m).

b) Overall height and width of section (in mm).

c) Thickness of material (in mm).

d) Area of section (in mm^2).

e) Size and location of any holes (in mm).

f) Position of centroid of section (in mm).

g) Second moment of area of section about X-X and Y-Y axes (in mm^4).

h) Minimum yield stress of the material (in N/mm^2) (see BS 18).

i) Minimum ultimate tensile strength (in N/mm^2).

3.3 Beam and column load data

Beam and column load data which shall be determined in accordance with BS 5950-5.

3.4 Brackets

a) Nominal thickness of material (in mm).

b) Minimum yield stress of the material (in N/mm^2) (see BS 18).

c) Minimum ultimate tensile strength (in N/mm^2).

d) Size and location of any holes (in mm).

e) Nominal dimensions (in mm and degrees).

f) Mass (in kg).

3.5 Channel tee bolts

a) Size and grade of channel tee bolt to BS 6105 or BS 4190.

b) Thread details.

3.6 Safe working loads

a) Safe working slip load (in N) (see **8.1**).

b) Size and grade of channel nut and set screw.

c) Tightening torque (in N m).

d) Finishes of all items.

e) Force to produce 1 mm movement (in N).

f) Recommended safe working pull-out load (in N) (see **8.2**).

4 Construction

Multiple configurations shall be produced by welding in accordance with BS 5950-5.

NOTE See Figure 1 for examples of multiple configurations.

Screws and hexagon nuts shall either have a washer face or shall be used in conjunction with washers.

5 Process of manufacture and protective coating

5.1 Channels and brackets

Channels shall be manufactured from steel complying with BS 1449 or BS 2989.

When tested in accordance with BS 18 steel for the formation of channels shall have a minimum yield strength of 250 N/mm^2.

Brackets shall be manufactured from steel complying with BS 970, BS 1449 or BS 4360.

When tested in accordance with BS 18 steel for the formation of brackets shall have a minimum yield strength of 170 N/mm^2.

The finish for channels and brackets shall be either a zinc coating or a special finish.

NOTE 1 Zinc coating is the preferred finish.

Zinc coating shall be applied either after manufacture or components shall be manufactured from steel that has been zinc coated.

If zinc coating is applied to channels after manufacture it shall be hot-dip zinc coated in accordance with BS 729. If zinc coating is applied to brackets after manufacture it shall comply with BS 729 or BS 1706.

Material that has been zinc coated and is used for the manufacture of components in accordance with this standard shall comply with BS 2989.

In the case of hot-dip zinc coated channel, edges exposed by shearing, cutting, etc. shall be protected by the application of a zinc-rich paint complying with BS 4652.

NOTE 2 In the case of pre-zinc coated channel, edges exposed by shearing, sawing, etc., are permitted. However where the integrity of the corrosion protection is impaired by welding it is permissible to apply zinc-rich paint complying with BS 4652 to the affected area.

5.2 Bolts, hexagon nuts, screws and washers

Bolts, hexagon nuts, screws and washers shall be fabricated from steel complying with BS 3692, BS 970, grade A4 of BS 6105 or BS 4190. They shall have a protective coating complying with BS 1706 or the appropriate Part of BS 3382.

6 Dimensions

NOTE 1 The preferred lengths of channel are 3 m $^{+6}_{-0}$ mm and 6 m $^{+6}_{-0}$ mm.

NOTE 2 Tighter tolerances than those specified in **6.1** to **6.5** and note 1 may be agreed between the purchaser and the manufacturer.

6.1 Thickness of channel

Channel shall be either 1.5 mm or 2.5 mm in thickness.

The thickness shall be measured after removal of any hot-dip zinc coated or special finishing and shall comply with the appropriate material tolerances of BS 1449-1 or BS 2989. Tolerances for stainless steel shall comply with BS 1449-2.

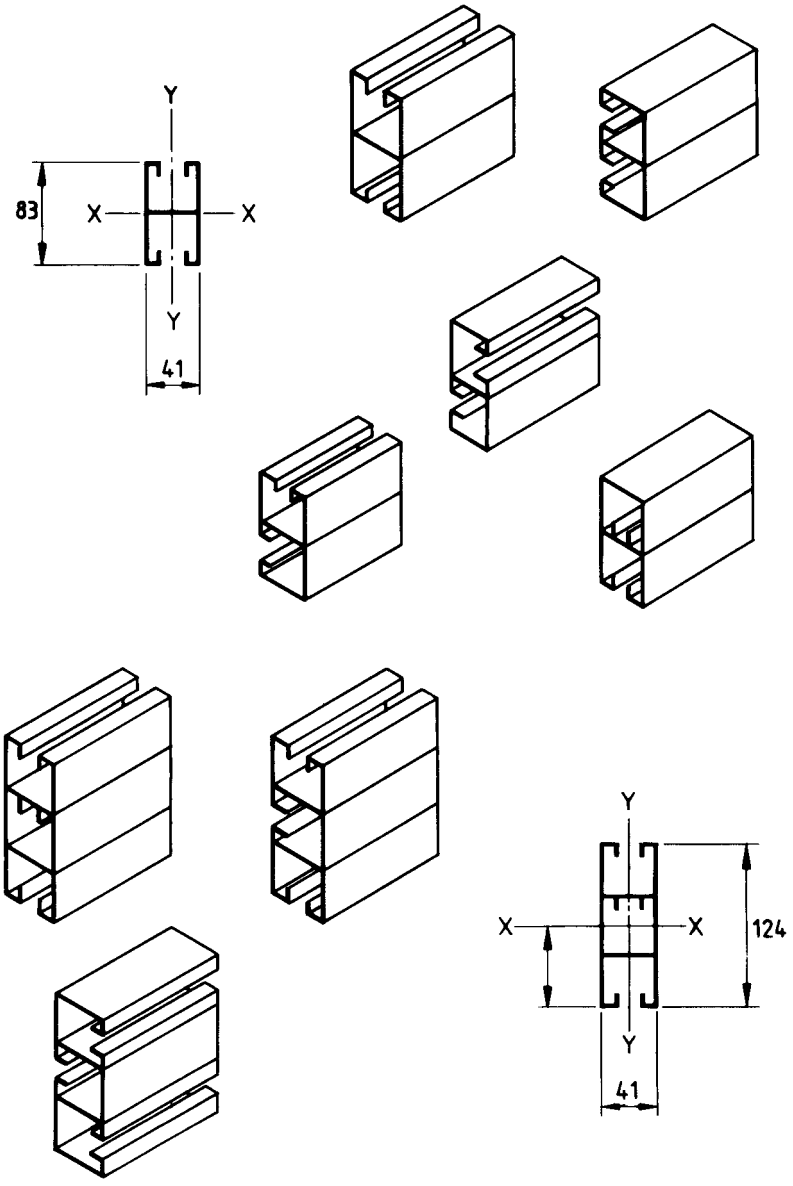
6.2 Sectional dimensions

Channel sections shall have the dimensions and tolerances shown in either (a) or (b) of standard sheet 1, when measured not less than 150 mm from the end of the length.

NOTE In the case of thin gauge channels (1.5 mm thick), ribs are permissible (see Figure 2 for examples).

Squareness and deviation of angle shall be ± 0.5° between adjacent planes when measured not less than 150 mm from the end of the length.

Channel ends shall be not more than 0.5° from square.



NOTE These are typical arrangements showing the use of channel sections in combination.
All dimensions are in millimetres.

Figure 1 — Examples of multiple configurations

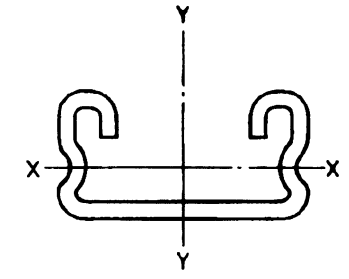


Figure 2 — Examples of ribbed channel sections

6.3 Twist

Twist shall be not greater than 2.5° per metre when measured by clamping one end of the channel to a flat surface and measuring the angle between the flat surface and the same side of the channel at the opposite end of the length (see Figure 3).

6.4 Bowing

Bowing in either the X-X or Y-Y axis shall be not more than 5 mm for channel 3 m in length or 10 mm for channel 6 m in length, when measured at the centre of the length (see Figure 4).

6.5 Brackets

Where brackets have stated angles, the tolerances on these angles shall be ± 1°.

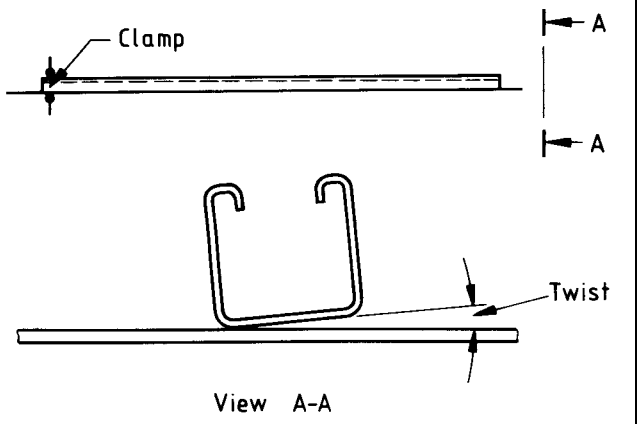


Figure 3 — Measurement of twist

7 Provision of test samples

7.1 Tests according to this standard shall be type tests.

7.2 Two sets of three samples each shall be provided. The tests shall be carried out on one set of three samples.

7.3 If one sample fails out of the first set of samples the test shall be repeated on the other set of three samples. All three test samples shall satisfy the requirements of clause **8**.

8 Requirements for safe working loads

8.1 Safe working slip load

8.1.1 *Requirement*. When tested in accordance with **8.1.2**, the force required to give continuous slip shall be not less than three times the safe working slip load given by the manufacturer [see **3.6** a)].

8.1.2 *Slip test*. Secure a hot-dip zinc coated steel plate having dimensions of 40 mm × 40 mm × 6 mm centrally to an open face of a channel 300 $^{+6}_{-0}$ mm long, complying with this standard, using a standard channel tee bolt or channel nut, with appropriate nut or set screw, and tighten to a torque stated by the manufacturer [see **3.6** c)].

Apply a slowly increasing force to the steel plate as shown in Figure 5.

Note the force to give 1 mm slip. Note the force to give continuous slip.

NOTE If fixings are used at or close to the end of a channel, care should be taken to ensure that the nut correctly engages with the channel.

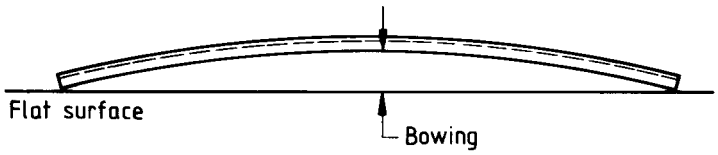


Figure 4 — Measurement of bowing

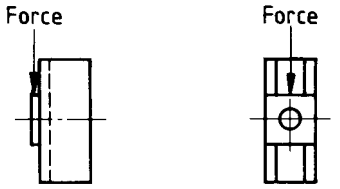


Figure 5 — Slip test

8.2 Safe working pull-out load

8.2.1 *Requirement*. When tested in accordance with **8.2.2**, the ultimate failure force shall be a minimum of three times the safe working pull-out load given by the manufacturer [see **3.6** f)].

8.2.2 *Pull-out test*. Secure a length of channel 300^{+6}_{-0} mm long to a rigid structure giving a free length of channel of 100 ± 5 mm between supports.

Position a steel plate having dimensions of 40 mm × 40 mm × 6 mm centrally between the supports and secure to the open face of the channel using a standard channel tee bolt, or channel nut, with appropriate nut or threaded rod, and tighten to a torque stated by the manufacturer [see **3.6** c)].

Apply a slowly increasing force to the channel tee bolt or threaded rod, as shown in Figure 6.

Record the force at 1 mm movement and also the force at ultimate failure.

9 Marking

9.1 Channels

Channels shall be marked with the following:

a) the manufacturer's or responsible vendor's name, trade mark, or other identifying symbol; and

b) the number and date of this British Standard, i.e. BS 6946:1988[1)].

Marking of the channels shall be repeated at regular intervals of not greater than 3 m.

NOTE Marking should preferably be carried out at intervals of 1 m.

9.2 Brackets and other components

The information given in **9.1** shall be marked on each bracket or shall be marked on a label attached to each carton or box in which brackets are supplied.

For other components, the information given in **9.1** shall be marked on a label attached to each carton or box in which components are supplied.

9.3 Method of marking

Marking shall be applied either by stamping, printing, adhesive labels or water slide transfers.

In the case of printing, marking shall still be legible after being rubbed by hand for 15 s with a piece of cloth soaked with water and again for 15 s with a piece of cloth soaked with petroleum spirit.

NOTE Petroleum spirit is defined as the aliphatic solvent hexane with a content of aromatics of maximum 0.1 % volume, a kauri-butanol value of 29, initial boiling point 65 °C, dry point 69 °C and density 680 kg/m^3.

[1)] Marking BS 6946:1988 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

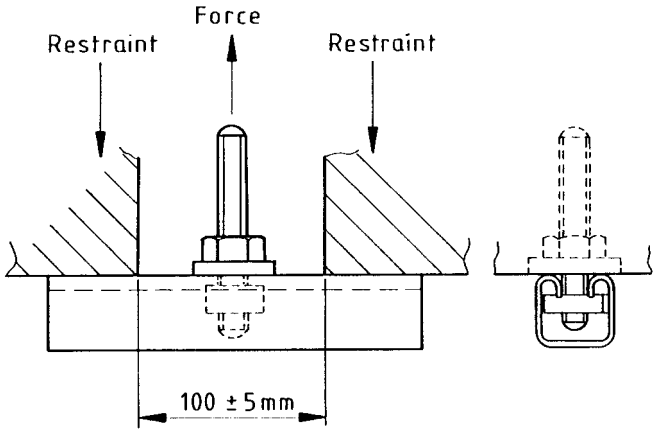
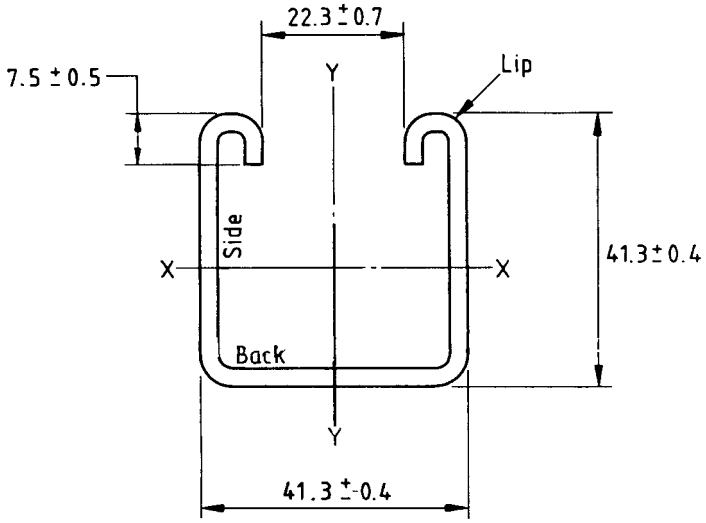


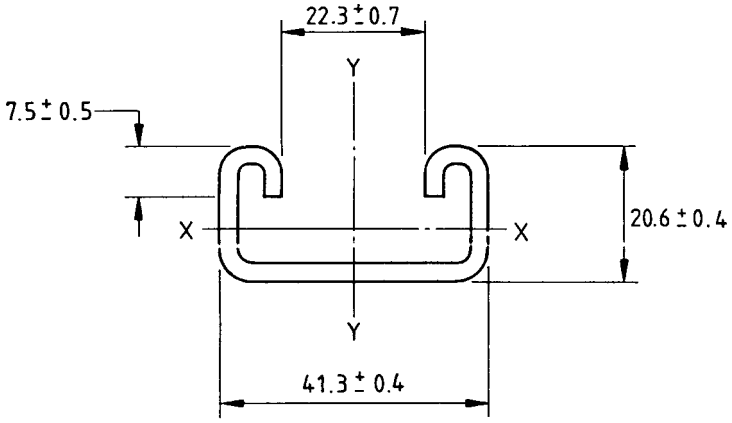
Figure 6 — Pull-out test

Standard Sheet 1

Sizes of channel



(a)



(b)

All dimensions are in millimetres.

NOTE The dimensions shown in (a) and (b) apply to channels either before application or after removal of any protective coating.

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Publications referred to

BS 18, *Method for tensile testing of metals (including aerospace materials).*

BS 729, *Specification for hot dip galvanized coatings on iron and steel articles.*

BS 970, *Specification for wrought steels for mechanical and allied engineering purposes.*

BS 1449, *Steel plate, sheet and strip.*

BS 1449-1, *Specification for carbon and carbon-manganese plate, sheet and strip.*

BS 1449-2, *Specification for stainless and heat-resisting steel plate, sheet and strip.*

BS 1706, *Specification for electroplated coatings of cadmium and zinc on iron and steel.*

BS 2989, *Specification for continuously hot-dip zinc coated and iron-zinc alloy coated steel: wide strip, sheet/plate and slit wide strip.*

BS 3382, *Specification for electroplated coatings on threaded components.*

BS 3382-1 & BS 3382-2, *Cadmium on steel components. Zinc on steel components.*

BS 3382-3 & BS 3382-4, *Nickel or nickel plus chromium on steel components. Nickel or nickel plus chromium on copper or copper alloy (including brass) components.*

BS 3382-5 & BS 3382-6, *Tin on copper and copper alloy (including brass) components. Silver on copper and copper alloy (including brass) components.*

BS 3382-7, *Thicker platings for threaded components.*

BS 3692, *Specification for ISO metric precision hexagon bolts, screws and nuts. Metric units.*

BS 4190, *Specification for ISO metric black hexagon bolts, screws and nuts.*

BS 4360, *Specification for weldable structured steels.*

BS 4652, *Specification for metallic zinc-rich priming paint (organic media).*

BS 5950, *Structural use of steelwork in building.*

BS 5950-5, *Code of practice for design of cold formed sections.*

BS 6105, *Specification for corrosion-resistant stainless steel fasteners.*

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