# Adjustable telescopic steel props — Product specifications, design and assessment by calculation and tests

The European Standard EN 1065:1998 has the status of a
British Standard

ICS 91.220

# National foreword

This British Standard is the English language version of EN 1065:1998.

The UK participation in its preparation was entrusted by Technical Committee B/514, Access and support equipment, to Subcommittee B/514/28, Props, tubes and couplers, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

This British Standard, together with BS 4074:1999 (in course preparation), will supersede BS 4074:1982, and partially supersede BS 5507-3:1982 which is currently under revision. The revised edition of BS 5507-3 will descibe methods of determining the characteristic resistance of adjustable props not conforming to BS EN 1065. BS 4074:1999 covers steel trench struts.

This standard provides the user with a greatly enlarged choice of props. It is recommended, therefore, in the interests of maximizing site utilization, length compatibility with existing props, and as an aid to economic prop manufacture, that users should give preferential consideration to sizes 25, 30, 35, 40 and 50 in either B or C strength grades and to either F2 or F4 corrosion protection methods. Additionally, the use of loose forkheads is recommended.

It is recommended that, if a pin has any reduction in its nominal cross section (such as holes for cables or chains), a means should be provided to ensure that this portion of the pin is always outside the collar nut major diameter.

The principal changes from BS 4074:1982 and points of significance are as follows:

a) Steel trench struts (previously known as trench struts) are not covered.

b) Advice on safe working loads is not included. It is envisaged that the next amendment to BS 5975 will contain some advice.

c) Five different strength classes of props are included. Identification is now given by marking on each prop the number of the standard, the name or trademark of the manufacturer, the year of manufacture, the classification, and the prop's compatibility with EN 74 couplers. The prop may also have the classification identified by profiling the endplates. When required (see annex E) the level of inspection and/or the sign of the independent certification system also have to be marked.

d) Five methods of corrosion protection are given.

e) Props are classified according to their fully extended lengths which range from 2,5 m to 5,5 m in 0,5 m intervals. Fully closed lengths of props are no longer specified but all props have at least 1,0 m of adjustment.

f) Props having a fully closed height of less than 1,5 m are no longer included.

g) A test to verify that the component parts of adjustable telescopic steel props do not become inadvertently disengaged in use has been added.

h) There is a minimum linear clearance of 100 mm between the inner and outer tubes intended to form an anti-hand trapping gap when the prop is in the fully closed position.

i) The minimum permissible end plate bearing area is reduced.

j) A maximum clearance between threads is now specified.

k) There is a minimum material thickness for all prop components.

l) The use of rimming steel is no longer permitted.

m) Geometric designed props are no longer included.

n) Verification of the nominal characteristic resistance of an individual prop design may also be by calculation.

o) Information about independent prototype assessment is included in annex D.

**Cross-references**

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

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.

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**Summary of pages**

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## Amendments issued since publication

| Amd. No. | Date | Comments |
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# EUROPEAN STANDARD

# NORME EUROPÉENNE

# EUROPÄISCHE NORM

**EN 1065**

September 1998

English version

## Adjustable telescopic steel props — Product specifications, design and assessment by calculation and tests

Etais télescopiques réglables en acier — Spécifications du produit, conception et évaluation par calculs et essais

Baustützen aus Stahl mit Ausziehvorrichtung — Produktfestlegungen, Bemessung und Nachweis durch Berechnung und Versuche

This European Standard was approved by CEN on 10 June 1998.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

## CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

**Central Secretariat:  rue de Stassart, 36   B-1050 Brussels**

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## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 53, Temporary works equipment, the Secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 1999, and conflicting national standards shall be withdrawn at the latest by March 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

## Introduction

Whilst this European Standard deals with the more common types of adjustable telescopic steel props in use, it is not intended to prevent development of other types of props. For example, props may have hinged ends or other length adjustment devices or be made of other materials. Whilst such props cannot comply with this European Standard it is recommended that the principles of this European Standard be considered in the design and assessment of such props.

The characteristic strength values specified in this European Standard form a reference level which is unsafe for direct site use. It is a matter for a separate European Standard to relate these characteristic strengths to safe site usage by applying suitable partial safety factors $\gamma_M$ and $\gamma_F$. It is also a matter for a separate European Standard to specify the required level of corrosion protection and inspection.

This European Standard is a product standard primarily for use in the field of falsework and formwork.

In cases where the prop is an integral part of a system of soffit support, other design and assessment procedures may be more appropriate or even necessary.

This European Standard gives a number of alternatives, a designation of which is given in clause **5**.

## 1 Scope

This European Standard specifies materials, design requirements, corrosion protection alternatives together with assessment methods using both calculations and testing for open thread and covered thread adjustable telescopic steel props which are intended for use on construction sites (see Figure 1).

It specifies five classes of nominal characteristic strengths for adjustable telescopic steel props each having a series of maximum extended lengths. Each having differing endplate configuration.

This European Standard does not apply to adjustable props of different materials or construction, nor does it provide any information concerning the use of adjustable steel props.

a) Open thread (= DO)   b) Covered thread (= DC)

1 Endplate
2 Outer tube
3 Inner tube
4 Length adjustment device
4.1 Attached pin (see **7.3.6**)
4.2 Collar nut
4.3 Handle
5 Central hole
6 Connection holes
7 Pin hole
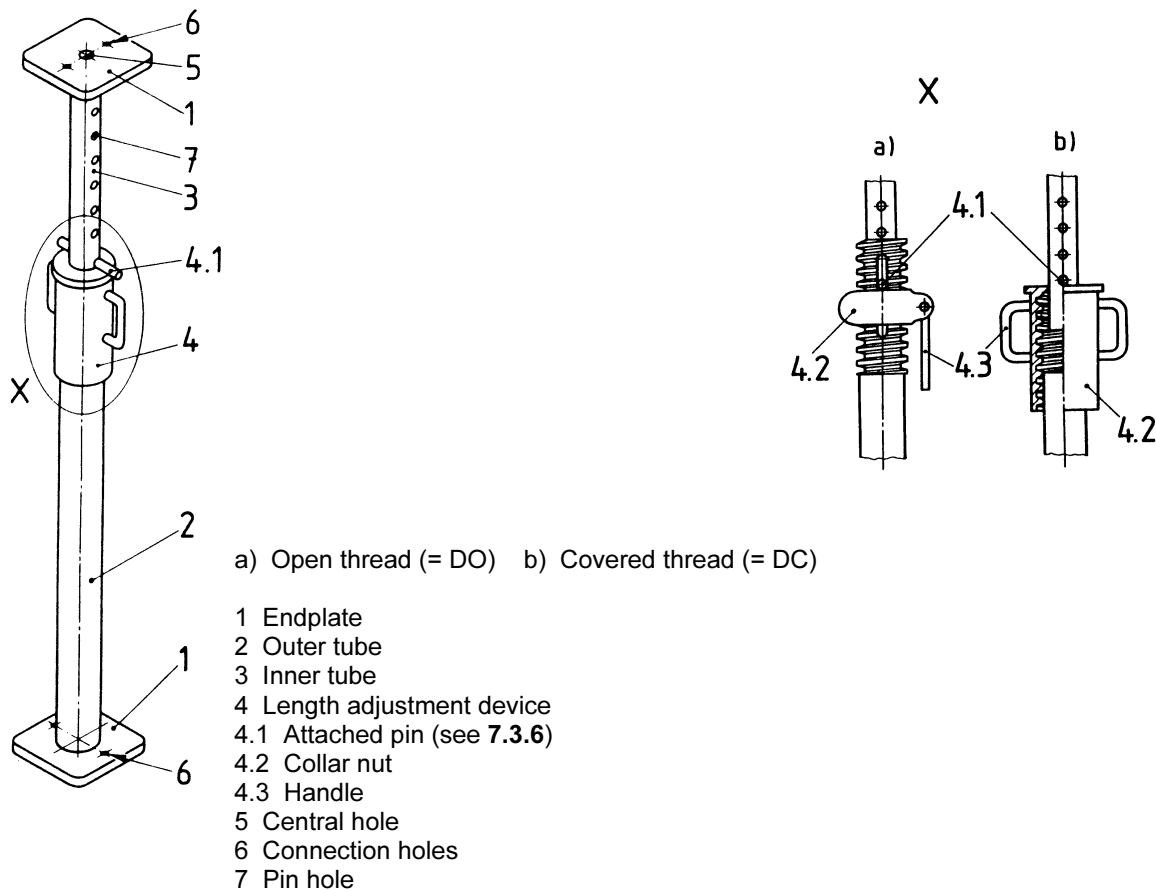
**Figure 1: Adjustable telescopic steel prop**

## 2  Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 74
　　Couplers, loose spigots and base-plates for use in working scaffolds and falsework made of steel tubes – Requirements and test procedures

EN 729-2
　　Quality requirements for welding – Fusion welding of metallic materials – Part 2: Comprehensive quality requirements

EN 1562
　　Founding – Malleable cast irons

EN 1563
　　Founding – Spheroidal graphite cast irons

EN 10002-1
　　Tensile testing of metallic materials – Method of test at ambient temperature

EN 10025
　　Hot rolled products of non-alloy structural steels – Technical delivery conditions

EN 10083-1
   Quenched and tempered steels – Part 1: Technical delivery conditions for special steels

EN 10083-2
   Quenched and tempered steels – Part 2: Technical delivery conditions for unalloyed quality steels

EN 10083-3
   Quenched and tempered steels – Part 3: Technical delivery conditions for boron steels

EN 10113-1
   Hot-rolled products in weldable fine grain structural steels – Part 1: General delivery conditions

EN 10113-2
   Hot-rolled products in weldable fine grain structural steels – Part 2: Delivery conditions for normalized/normalized rolled steels

EN 10113-3
   Hot-rolled products in weldable fine grain structural steels – Part 3: Delivery conditions for thermomechanical rolled steels

EN 10155
   Structural steels with improved atmospheric corrosion resistance – Technical delivery conditions

EN 10204 : 1991
   Metallic products – Types of inspection documents

EN 10210-1
   Hot finished structural hollow sections of non-alloy and fine grain structural steels – Part 1: Technical delivery requirements

EN 10210-2
   Hot finished structural hollow sections of non-alloy and fine grain structural steels – Part 2: Tolerances, dimensions and sectional properties

EN 10219-1
   Cold formed structural hollow sections of non-alloy and fine grain structural steels – Part 1: Technical delivery requirements

EN 10219-2
   Cold formed structural hollow sections of non-alloy and fine grain structural steels – Part 2: Tolerances, dimensions and sectional properties

prEN 39
   Steel tubes for tube and coupler scaffold structures – Technical delivery conditions

ENV 1993-1-1
   Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings

EN ISO 9001
   Quality systems – Model for quality assurance in design, development, production, installation and servicing (ISO 9001)

EN ISO 9002
   Quality systems – Model for quality assurance in production, installation and servicing (ISO 9002)

ISO 2937
   Plain end seamless steel tubes for mechanical application

ISO 3304
   Plain end seamless precision steel tubes – Technical conditions for delivery

ISO 3305
   Plain end welded precision steel tubes – Technical conditions for delivery

ISO 3306
   Plain end as-welded and sized precision steel tubes – Technical conditions for delivery

## 3 Definitions and symbols

For the purposes of this European Standard the following definitions and symbols apply.

**3.1 adjustable telescopic steel prop**: Compression member normally used as temporary vertical support in construction works. A prop consists of two tubes which are telescopically displaceable within each other. A prop has a coarse adjustment with a pin inserted into holes in the inner tube and a means of fine adjustment using a threaded collar (see Figure 1).

**3.2 endplate:** Plate which is fixed at right angles to one end of inner or outer tube.

**3.3 forkhead:** Endplate with lateral projections to locate a beam.

**3.4 collar nut:** Nut which incorporates at least one handle and has one face which supports the pin and is internally threaded to provide fine length adjustment to the prop.

**3.5 inner tube:** The smaller diameter tube provided with holes for the coarse adjustment of the prop.

**3.6 outer tube:** The larger diameter tube one end of which is threaded externally.

**3.7 length adjustment device:** Device consisting of a pin, collar nut, holes in the inner tube and a threaded outer tube.

> NOTE: The forces from the endplate are transferred to the pin inserted in the inner tube holes and to the collar nut which transfers the forces to the outer tube thread. In some prop designs an additional loose washer is used between the pin and the collar nut.

**3.8 pin:** The part of the length adjustment device which is inserted through the inner tube holes and is secured to the prop.

**3.9 length at maximum extension:** The distance measured between the outside faces of the endplates when the prop is in the fully extended position.

> NOTE: The prop extension is called "fully open" if the pin is in the hole farthest away from the inner tube endplate and the collar nut is in the uppermost position. The prop extension is called "fully closed" if the pin is in the hole nearest the inner tube endplate and the collar nut is in the lowest position.

**3.10 main symbols:** Symbols are given in Table 1.

### Table 1 — Main symbols

| Number | Symbol | Denomination | Unit |
|---|---|---|---|
| 1 | $D_i$ | Outer diameter of the inner tube | mm |
| 2 | $D_m$ | Collar nut major thread diameter | mm |
| 3 | $d_p$ | Diameter of the pin | mm |
| 4 | $e_{b,core}$ | Eccentricity at the base at which the spring becomes effective | mm |
| 5 | $e_{b,limit}$ | Limit eccentricity at the base | mm |
| 6 | $e_{b,0}$ | Initial eccentricity at the base | mm |
| 7 | $e_t$ | Eccentricity at the top | mm |
| 8 | $f_y$ | Yield strength | N/mm$^2$ |
| 9 | $f_{y,act}$ | Actual yield strength | N/mm$^2$ |
| 10 | $f_{y,nom}$ | Nominal yield strength | N/mm$^2$ |
| 11 | $l$ | Actual extention length of the prop | m |
| 12 | $l_{max}$ | Length of a prop at maximum extension | m |
| 13 | $l_0$ | Overlapping length | mm |
| 14 | $M_{pl}$ | Plastic moment resistance of the cross section | kN $\times$ m |
| 15 | $M_{pl,N}$ | Reduced plastic moment resistance of the cross section | kN $\times$ m |
| 16 | $N$ | Normal (axial) force | kN |
| 17 | $N_{c,i}$ | Ideal buckling force | kN |
| 18 | $N_{pl}$ | Plastic compression resistance of the cross section | kN |
| 19 | $N_{pl,nom}$ | Nominal plastic compression resistance of the cross section | kN |
| 20 | $N_t$ | Normal (axial) force of the tube | kN |
| 21 | $R$ | Strength of a prop | kN |
| 22 | $R_{b,t}$ | Bearing resistance of the tube | kN |
| 23 | $R_{s,p}$ | Shear resistance of the pin | kN |
| 24 | $R_u$ | Failure load of a test | kN |
| 25 | $R_{y,act}$ | Actual characteristic strength of the prop class y where y corresponds to classes A, B, C, D or E | kN |
| 26 | $R_{y,k}$ | Nominal characteristic strength of the prop class y where y corresponds to classes A, B, C, D or E | kN |
| 27 | $V$ | Vertical load | kN |
| 28 | $\Delta\varphi_0$ | Angle of inclination between the inner and outer tube | rad |
| 29 | $\gamma_M$ | Partial safety factor for the resistance | 1 |
| 30 | $\gamma_{M1}, \gamma_{M2}$ | Splitted partial safety factors for the material | 1 |
| 31 | $\gamma_F$ | Partial safety factor for the action | 1 |

# 4 Classification

An adjustable telescopic steel prop shall be classified according to its nominal characteristic strength $R_{y,k}$ and its maximum length $l_{max}$ given in Table 2.

For classes A, B and C props the nominal characteristic strength given in Table 2 shall apply to the maximum extension length. For classes D and E props the nominal characteristic strength given in Table 2 shall apply to all possible extension lengths.

**Table 2 — Classification**

| Class | Length at maximum extension $l_{max}$ m | Nominal characteristic strength (see clause 8) $R_{y,k}$ kN |
|---|---|---|
| A 25 | 2,50 | 20,4 |
| A 30 | 3,00 | 17,0 |
| A 35 | 3,50 | 14,6 |
| A 40 | 4,00 | 12,8 |
| B 25 | 2,50 | 27,2 |
| B 30 | 3,00 | 22,7 |
| B 35 | 3,50 | 19,4 |
| B 40 | 4,00 | 17,0 |
| B 45 | 4,50 | 15,1 |
| B 50 | 5,00 | 13,6 |
| B 55 | 5,50 | 12,4 |
| C 25 | 2,50 | 40,8 |
| C 30 | 3,00 | 34,0 |
| C 35 | 3,50 | 29,1 |
| C 40 | 4,00 | 25,5 |
| C 45 | 4,50 | 22,7 |
| C 50 | 5,00 | 20,4 |
| C 55 | 5,50 | 18,6 |
| D 25 | 2,50 | 34,0 |
| D 30 | 3,00 | |
| D 35 | 3,50 | |
| D 40 | 4,00 | |
| D 45 | 4,50 | |
| D 50 | 5,00 | |
| D 55 | 5,50 | |
| E 25 | 2,50 | 51,0 |
| E 30 | 3,00 | |
| E 35 | 3,50 | |
| E 40 | 4,00 | |
| E 45 | 4,50 | |
| E 50 | 5,00 | |
| E 55 | 5,50 | |

## 5  Designation

Designation of a prop in accordance with EN 1065, class: "B 25", with a minimum extended length: "13" dm, with shaped: "SH" and plain: "O" endplates and a length adjustment device with open thread: "DO", completely hot-dip galvanized with a corrosion protection: "F4" and suitable for attaching EN 74 couplers with steel tubes in accordance with prEN 39 with nominal wall thickness greater than "3" mm and with an ongoing production inspection level "M":

<div align="center">Prop EN 1065 - B25 / 13 - SH0 - DO - F4 - 3 - M[1)]</div>

Description Block

European Standard number block

Classification according to Table 2

Minimum extended length in decimeters
(rounded up to the next whole number)

shaped "SH" endplates see 7.5, no forkhead "0" see 7.6
(possible designations: SH0, SH1, SH2, SQ0, SQ1, SQ2)

Type of lenght adjustment device with open thread "DO", see figure 1a)
(possible designations: DO or DC)

Method of corrosion protection complete hot
dip galvanized: "F4", see Table 3

Suitable for attaching EN 74 couplers with steel tubes in accordance with
prEN 39 with a minimum nominal wall thickness of "3" mm

Type of ongoing production inspection level "M", see annex E (informative)

## 6  Materials

### 6.1  General

Materials shall have a good resistance to, and/or be protected against atmospheric corrosion and shall be free of any impurities and defects which might affect their satisfactory use. Steels of deoxidation type FU (rimming steels) are not permitted.

Materials should be selected from the relevant existing European and International Standards and, whenever applicable, shall be in accordance with the following standards:

Material standards:        EN 10025, EN 10113-1, EN 10113-2, EN 10113-3, EN 10155

Tube standards:            EN 10210-1,  EN 10219-1, prEN 39

Bar standards:             EN 10083-1, EN 10083-2, EN 10083-3

Casting standards:         EN 1562, EN 1563

### 6.2  Modification by cold working

Steel for tubes conforming basically to EN 10025 and modified by cold working may be used provided that

    – the modified yield strength conforms to one of the yield strengths given in EN 10025 or
    – the yield strength amounts to 315 N/mm$^2$ or 395 N/mm$^2$ and
    – the elongation of the modified steel is not less than 18 %
    – the process used can be shown to guarantee these values.

    NOTE: Cold working modifies the structural properties by strain hardening.

## 6.3 Corrosion protection

Props shall be protected against corrosion by one of the methods given in Table 3.

**Table 3 — Methods of corrosion protection**

| Finish grade | Prop components | Corrosion protection |
|---|---|---|
| F1 | Tubes with endplates<br>Collar nut<br>Handle | Painted on the outside with no quality control |
| | Thread<br>Pin and attachment | Self-colour or protected with no quality control |
| F2 | Tubes with endplates<br>Collar nut<br>Handle<br>Thread | Painted on the outside in accordance with prEN 39 |
| | Pin and attachment | Painted with no quality control |
| F3[1] | Tubes<br>Endplates<br>Thread | Zinc coated 15 µm minimum before fabrication |
| | Tube, thread and endplate welds | Zinc coated 15 µm minimum after fabrication |
| | Collar nut<br>Handle<br>Pin and attachment | Zinc coated 15 µm minimum |
| F4 | Tubes with endplates<br>Collar nut<br>Handle<br>Thread[2] | Hot-dip galvanized after fabrication in accordance with prEN 39 |
| | Pin and attachment | Zinc coated 15 µm minimum |
| F5 | All prop components | Special arrangement |
| [1] Edges of holes and slots do not need to be protected.<br>[2] It is not necessary to measure the thickness of zinc in threaded zones. | | |

# 7 Configuration

## 7.1 Tubes

The cross-sections of the tubes should be selected from the relevant existing European or International Standards and, whenever applicable, shall be in accordance with the following standards:

EN 10210-1, EN 10210-2, EN 10219-1, EN 10219-2, prEN 39
ISO 2937, ISO 3304, ISO 3305, ISO 3306

For classes B, C, D and E props the nominal wall thickness of any tube used shall be at least 2,6 mm. For class A props the minimum wall thickness shall be not less than 2,3 mm after taking tolerances into account.

For the purposes of assessment, the method of making holes shall be stated on the drawings.

> NOTE: The preferred method of forming holes is by drilling (see **9.2.4.1**).

It is permissible to either, locally expand the diameter of the tube adjacent and welded to endplate or, add an additional larger diameter tube adjacent and welded to endplate to increase the stiffness of the connection (see also **9.2.3.1**).

## 7.2 Welding

The welding shall be carried out in accordance with EN 729-2.

All fillet welds produced by the metal arc process shall have a minimum throat thickness of 2,5 mm.

Where alternative means of welding are employed (for example friction, or projection welding), the resulting connection shall have an equal or greater weld strength to that produced by the metal arc process.

## 7.3 Length adjustment device

**7.3.1** The nominal minimum wall thickness in the threaded part, $t_r$, shall be 2,3 mm (see Figure 2).

**7.3.2** After taking into account the tolerances the bearing depth of the thread (see Figure 3) shall be:

$\geq$ 0,5 mm for a concentric configuration;
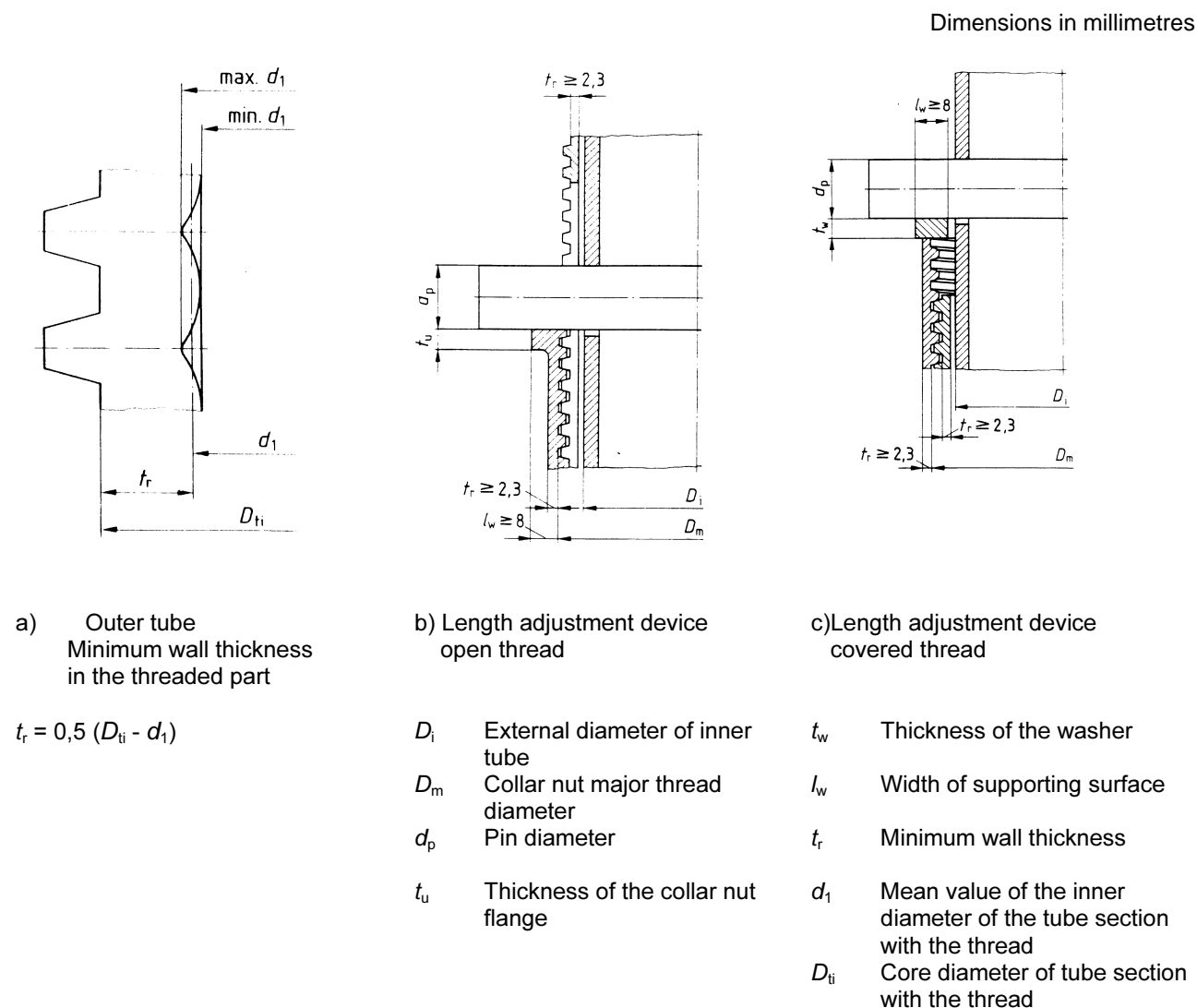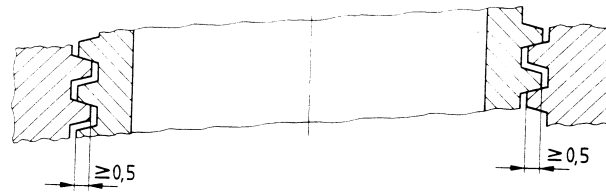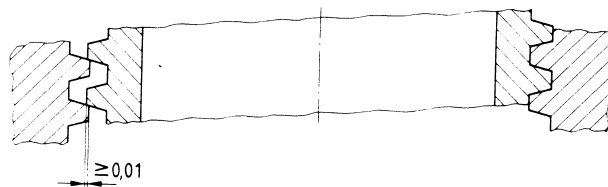$\geq$ 0,01 mm for an eccentric configuration

Dimensions in millimetres



a)     Outer tube
   Minimum wall thickness
   in the threaded part

$t_r = 0,5 \, (D_{ti} - d_1)$

b) Length adjustment device
    open thread

c) Length adjustment device
    covered thread

| | | |
|---|---|---|
| $D_i$ | External diameter of inner tube | |
| $D_m$ | Collar nut major thread diameter | |
| $d_p$ | Pin diameter | |
| $t_u$ | Thickness of the collar nut flange | |

| | |
|---|---|
| $t_w$ | Thickness of the washer |
| $l_w$ | Width of supporting surface |
| $t_r$ | Minimum wall thickness |
| $d_1$ | Mean value of the inner diameter of the tube section with the thread |
| $D_{ti}$ | Core diameter of tube section with the thread |

**Figure 2 — Length adjustment device**

Dimensions in millimetres



a) Concentric configuration



b) Eccentric configuration

**Figure 3 — Thread and collar nut**

**7.3.3** When a prop is assembled with all of its component parts and in the fully extended position, the collar nut shall have a torsional resistance of at least 100 Nm against unintentional disengagement from the outer tube thread.

In any position of a prop, the collar nut shall engage the outer tube thread with at least 30 mm effective axial thread length and for

– class A props with at least three complete turns of the thread in the collar nut,

– classes B, C, D and E props with at least four complete turns of the thread in the collar nut.

**7.3.4** The nominal pin diameter $d_p$ shall not be less than 13 mm.

**7.3.5** Where props have a length adjustment device which meets the following dimensional requirements (see Figure 2) then verification of the characteristic load carrying capacity of the pin and its supports shall be carried out according to **9.4.2.3**:

– The thickness $t_u$ of the collar nut flange or the thickness $t_w$ of the welded washer shall not be less than 5 mm (see Figure 2).

– The width $l_w$ of the collar nut flange or the width $l_w$ of the welded washer shall not be less than 8 mm.

– The nominal pin diameter $d_p$ shall not be less than 14 mm for $t_u \leq 7$ mm.

– With the fine adjustment threads in a Figure 3a) concentric configuration, the unsupported radial length $(D_m - D_i) / 2$ between the external diameter of the inner tube $D_i$ and the collar nut major thread diameter $D_m$ shall not be greater than the half pin diameter $d_p$. For covered thread props the same requirement is valid. If they have a washer welded to the top of the collar nut the unsupported radial length may be calculated by reducing $t_w$ from the collar nut thread diameter $D_m$.

Where props have a length adjustment device which does not meet these requirements then verification of the characteristic load carrying capacity of the pin and its supports shall be carried out to **9.4.2.4**.

**7.3.6** The pin shall be attached to the prop so that it cannot be detached unintentionally, for example by having a cable or chain, or by a special shape.

**7.3.7** Adjustment of the prop by fine adjustment device shall also be possible when the distance between the axis of the prop and a plane wall is only 100 mm.

## 7.4 Permanent prevention against unintentional disengagement

The inner and outer parts of a prop shall be prevented permanently from being separated except by intentional action.

## 7.5 Endplates

**7.5.1** Endplates shall either be square (SQ) or, for identification purposes, be shaped (SH) in accordance with Figure 4.

Endplates shall have at least two holes for connection purposes.

If a central hole (see Figure 1) is required in the endplates it shall have a minimum diameter of 28 mm.

**7.5.2** Plain endplates shall be made of a material having a minimum yield strength of 235 N/mm$^2$ and shall have a minimum thickness:

  6 mm for classes A, B and D props;

  8 mm for classes C and E props.

Profiled endplates shall have a spring stiffness and a bending resistance at least equal to that of plain endplates.

**7.5.3** It shall be possible to draw the following circles on endplates:

  110 mm diameter for class A props;

  120 mm diameter for class B, C, D and E props.

At corners which would otherwise be sharp the radius shall be 5 mm $\leq r \leq$ 10 mm.

## 7.6 Props with fixed forkheads

For props having a forkhead welded to the end of the inner tube, the dimensions and alternative configuration of the forkhead shall be as given in Figure 5 and Table 4. Forkheads shall be manufactured from steel having a minimum yield strength of 235 N/mm$^2$. The rigidity of each side upright of a type 1 (square) forkhead and of each pair of post uprights of a type 2 (rectangular) forkhead shall have a minimum bending resistance of 22 kN $\times$ cm.

>   NOTE: The minimum bending resistance is based on a pair of 14 mm diameter rods having a yield strength of 235 N/mm$^2$.
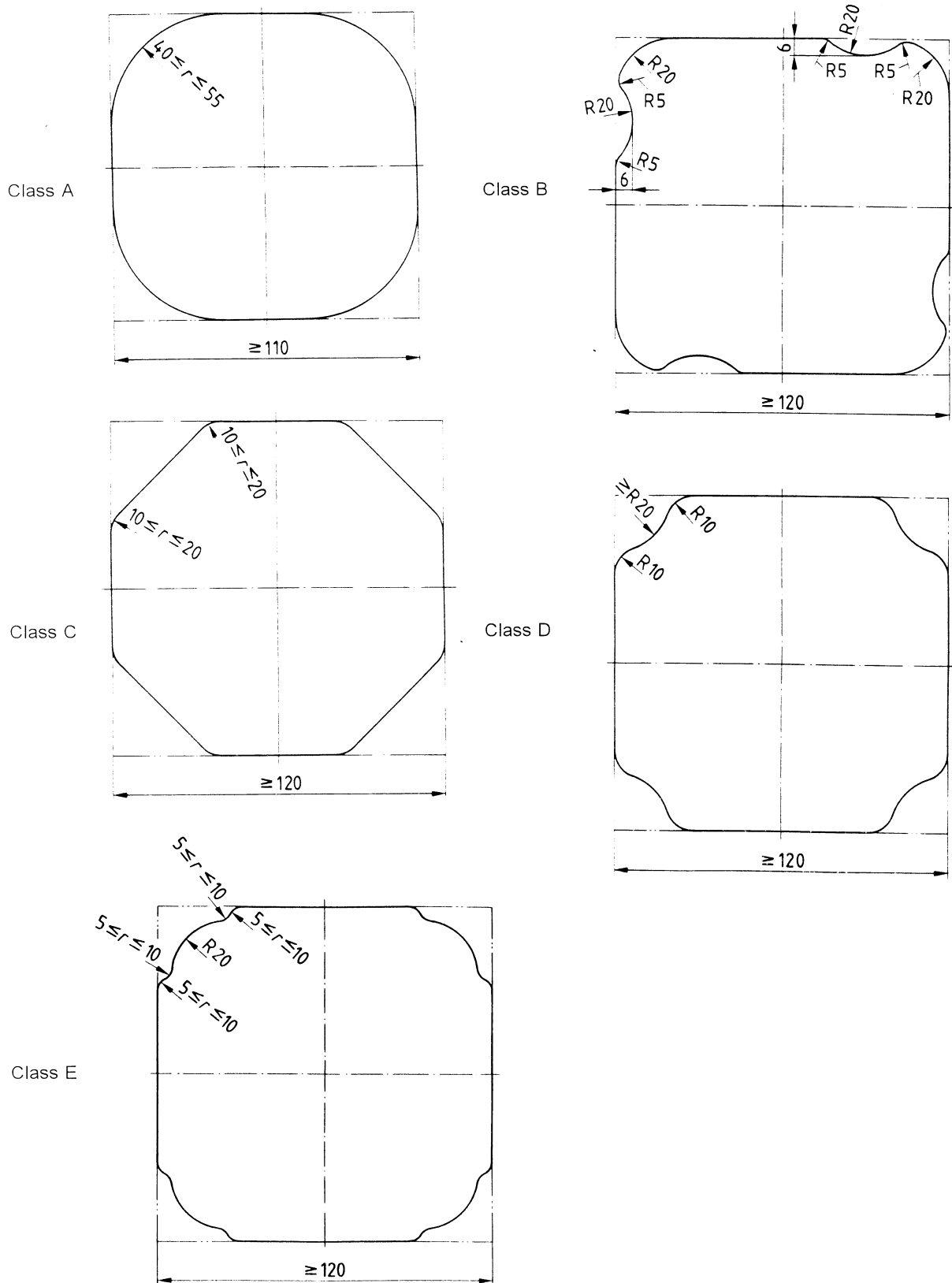
Dimensions in millimetres

Class A

$40 \leq r \leq 55$

$\geq 110$

Class B

R20

R20

R5

6

R20

R5

R5

R20

R5

6

$\geq 120$

Class C

$10 \leq r \leq 20$

$10 \leq r \leq 20$

$\geq 120$

Class D

$\geq R20$

R10

R10

$\geq 120$

Class E

$5 \leq r \leq 10$

$5 \leq r \leq 10$

$5 \leq r \leq 10$

R20

$5 \leq r \leq 10$

$\geq 120$

**Figure 4: Shapes of profiled endplates (SH) for props of different classes**

**Table 4 — Dimensions for forkheads**

| Type | Minimum thickness of the plate<br>mm | Maximum distance between sides upright or claws<br>mm | Minimum height of the sides upright or the claws<br>mm |
|---|---|---|---|
| Type 1 | 8 | 160 | 50 |
| Type 2 | 12 | 160 and 80 respectively | 80 |
| NOTE: This standard does not cover loose forkhead. | | | |

Dimensions in millimetres



type 1 (square)                    type 2 (rectangular)

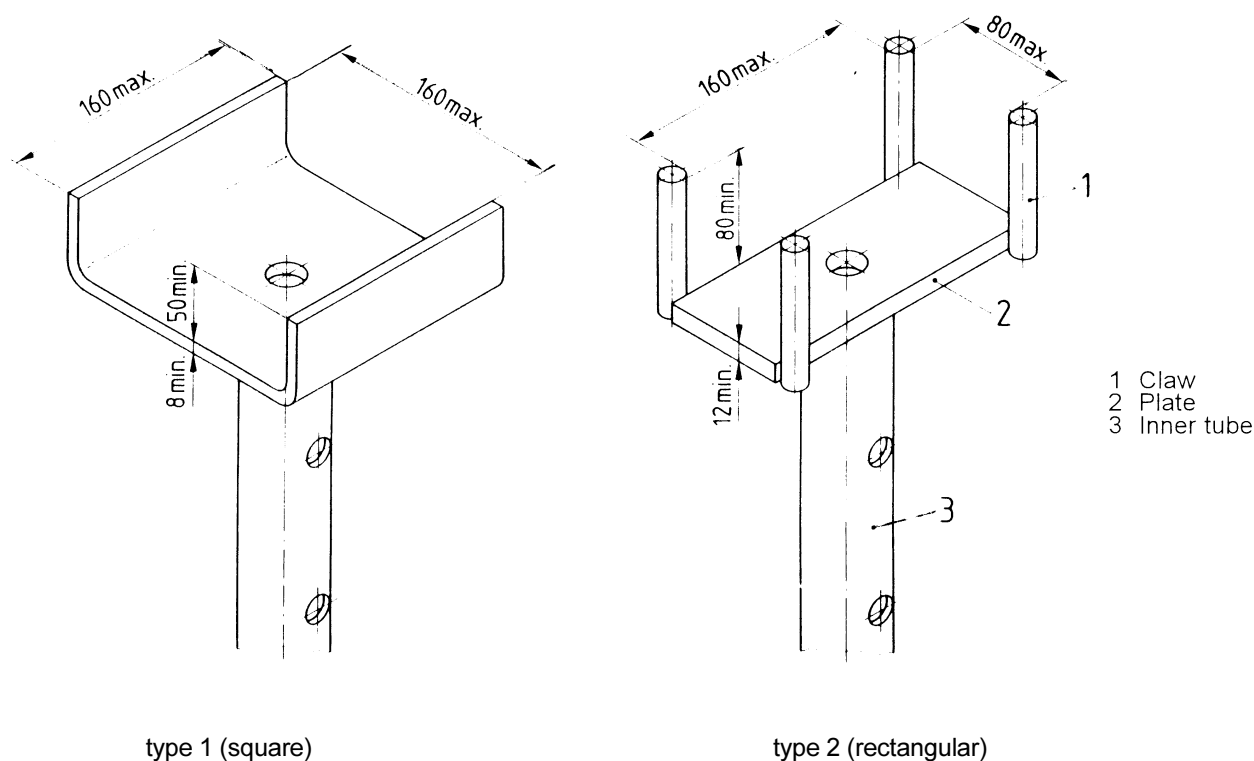1  Claw
2  Plate
3  Inner tube

**Figure 5 — Dimensions of forkheads**

## 7.7  Anti hand trap

When the prop is fully closed without the pin inserted, there shall remain at least 100 mm clearance between the endmost part of the outer tube or the collar nut in the case of a covered thread and the inside of the endplate or forkhead of the inner tube.

## 7.8  Minimum extended length

The distance between the fully open and fully closed prop shall be not less than 1,00 m.

The minimum extended length for the fully closed prop shall be stated by the manufacturer (see clause **5**).

## 7.9 Overlapping length

There shall be an overlapping length between the outer and inner tube, $l_0$, of at least 300 mm when the prop is fully open (see Figure 6).

## 7.10 Data required from the manufacturer

The prop manufacturer shall record the following data:

- shape,
- class,
- minimum extended length,
- essential dimensions with tolerances,
- material characteristics of all components,
- profile of endplate, forkhead,
- type of welding,
- corrosion protection,
- method of hole production,
- marking details,
- type of quality control.

# 8 Nominal characteristic strength

According to the class and to the length at maximum extension a prop shall have the nominal characteristic strength calculated in accordance with the equation below (see also clause **4** and Table 2).

$$R_{A,k} = 51,0 \frac{l_{max}}{l^2} \leq 44,0 \text{ kN} \tag{1}$$

$$R_{B,k} = 68,0 \frac{l_{max}}{l^2} \leq 51,0 \text{ kN} \tag{2}$$

$$R_{C,k} = 102,0 \frac{l_{max}}{l^2} \leq 59,5 \text{ kN} \tag{3}$$

$$R_{D,k} = 34,0 \text{ kN} \tag{4}$$

$$R_{E,k} = 51,0 \text{ kN} \tag{5}$$

where:

$R_{y,k}$ is the nominal characteristic strength for the prop class y in kilonewtons

$l_{max}$ is the length at maximum extension in metres

$l$ is the actual extension length in metres.

# 9 Verification

## 9.1 General

> NOTE: Table 5 lists the main steps in the verification.

The actual characteristic strength of a prop shall either be verified by calculation (see **9.2**) or by tests (see **9.3**) at the manufacturer's discretion.

The characteristic strength of a prop having a plain endplate at each end shall be verified both with the outer tube at the bottom and with the inner tube at the bottom.

The characteristic strength of a prop having a fixed forkhead shall only be verified with the forkhead at the top.

The actual characteristic strength of a prop, $R_{y,act}$, shall be verified at maximum extension, for the classes A, B or C at the fully closed extension and the most unfavourable extension in between also. The most unfavourable extension is the length with the smallest quotient $R_{y,act} / R_{y,k}$.

For all extended lengths, the actual characteristic strength of a prop shall be at least equal to the nominal characteristic strength in accordance with one of the equations (1 through 5) in accordance with clause **8**.

**Table 5 — Verification steps**

| | Property | | Verification method | |
|---|---|---|---|---|
| 1.1 | Actual characteristic strength | | Determined by calculation in accordance with **9.2** | |
| 1.2 | | | Determined by testing in accordance with **9.3** | |
| 2.1 | Pin and its support | Pin: Strength | Prop conforms to **7.3.5** | Determine the shear resistance by calculation in accordance with **9.4.2** |
| 2.2 | | | Prop does not conform to **7.3.5** | Test in accordance with **10.3** |
| 2.3 | | Inner tube: Pin bearing capacity | Determine by calculation in accordance with **9.4.2** | |
| 3 | Unintentional disengagement | | Test according to **10.4** | |

## 9.2 Verification of the actual characteristic strength by calculation

### 9.2.1 General

Calculations shall be carried out in accordance with this European Standard and with ENV 1993-1-1 : 1992, Eurocode 3, in cases where this European Standard gives no requirements.

The global analysis to determine the internal forces and moments shall use elastic analysis design principles assuming that the behaviour of the material is linear at all stress levels. The resistances of cross sections may be calculated by using plastic stress distributions. For the global analysis, the second order theory shall be used, taking into account the influence of the deformations of the structure on the internal forces and moments.

### 9.2.2 Static system

Characteristic strength calculations shall be carried out using the structural model given in Figure 6, taking into account **9.2.3**, **9.2.4** and annexes A and B.

The deformation of the inner tube in the overlap zone shall be taken into account.

Additional contact points which occur when the looseness between the inner and outer tube has been taken up, may also be allowed for.

### 9.2.3 Imperfections

**9.2.3.1** *Eccentricities at the ends*

The following eccentricities shall be assumed (see Figure 6):

At the top of the prop: $e_t$ = 10 mm

> NOTE: This model makes allowance for a possibly greater eccentricity combined with some elastic restraint resulting from the loading condition at the top of the prop.

At the base of a prop (see Figure 6 detail X, Figure 7 and **9.2.4.2**):

$$e_{b,0} = 0{,}40 \times D_1$$
$$e_{b,core} = -0{,}25 \times D_1$$
$$e_{b,limit} = -0{,}50 \times D_1$$

where:

$D_1$ is the effective diameter at the base in millimetres.

The effective diameter is the outer diameter of the tube welded to the endplate (excluding weld), for plain endplates the thickness of the plate $t$ may be taken into account additionally ($D + 2 \times t$).

### 9.2.3.2 *Angle of inclination*

The angle of inclination $\Delta \varphi_0$ (see Figure 6) caused by the clearance between the tubes in the overlap zone shall be determined from the nominal dimensions of the components.
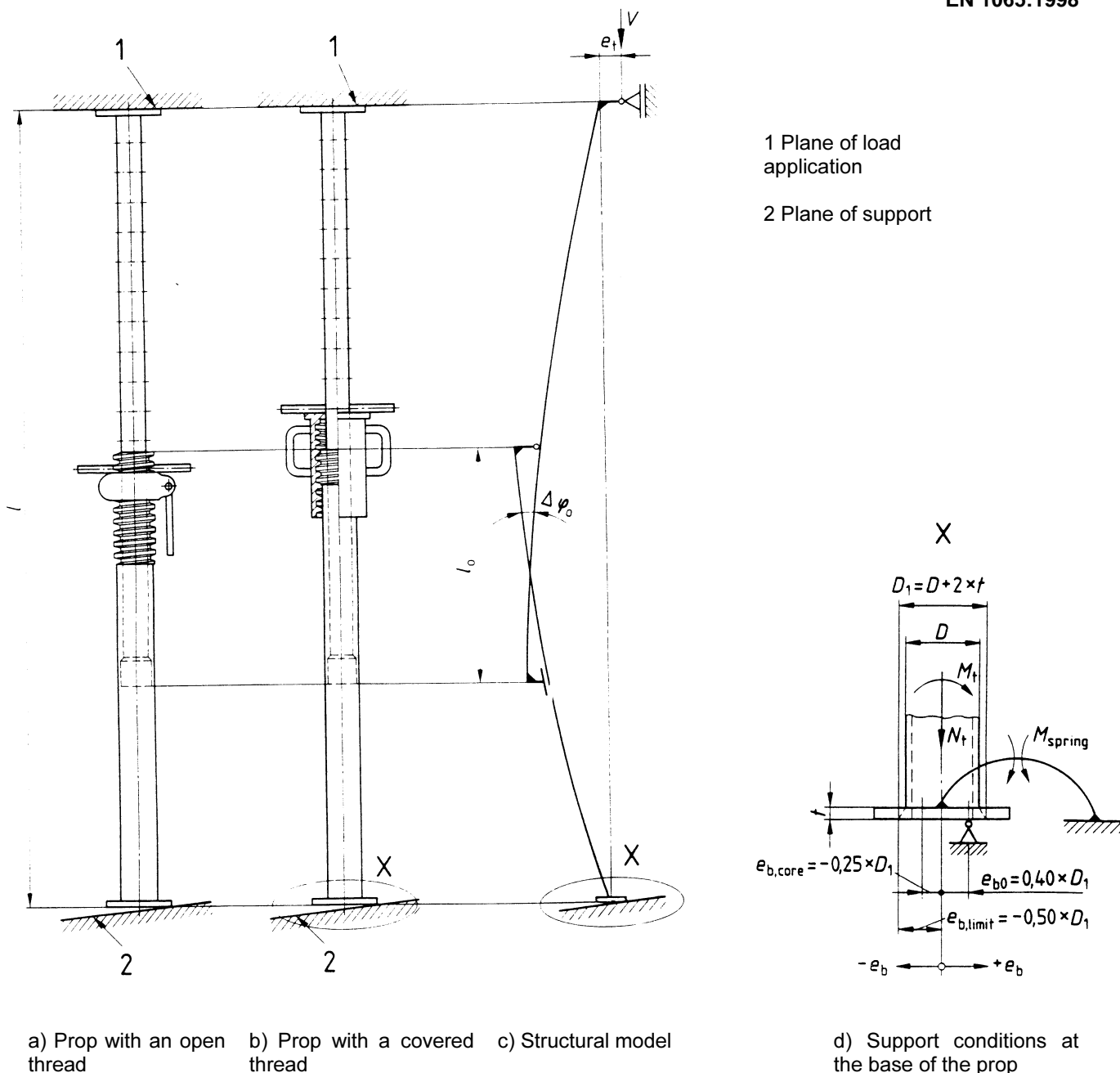
1 Plane of load application

2 Plane of support

a) Prop with an open thread   b) Prop with a covered thread   c) Structural model   d) Support conditions at the base of the prop

**Figure 6 — Structural model for the verification of the actual characteristic strength**

**9.2.3.3** *Preflexure*

In addition to the angle of inclination, a sine shaped preflexure of the prop as a whole with a maximum offset of $l/500$ shall be assumed, where $l$ is the extended length considered.

**9.2.4 Rigidity**

**9.2.4.1** If the holes in the inner tube are made by drilling, the reduction of the flexural rigidity due to the holes shall be calculated in accordance with annex A.

If the holes are not produced by drilling the resultant deformations of the tube shall be measured and the sectional properties of the deformed tube calculated.

**9.2.4.2** The relation between the moment of the spring $M_{spring}$ (see detail X of Figure 6) and rotation at the base of the prop shall be taken as that shown in Figure 7.
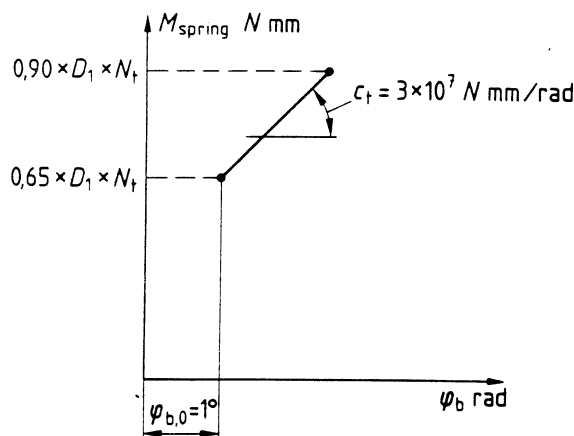
**Figure 7 — Relation between the moment of the spring and the rotation at the base of the prop**

NOTE: For the base of the prop a structural model with load-dependant mechanical properties is analysed (see Figure 7). First a hinged support with an initial eccentricity $e_{b,0}$ is assumed. When the rotation reaches $\varphi_b = 1°$ any additional rotation will be prevented until the quotient $M_t/N_t$ reaches the core eccentricity $e_{b,core}$. For higher values of the quotient $M_t/N_t$ *a spring stiffness* $c_t = 3 \times 10^7$ N mm/rad is assumed until the value of the quotient reaches the limit eccentricity $e_{b,limit}$. For higher values of the quotient than $e_{b,limit}$ the load carrying capacity of the prop is assumed to be exhausted.

### 9.2.5  Resistances of tubes

The moment capacity $M_{pl,N}$ shall be determined taking into account the effects of axial forces. This capacity, $M_{pl,N}$, shall be calculated from the equation:

$$M_{pl,N} = M_{pl} \times \cos((\pi/2) \times (N/N_{pl})) \tag{6}$$

where

| | |
|---|---|
| $N$ | is the axial force; |
| $M_{pl,N}$ | is the reduced plastic resistance moment allowing for axial force; |
| $M_{pl}$ | is the moment resistance of the cross-section; |
| $N_{pl}$ | is the compression resistance of the cross section. |

Equations for determining the structural properties of a perforated tube are to be taken into account in accordance with annex A.

### 9.2.6  Verification of strength

The actual calculated strength, $R_{y,act}$, shall be compared with the nominal characteristic value, $R_{y,k}$, specified in clause **8**, for a prop with the same class and extension. $R_{y,act}$ shall not be less than $R_{y,k}$.

## 9.3 Verification of the actual characteristic strength by testing

When tested in accordance with **10.2**, the actual characteristic value obtained from **10.1.3**, $R_{y,act}$, shall be compared with the nominal characteristic value specified in clause **8**, $R_{y,k}$, for a prop of the same class and extension. $R_{y,act}$ shall not be less than $R_{y,k}$.

Eight props shall be subjected to these tests for each of the extended lengths specified in **9.1**. The most unfavourable extended length may be established by a preliminary series of tests on up to seven single props at seven different intermediate extensions. The length increments between each of these tests shall be equal.

## 9.4 Verification of the strength of adjustment device

### 9.4.1 Fine adjustment device

> NOTE 1: The screw-nut connection does not need to be assessed.

> NOTE 2: It may be assumed that a length adjustment device conforming to **7.3** results in a safe construction.

### 9.4.2 The pin and its supports

#### 9.4.2.1 *General*

For the purpose of verification in accordance with **9.4.2.2** and **9.4.2.3**, the characteristic strength given in clause **8** shall be increased by a factor of 1,14.

> NOTE: The factor 1,14 takes into account a higher partial safety factor $\gamma_{M2} = 1{,}25$ for the pin connection resulting from the quotient $\gamma_{M2}/\gamma_{M1}$ wherein $\gamma_{M1} = 1{,}1$ is the general partial safety factor for steel structures.

For the purpose of verification in accordance with **9.4.2.4**, the characteristic strength given in clause **8** shall be increased by a factor of 1,27.

> NOTE: The factor 1,27 takes into account a higher partial safety factor $\gamma_{M2} = 1{,}40$ for the pin connection resulting from the quotient $\gamma_{M2}/\gamma_{M1}$ wherein $\gamma_{M1} = 1{,}1$ is the general partial safety factor for steel structures.

#### 9.4.2.2 *Inner tube*

The bearing capacity of the inner tube shall always be verified by calculation. It may be assumed that half of the axial force acts at either side of the tube. The bearing resistance of the tube shall be calculated in accordance with **B.2**.

#### 9.4.2.3 *Pin and supports conforming to 7.3.5*

The shear capacity of the pin shall be verified by calculation. It may be assumed that half of the axial force acts at either end of the pin. The shear resistance shall be calculated in accordance with **B.1**.

#### 9.4.2.4 *Pin and supports not conforming to 7.3.5*

Specimens shall be tested in accordance with **10.3** and shall be verified by comparison with the modified value given in **9.4.2.1**.

## 9.5 Verification of the prevention against unintentional disengagement

When a prop is tested three times in accordance with **10.4** the inner tube and outer tube shall remain attached to each other.

## 10 Test methods

### 10.1 General

#### 10.1.1 Sampling

The required number of specimens (see **9.3**) to form the sample shall be chosen at random from a batch of at least 500. The batch shall either be taken from current production, or from a stock.

#### 10.1.2 Method of loading

The test load on the specimen shall be applied either in steps not exceeding 20 % of the anticipated failure load, or increasing uniformly at a rate not exceeding 20 % per minute of the anticipated failure load.

When an adjustment of the load application velocity becomes necessary to establish the orderly deformation behaviour in the plastic zone, this adjustment shall be achieved in the prop strength test by:

– using a deformation controlled test machine; or

– by measuring at each load step the horizontal deflection at the middle of the prop and at the length adjustment device.

The deflections shall be recorded either step by step or autographically.

#### 10.1.3 Statistical evaluation

Analyse the values $R'_u$ from the set of tests (see **10.2.6**) statistically to establish the 5 % quantile values with a confidence level of 75 % either

– in accordance with annex C with a log-normal distribution; or

– by assuming a normal distribution.

Annex C may also be used when assuming a normal distribution. In this case the transformations according to equations (C.1) and (C.5) are not applicable.

### 10.2 Test method for the prop strength

#### 10.2.1 General

Test procedure see **9.1**.

#### 10.2.2 Material properties

The mechanical properties of the tubes from six of the tested props shall be established by testing in accordance with EN 10002-1 to determine:

a) yield strength $f_y$
b) tensile strength $f_u$
c) elongation $\varepsilon_u$

For the reduction of test results in accordance with **10.2.6**:

d) the average of the material test results shall be taken, when the variance of the six test results is not greater than 10 %; otherwise

e) the individual relevant material properties shall be determined for each prop tested.
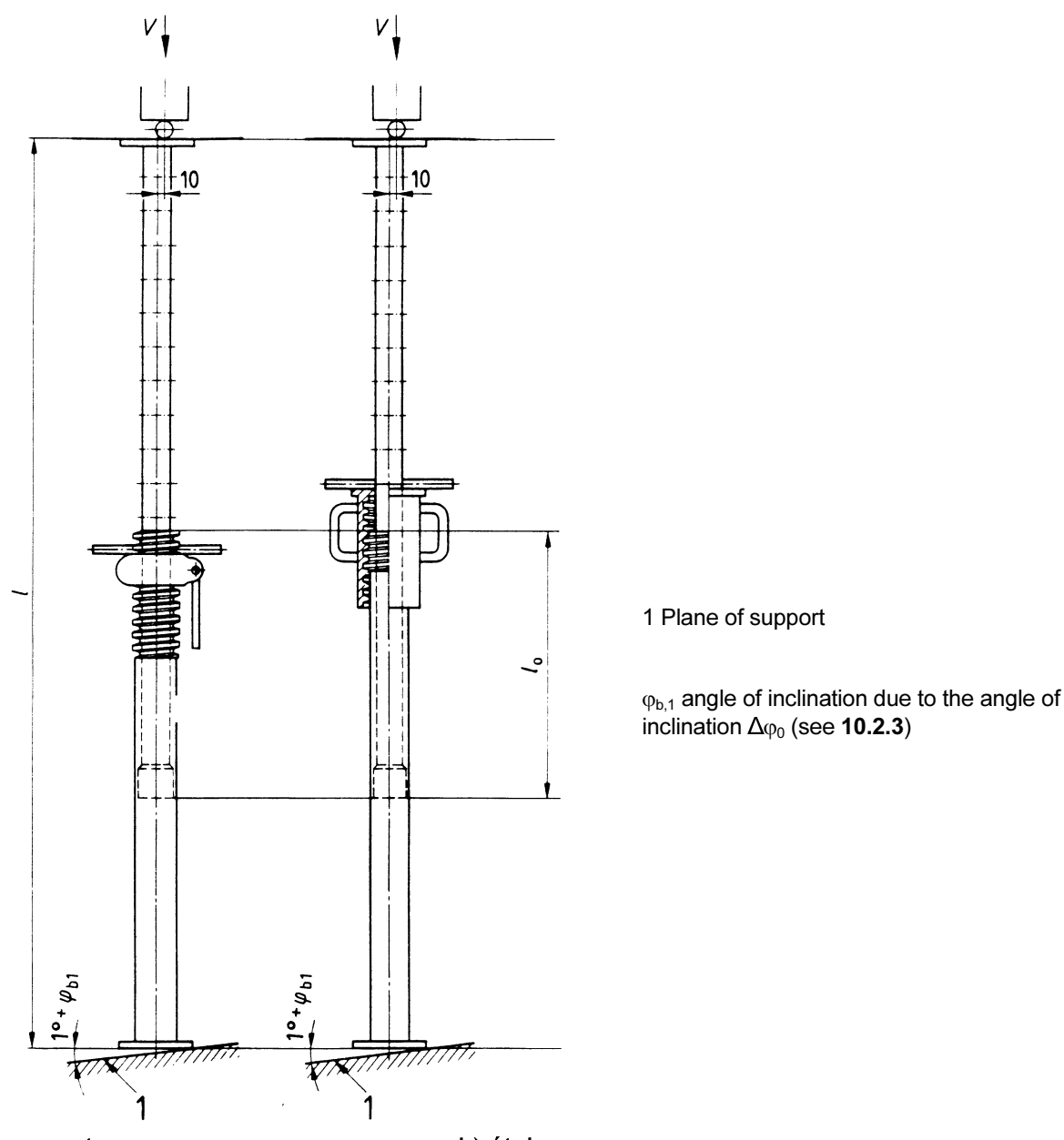
#### 10.2.3 Test set-up

Set up the prop in a compression testing machine at the required extension (see Figure 8).

The prop shall be tested in the upright position. Where a horizontal testing machine is used, a compensating upwards force equal to half the prop weight may be applied in the mid-length position of the prop.

At the base of the prop, position a plane support of steel or concrete which allows the adjustment of an angle of 1° (± 0,1°) relative to the plane normal to the axis of the adjacent tube which is already inclined by the angle $\varphi_{b,1}$ due to the angle of inclination $\Delta\varphi_0$ (see Figure 6 and **9.2.3.2**).

At the head of the prop, position a ball joint in accordance with Figure 9 and an eccentricity of $e_t$ = 10 mm (± 0,5 mm). This ball joint shall be on the same side of the prop as the line of contact at the base of the prop. Friction of the ball joint shall be minimized by lubrication.

Rotate the prop until the transverse direction of the pin is as indicated in Figure 8 and the principal pre-deflection of the prop is away from the line of axis through the ball joint. The natural set-up of the prop shall not be improved by the use of wedges or other means.



1 Plane of support

$\varphi_{b,1}$ angle of inclination due to the angle of inclination $\Delta\varphi_0$ (see **10.2.3**)

a) Props with an open thread     b) Props with a covered thread

**Figure 8 — Test set-up for the prop**
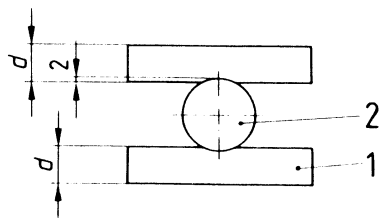
1   Part for accepting the prop

2   Ball diameter $(50 \pm 3)$ mm

Plate and ball hardened HRC $\geq$ 55
$d \geq 25$ mm

HRC   Hardness according to Rockwell - Scale C

**Figure 9 — Details of the ball joint**

### 10.2.4 Deflection measurement

Set up gauges to record horizontal deflections at the middle of the prop and at the middle of the length adjustment device.

### 10.2.5 Failure load

The rate of loading shall ensure that accurate recording of the horizontal deflections and the prop failure load, $R_u$, are both possible.

The load shall be increased until the prop fails or the load cannot be increased further.

The prop failure load, $R_u$, shall be recorded and analysed in accordance with clause **10.2.6**.

The plotted load deflection graphs shall be included in the test report.

### 10.2.6 Reduction of test results, $R'_u$

Reduce each test result, $R_u$, in accordance with the equation:

$$R'_u = R_u / \psi \tag{8}$$

where $\psi$ is the reduction factor as a function of $\varphi_y$ obtained from figure 10.

Calculate $\varphi_y$ from the equation:

$$\varphi_y = \frac{f_{y,act}}{f_{y,nom}} \tag{9}$$

where:

$f_{y,act}$   is the actual yield strength in N/mm$^2$ obtained from the tests in accordance with clause **10.2.2**;

$f_{y,nom}$   is the nominal yield strength in N/mm$^2$ given in the relevant material standards.

Calculate $\overline{\lambda}$ from the equation:

$$\overline{\lambda} = \sqrt{N_{\mathrm{pl,nom}} / N_{\mathrm{c,i}}} \tag{10}$$

where:

$N_{\mathrm{pl,nom}}$     is the plastic compression resistance of the cross-section;

$N_{\mathrm{c,I}}$     is the ideal buckling force.

The value of the ideal buckling force $N_{\mathrm{c,i}}$ may be calculated by using the simplification that the prop is a continuous tube of cross-section equal to the inner tube in accordance with the equation:

$$N_{\mathrm{c,i}} = (\pi^2 \times E \times I) / (0{,}7 \times I)^2 \tag{11}$$

where

$E \times I$     is the bending stiffness of the inner tube, where $E = 210\,000$ N/mm$^2$ and $I$ is the moment of inertia;

$I$        is the actual extension length.

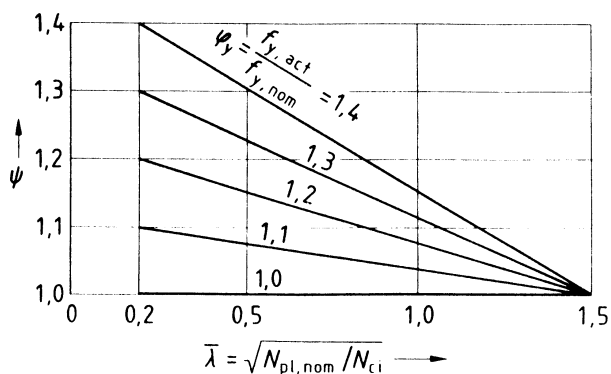NOTE: The factor 0,7 takes into account the buckling length approximately.



**Figure 10 — Reduction factor $\psi$**

## 10.3 Test of a pin and its supports

### 10.3.1 Principle

This test establishes the characteristic strength value for the combination of the pin and its supports.

### 10.3.2 Arrangement of test

Cut the section of the prop which forms the adjustment device to the dimensions shown in Figure 11. Apply the platens of a compression testing machine to the cut ends. Set up gauges to record the displacement of the inner tube with reference to the outer tube.

### 10.3.3 Procedure

Apply the load in accordance with **10.1.2**. The displacement readings shall be recorded at each step. Increase the load until it cannot be increased further. Record the maximum load.
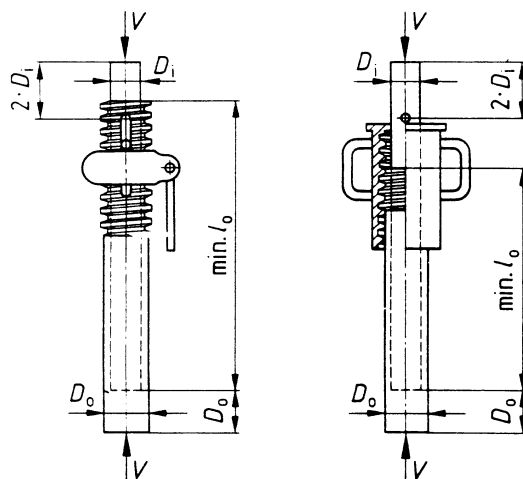
a) Prop section with an open thread      b) Prop section with a covered thread

**Figure 11 — Dimensions of prop section for the test of the length adjustment device**

### 10.3.4 Reduction of test results

The maximum load at failure, $R_u$, shall be reduced in the proportion of nominal to actual tensile strength of that component which controls the failure.

The results shall be evaluated in accordance with **10.1.3**.

> NOTE: See also **9.4.2.1**.

### 10.4 Test of the prevention against unintentional disengagement

Suspend the prop vertically by its endplate with the outer tube uppermost. Raise the inner tube until the prop is in the fully closed position. Allow it to fall under gravity.

## 11 Test report

The results of all tests and calculations on the props submitted for assessment shall be recorded in a test report and shall include the following:

a) name of the test laboratory and the supervising engineer;

b) designation according to clause **5** of the tested props, and trademark or name of the manufacturer;

c) all information provided by the manufacturer (e. g. drawings, sizes, material characteristics);

d) information about the test equipment and about the test procedure;

e) the measured dimensions and deviations from nominal values stated in the manufacturer's prop data;

f) a confirmation that the mechanical properties of materials conform to the manufacturer's prop data;

g) all measured values, calculations and verification results. The stiffness behaviour shall be presented by graphical means;

h) significant information, such as plastic deformations.

## 12 Marking

The marking shall be impressed or embossed on the prop or be on a steel plate welded to the prop, and shall be legible after the protective coating has been applied. The height of the characters shall be at least 4 mm and their depth shall be at least 0,2 mm.

The position of the marking shall not be obscured when the prop is in the upright position with the outer tube at the bottom.

Props shall be marked with the following information, in the sequence given:

    – EN 1065;

    – name or trademark of the prop manufacturer;

    – year of manufacture (last two digits);

    – classification (see Table 1);

    – inspection level (see annex E), if annex E (informative) is applied;

    – sign of the independent certification system (for inspection level M only), if annex E (informative) is applied;

e.g. EN 1065 Europrops 97 B 30 L.

Props utilizing tubes conforming to prEN 39 shall be marked with "3" indicating that couplers conforming to EN 74 may be attached.

## Annex A  (normative)

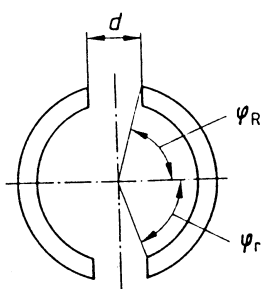## Equations for the calculation of the structural properties of tubes
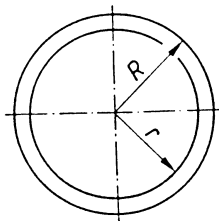
$$A_{gr} = \pi(R^2 - r^2) \tag{A.1}$$

$$I_{gr} = \frac{\pi}{4}(R^4 - r^4) \tag{A.2}$$

$$W_{gr}^{el} = \frac{I_{gr}}{R} \tag{A.3}$$

$$W_{gr}^{pl} = \frac{4}{3}(R^3 - r^3) \text{, where} \tag{A.4}$$

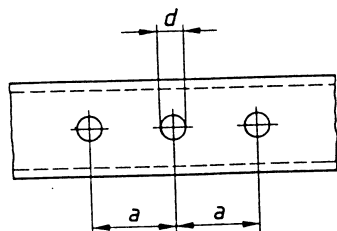calc $W_{gr}^{pl}$ shall be not greater than $1{,}25\, W_{gr}^{el}$

$$\varphi_R = \arccos\frac{d}{2R} \tag{A.5}$$

$$\varphi_r = \arccos\frac{d}{2r} \tag{A.6}$$

$$A_n = 2(\varphi_R R^2 - \varphi_r r^2) - d(R\sin\varphi_R - r\sin\varphi_r) \tag{A.7}$$

$$I_n = \frac{R^3}{2}[\varphi_R R - \frac{d}{6}\sin\varphi_R(3 + 2\sin^2\varphi_R)]$$
$$- \frac{r^3}{2}[\varphi_r r - \frac{d}{6}\sin\varphi_r(3 + 2\sin^2\varphi_r)] \tag{A.8}$$

$$W_n^{el} = \frac{I_n}{R\sin\varphi_R} \tag{A.9}$$

$$W_n^{pl} = \frac{4}{3}[R^3(1-\cos\varphi_R) - r^3(1-\cos\varphi_r)]$$
$$- \frac{1}{3}d(R^2\sin^2\varphi_R - r^2\sin^2\varphi_r) \tag{A.10}$$

$$I_i = I_{gr}\frac{1}{1 + 2\frac{d}{a}\left(\frac{I_{gr}}{I_n} - 1\right)} \tag{A.11}$$

**Figure A.1 — Symbols for the calculation of the section properties of tubes**

where

$A_{gr}$     is the gross area in $mm^2$;

$A_n$     is the net area in $mm^2$;

$I_{gr}$     is the gross moment of inertia in $mm^4$;

$I_n$     is the net moment of inertia in $mm^4$;

$W_{gr}^{el}$     is the gross elastic bending resistance in $mm^3$;

$W_n^{el}$     is the net elastic bending resistance in $mm^3$;

$W_{gr}^{pl}$     is the gross plastic bending resistance in $mm^3$;

$W_n^{pl}$     is the net plastic bending resistance in $mm^3$;

$I_l$     is the ideal moment of inertia of the perforated tube in millimetres;

$R$     is the outer radius of the tube in millimetres;

$R$     is the inner radius of the tube in millimetres;

$D$     is the diameter of the holes in millimetres;

$A$     is the distance between the holes in millimetres;

$\varphi_R$     is the angle between the edge of the hole on the outer radius of the tube and the neutral axis of the tube inner radius in degrees;

$\varphi_r$     is the angle between the edge of the hole on the inner radius of the tube and the neutral axis of the tube inner radius in degrees.

## Annex B  (normative)

## Calculation of resistance for pin connections (see also **9.4.2.2**)

**B.1**  Calculate the shear resistance per shear plane $R_{s,p}$ using the following equation:

$$R_{s,p} = 0,6 \times A_s \times f_{u,p} \qquad\qquad\qquad (B.1)$$

where:

$f_{u,p}$     is the tensile strength of the pin material;

$A_s$     is the cross sectional area of the pin.

**B.2**  Calculate the bearing resistance of the tube $R_{b,t}$ using the following equation:

$$R_{b,t} = 2,12 \times f_{y,t} \times (2t) \times d \qquad\qquad\qquad (B.2)$$

where:

$f_{y,t}$     is the yield strength of the tube;

$t$     is the wall thickness of the tube;

$d$     is the diameter of the pin.

## Annex C  (normative)

## Statistical evaluation of data

**C.1**  Transform the data using the following equation:

$$y_i = \log_e R_{u,i} \qquad\qquad (C.1)$$

**C.2**  Calculate the mean value and the standard deviation for the n test results using the following equations:

$$\overline{y} = 1/n \left(\Sigma\, y_i\right) \qquad\qquad (C.2)$$

$$s_y = \sqrt{\frac{1}{(n-1)} \times \Sigma\,(y_i - \overline{y})^2} \qquad\qquad (C.3)$$

**C.3**  Calculate the 5 %-quantile value using the following equation:

$$y_5 = \overline{y} - k_s \times s_y \qquad\qquad (C.4)$$

with $k_s$ according to Table C.1.

**C.4**  Calculate the actual characteristic strength using the following equation:

$$R_{u,5} = \exp^{y_5} \qquad\qquad (C.5)$$

**Table C.1 — Values of $k_s$ for determining the 5 %-quantile for the 75 % confidence level**

| n | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|
| $k_s$ | 5,12 | 3,15 | 2,68 | 2,46 | 2,33 | 2,25 | 2,19 | 2,14 | 2,10 | 2,07 | 2,05 | 2,03 |
| n | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| $k_s$ | 2,00 | 1,99 | 1,98 | 1,96 | 1,95 | 1,94 | 1,93 | 1,92 | 1,92 | 1,91 | 1,90 | 1,90 |
| n | 26 | 27 | 28 | 29 | 34 | 39 | 44 | 49 | 54 | 55 | ∞ | |
| $k_s$ | 1,89 | 1,88 | 1,88 | 1,87 | 1,87 | 1,85 | 1,83 | 1,82 | 1,81 | 1,80 | 1,64 | |

## Annex D (informative)

## Prototype assessment

For prototype approval the manufacturer should ensure that the assessment of the prototype is carried out by a competent, independent organization.

This organization shall

– check whether the performance requirements of this European Standard are fulfilled;

– carry out an independent check of all calculations;

– supervise all tests;

– check that the dimensions of the assessed props conform to the manufacturer's data.

The certificate of the independent organization shall quote the reference number of the test report and shall identify the assessed prop by reference to clause **5**.

The certificate shall certify that the assessed prop has been examined in accordance with the appropriate clauses of this European Standard and that it complies with EN 1065.

## Annex E (informative)

## Ongoing production inspection

The manufacture of adjustable telescopic steel props should be controlled by one of the following inspection methods:

– Inspection level L

The production quality control shall be carried out by a manufacturer approved to either EN ISO 9001 or EN ISO 9002.

– Inspection level M

The production quality control shall be carried out by an independent certification system.

Minimum ongoing quality control requirements are given in Tables E.1 and E.2.

**Table E.1 — Inspection of materials and bought in components**

| Parameter | Property to be checked | If supplied to the prop manufacturer | | If produced by the prop manufacturer |
|---|---|---|---|---|
| | | **Per batch** | **Additional check** | **Frequency** |
| Materials | Accordance with the relevant standard as listed in **6.1** | Certificate in accordance with **2.1** of EN 10204:1991 (certificate of compliance with the order "2.1") | Random checks on receipt of materials | Not applicable |
| Tube | Material, dimensions, tolerances as per relevant standard | Certificate in accordance with **2.1** of EN 10204:1991 (certificate of compliance with the order "2.1") | | Not applicable |
| | Increased yield strength | Certificate in accordance with **2.3** of EN 10204:1991 (test report "2.3") | | |
| Collar nut, pin, outer tube thread | Material, dimensions, tolerances as per relevant standard | Certificate in accordance with **2.1** of EN 10204:1991 (certificate of compliance with the order "2.1") | | 1 ‰ except for materials |
| NOTE: Nothing prevents the prop manufacturer asking for a higher level EN 10204:1991 certificate. | | | | |

**Table E.2 — Inspection of prop manufacturer**

| Parameter | Characteristic to be checked | Limit deviation | Frequency of inspection | |
|---|---|---|---|---|
| | | | **Internal inspection** | **M-level third party inspection** |
| Length of prop | Fully open | + 10 mm/ 0 mm | At least 1 ‰ of all props and prop component units produced per working day with a minimum of one unit per working day | Usually two visits per year; during each visit at least three props of each prop class currently being produced |
| | Fully closed | 0 mm/- 10 mm | | |
| End plate, forkhead | Perpendicularity to tube axis | 1,0 ° | | |
| | Concentricity to tube axis | ± 2 mm | | |
| | Flatness | 1 mm | | |
| Inner tube holes | Diameter | ± 0,3 mm | | |
| | Concentricity relative to tube axis | ± 0,5 mm | | |
| Outer tube thread (if separate) | Concentricity to outer tube | 0,5 mm | | |
| Axial clearance between the tubes in the overlap zone | Angle of inclination | + 20 % as clause **9.2.3.2** | | |
| Anti hand trap | Prop fully closed, clearance as prescribed in **7.7** | No minus limit deviation | | |
| Welding | Throat thickness, workmanship | As clause **7.2** and data drawing | | |
| Unintentional disengagement | 3 drop tests on a single prop in accordance with **10.4** | No disengagement of tubes | | |
| Marking | Completeness and legibility | As clause **14** and data drawing | | |

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