BRITISH STANDARD

BS 7906-2:2000

Incorporating Corrigendum No. 1

Lifting equipment for performance, broadcast and similar applications —

Part 2: Code of practice for use of aluminium and steel trusses and towers

ICS 53.020.99; 91.080.10; 97.200.10

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee MHE/3, Cranes and derricks, to Subcommittee MHE/3/13, Lifting equipment for performance, broadcast and similar applications, upon which the following bodies were represented:

Association of British Theatre Technicians
Broadcasting Entertainment Cinematograph and Theatre Union
H.S.E
ITV Association (ITVA)
Lifting Equipment Engineers Association
Professional Lighting and Sound Association
Safety Assessment Federation Ltd
Theatres Advisory Council

This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 July 2000

The following BSI references relate to the work on this standard:
Committee reference MHE/3/13
Draft for comment 99/706163 DC

ISBN 0 580 33162 8

Amendments issued since publication

Amd. No.	Date	Comments
11026 Corrigendum No. 1	July 2000	Corrections to inside front cover. Other corrections indicated by a sideline in the margin.

Contents

Foreword

This British Standard has been prepared by Subcommittee MHE/3/13, Lifting equipment for performance, broadcast and similar applications.

There are no specific British Standards that cover the design, manufacture and use of aluminium or steel trusses in the entertainment industry. It should be noted that other British Standards may be relevant, depending on the application and intended use.

In an attempt to improve safety and standards in the entertainment industry, the Entertainment Services and Technology Association (ESTA) of New York, USA, convened a series of meetings to prepare a draft standard for the American National Standards Institute. The preparation of the draft standard was entrusted to the Truss Team working as part of the Rigging Work Group for the Technical Standards Committee (TSC) of ESTA. The Truss Team generally consisted of manufacturers and their structural engineering advisors.

This British Standard is based on the American draft standard.

It has been assumed in the drafting of this British Standard that it is used by suitably qualified and experienced people and organizations.

This British Standard provides a coordinated set of recommendations that can also be a guide to government and other regulatory bodies and municipal authorities responsible for guarding and inspection of the equipment falling within its scope.

Safety codes and standards are intended to enhance public safety. Revisions result from committee consideration of factors such as technology advances, new data, and changing environmental and industry needs. Revisions do not imply that previous editions were not adequate.

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 7 and a back cover.

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

Sidelining in this document indicates the most recent changes by amendment.

1 Scope

This British Standard provides recommendations on the use of aluminium and steel trusses, towers and associated structural components such as tower head blocks, sleeve blocks, bases, and corner blocks in the entertainment industry. This British Standard covers truss beams and two dimensional ladder beams but does not cover individual, separate rigging hardware (half couplers, shackles, wire ropes, etc.).

This British Standard covers a variety of uses that are confined to the entertainment industry and applies to a range of structures subjected to normal atmospheric conditions.

This British Standard does not cover the use of curved shell structures or structures subjected to severe thermal or chemical conditions. This British Standard is not intended to be used for the design of containment vessels, airborne structures, or vessels, or for any application covered by another standard.

Requirements for design and manufacture of the equipment covered by this British Standard are given in BS 7905-2.

Wherever "truss" is referred to in this British Standard, it equally applies to "tower" and vice versa. "Truss" also applies to associated structural components.

2 Normative references

The following normative document contains provisions that, through reference in this text, constitute provisions of this British Standard. Subsequent amendments to, or revisions of, this publication do not apply.

BS 7905-2:2000, *Design of lifting equipment for performance, broadcast and similar applications — Part 2: Specification of trusses and towers.*

3 Definitions

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

NOTE Figure 1 shows some components of a typical truss or tower module.

3.1

abrasion

loss of material due to wear

3.2

allowable load

maximum static equivalent load imposed on truss/tower in addition to the self-weight

3.3

ancillary

supplementary

3.4

camber

intended vertical deviation of a truss, usually radiused

3.5

chord

element of a truss or tower module that carries axial forces associated with flexure or axial loading

3.6

competent person

person with sufficient practical and theoretical knowledge and experience to carry out the person's duties, and who is aware of the limits of the person's competency, expertise and knowledge

3.7

connecting plates

plates welded to the end frames of a truss or tower module, used to connect adjacent modules together

3.8

crack

crevice type discontinuity in a material

3.9

damage

condition that adversely affects the intended use of a truss module (usually load carrying capacity)

3.10

dent

local deformation resulting in measurable change in cross section of member or element

3.11

diagonal

element of a truss or tower module that is at an angle to the main chords

3.12

dye penetrant test

standard non-destructive test that highlights cracks in welds

3.13

lacing member

secondary member between chords

3.14

manufacturer

person or company who fabricates truss/tower modules or systems

3.15

module

singular framed structure built up entirely from tension and compression members, arranged in panels so as to be stable under load

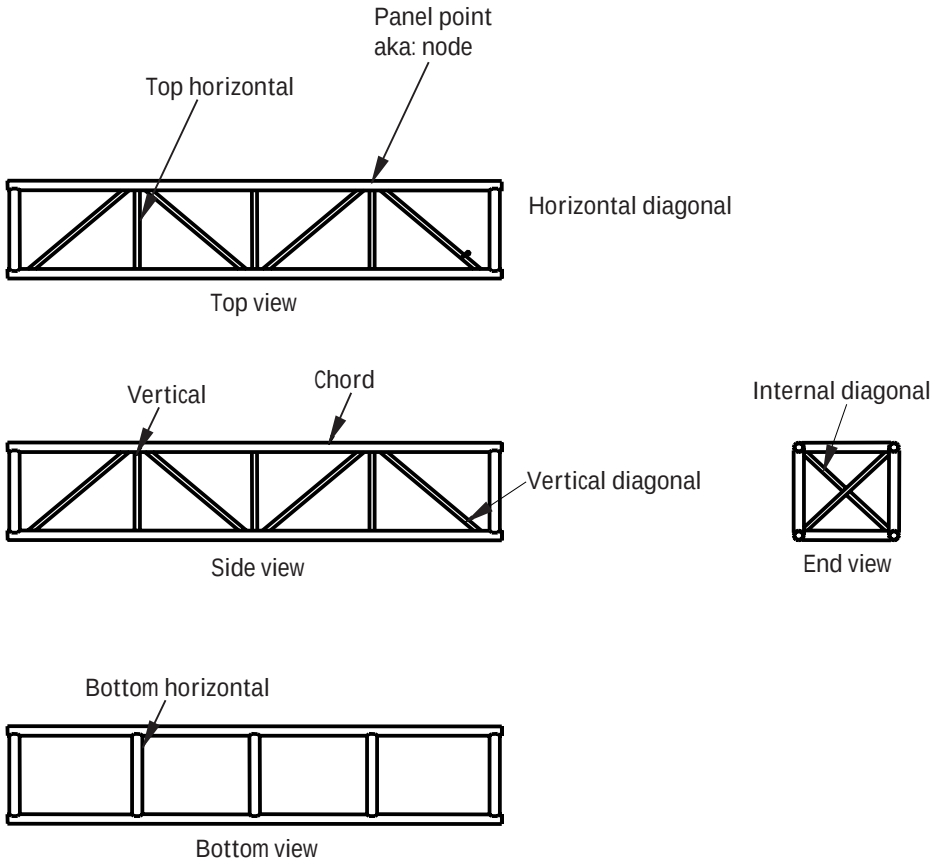

Figure 1 — Components of a typical truss or tower module

3.16

panel point

junction of one or more lacing members with a chord

3.17

pinned connection

end tube connection that uses a removable pin to connect truss modules

3.18

qualified person

person who, by possession of a recognized degree or certificate of professional standing, or who by extensive knowledge, training, and experience, has demonstrated the ability to solve problems relating to the subject matter and work

3.19

regular service

normal use with repetitive assembling and dismantling

3.20

skin

material cover to a truss structure

NOTE A skin is normally used on a roof system.

3.21

sweep

intended lateral deviation of a truss, usually radiused

3.22

tower

one or more modules, usually square or triangular, assembled vertically to carry primarily axial load

3.23

truss

one or more modules, generally horizontal, assembled to carry load over a distance, primarily in flexure

3.24

user

person or company who assembles or uses truss or tower modules or systems

4 Manufacturer's guidelines and recommendations

The manufacturer's guidelines and recommendations on usage should be complied with at all times unless otherwise recommended by a qualified person.

If the proposed use is not covered by the manufacturer's recommendations, a qualified person should be consulted.

The allowable loads, bending moments and shear forces specified by the manufacturer should not be exceeded unless otherwise recommended by a qualified person.

5 Applied loads

5.1 The user should assess all loads on the fully assembled truss system. Full consideration should be made of the weight of all equipment, including, but not limited to, any motors, light and sound equipment, multicore cables, follow-spot chairs, temporary personnel occupancy, and reactions from fall protection lines.

5.2 The user should consider the following:

a) disposition of the loads on the trusses, and whether they are evenly balanced beneath the centreline of the truss, or, as is more often the case, whether they are mainly concentrated to one side or other;

b) the increase in weight of the multicore cables towards the point of entry of the cables onto the trussing;

c) the possible dynamic effects on the trusses from raising and lowering of the suspended equipment, or from raising and lowering of the completed truss system;

d) the wind forces that could be applied to the truss system during erection, when complete and when in an unloaded as well as the fully loaded state (it is essential that consideration is given to the wind forces from items attached to the truss structure, e.g. banners, roof skins, sound and lighting equipment, projection screens, scenery);

e) the effects of changes in temperature during use of the truss system, of the weight of any snow on the system or any covering, of the possibility of seismic action affecting the overall stability of the system, and the possibility of accidental impact damage when the system is operational;

f) the most suitable way to attach hardware so as not to cause damage.

6 Handling

6.1 Individual modules and fully assembled trusses, and any ancillary components that form part of a complete system, should be carefully handled to avoid impact damage or abrasion.

6.2 Trusses should not be dragged. Trusses should be carried or moved on dollies or trolleys, and laid down carefully.

6.3 Trusses should be properly secured and supported during transportation, and should be stacked with spacers between successive heights to limit abrasion.

6.4 End connections should be protected from damage.

7 Erection

7.1 Detailed layout drawings and calculations should be prepared to cover each time the trussing is to be used, and should include the following information:

a) accurate overall dimensions;

b) distribution and/or location of applied loads;

c) location of suspension points.

7.2 Care should be taken to ensure that trussing is assembled and erected correctly in accordance with the layout drawings and calculations.

7.3 Truss modules should be inspected before assembly in accordance with clause **8**. Truss modules should be assembled, joined together, and erected by competent persons.

7.4 If the trusses are to be supported on towers that form part of the complete trussing system, a full assessment should be made, by a qualified person, of the load-carrying abilities of the ground on which the towers are to be erected. The ground should be improved if required to provide a suitable bearing surface. Spreader plates should be provided beneath the tower bases if required.

7.5 If the trusses are to be suspended from the roof beams or other structure within an existing building, or from a framework that is not part of the complete trussing system, then a full assessment should be made, by a qualified person, of the roof beams or other structure. The position of the suspension points should be moved to the optimum, as appropriate, or suitable strengthening measures should be made to the existing structure.

NOTE Lifting and suspension of trusses should be carried out in accordance with BS 7906-1 (under preparation).

7.6 After initial erection, the truss assembly should be inspected by a competent person.

8 Inspection

NOTE This clause provides minimum inspection routines and guidelines for the truss user. Although every effort is made to provide a thorough list of situations and inspection criteria, a complete list is beyond the scope of this British Standard.

8.1 General

Advice should be sought by the user for specific inspection routines from the manufacturer or a qualified person. Inspection routines should define the level and frequency of the inspections.

8.2 Inspection levels

8.2.1 *Initial inspections*

When first acquired, either new or used, truss modules should be inspected, in accordance with **8.4**, and a record of the inspection maintained.

8.2.2 *Regular inspections*

Regular visual inspections should be carried out in accordance with **8.4**.

Regular inspections should be performed by a competent person and should be carried out prior to each use and after any incident that could damage the truss system.

8.2.3 *Periodic inspections*

Periodic visual inspections should be carried out in accordance with **8.5**, and a record of the inspections maintained.

Periodic inspections should be performed by a qualified person and should be conducted at least once each year or in accordance with an inspection routine established by a qualified person.

8.3 Inspection frequency

8.3.1 *Truss in regular service*

Truss modules in regular service should be subjected to regular and periodic inspections (see **8.2.2** and **8.2.3**).

8.3.2 *Truss not in regular service*

Truss modules not in regular service should be inspected with regard to the conditions of storage when returned to service. If the equipment has been stored correctly, an inspection should be carried out in accordance with **8.4**. If the equipment has not been stored correctly, an inspection should be carried out in accordance with **8.5**.

8.3.3 *Permanent installations, stationary*

Periodic inspections should be carried out on all truss modules that are permanently installed in a stationary (non-movable) configuration. The frequency of inspections should be determined based on the prevalent conditions.

8.3.4 *Permanent installations, moving*

Periodic inspections should be carried out every three months, or in accordance with an inspection routine established by a qualified person, on all truss modules that are installed in a permanent configuration where movement of the truss system is an integral part of use.

8.4 Regular inspection procedure

The following items should be checked during a regular inspection:

a) chords for:
   dents;
   bends;
   abrasion;
b) diagonals for:
   dents;
   bends;
   abrasion;
   missing members;
c) connecting plates (if used) for:
   flatness;
   deformation or excessive wear of holes;
d) pinned connectors (if used) for:
   deformation;
e) welds for:
   cracks by visual inspection (100 % of fillet and butt welds);
   abrasion by inspection (100 % of fillet and butt welds);
f) fasteners (bolts, pins) for:
   correct grading (matching);
   deformation;
   excessive wear;
g) geometry of truss for:
   twisting;
   squareness;
   bending.

8.5 Periodic inspection procedure

The following items should be checked during a periodic inspection:

a) chords for:
   dents;
   bends;
   abrasion;
   corrosion;
b) diagonals for:
   dents;
   bends;
   abrasion;
   corrosion;
   missing members;
c) connecting plates (if used) for:
   flatness;
   deformation or excessive wear of holes;
   corrosion;
d) pinned connections (if used) for:
   excessive abrasion;
   deformation of connection pin holes;
   method of connection to truss;

e) welds for:

cracks by visual inspection (100 % of fillet and butt welds);

abrasion by visual inspection (100 % of fillet and butt welds);

NOTE Dye penetrant testing should be carried out by a qualified person on any weld that could be defective.

f) fasteners (bolts, pins) for:

correct grading (matching);

deformation;

excessive wear;

g) geometry of truss for:

twisting;

squareness;

bending;

sweep;

camber.

8.6 Records

Records of initial inspections and periodic inspections should be kept by the owner for each truss module and should be signed and dated by the person carrying out the inspections.

8.7 Repairs and removal from service

8.7.1 If any member shows significant visible damage or is suspected to contain a damaged element (visible or not), the truss should be removed from service and marked accordingly. A qualified person should carry out an assessment of the truss.

8.7.2 Any module that contains damage deemed unrepairable should be permanently removed from use.

8.7.3 Damaged modules should be clearly and permanently marked accordingly.

8.7.4 Repairs should be carried out by a qualified person.

blank

Bibliography

BS 5950 (all parts), *Structural use of steelwork in building.*

BS 6399 (all parts), *Loading for buildings.*

BS 7905-1, *Design of lifting equipment for performance, broadcast and similar applications — Specification for above stage equipment (excluding towers and trusses)* (under preparation).

BS 7906-1, *Use of lifting equipment for performance, broadcast and similar applications — Code of practice for installation, use and removal of above stage equipment (excluding towers and trusses)* (under preparation).

BS 8118-1 (all parts), *The structural use of aluminium.*

The Event Safety Guide — Guide to Health, Safety and Welfare at Music and Similar Events. Ref. no. HSG 195, HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA.

Manual Handling, HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA.

Safe Use of Lifting Equipment, HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA.

Safe Use of Work Equipment, HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA.

Temporary Demountable Structures, Institution of Structural Engineers.

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL