BRITISH STANDARD

BS EN ISO
13626:2004

Petroleum and natural gas industries — Drilling and production equipment — Drilling and well-servicing structures

The European Standard EN ISO 13626:2004 has the status of a British Standard

ICS 75.180.10

National foreword

This British Standard is the official English language version of EN ISO 13626:2004. It is identical with ISO 13626:2003.

The UK participation in its preparation was entrusted by Technical Committee PSE/17, Materials and equipment for petroleum, petrochemical and natural gas industries, to Subcommittee PSE/17/-/4, Drilling and production equipment, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/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.

Cross-references

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

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EUROPEAN STANDARD

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English version

Petroleum and natural gas industries - Drilling and production equipment - Drilling and well-servicing structures (ISO 13626:2003)

Industries du pétrole et du gaz naturel - Equipement de forage et de production - Structures de forage et d'entretien des puits (ISO 13626:2003)

Erdöl- und Erdgasindustrie - Bohr- und Dörderanlagen - Anforderungen an Bohrungen und Bohrloch-Aufbauten (ISO 13626:2003)

This European Standard was approved by CEN on 30 September 2004.

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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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Foreword

The text of ISO 13626:2003 has been prepared by Technical Committee ISO/TC 67 "Materials, equipment and offshore structures for petroleum and natural gas industries" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 13626:2004 by Technical Committee CEN/TC 12 "Materials, equipment and offshore structures for petroleum and natural gas industries" the secretariat of which is held by AFNOR.

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 April 2005, and conflicting national standards shall be withdrawn at the latest by April 2005.

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

Endorsement notice

The text of ISO 13626:2003 has been approved by CEN as EN ISO 13626:2004 without any modifications.

NOTE Normative references to International Standards are listed in annex ZA (normative).

INTERNATIONAL STANDARD

ISO 13626

First edition
2003-11-01

Petroleum and natural gas industries — Drilling and production equipment — Drilling and well-servicing structures

Industries du pétrole et du gaz naturel — Équipement de forage et de production — Structures de forage et d'entretien des puits

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 13626 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 4, *Drilling and production equipment*.

Introduction

This International Standard is based on API Spec 4F, second edition, June 1995.

Petroleum and natural gas industries — Drilling and production equipment — Drilling and well-servicing structures

1 Scope

This International Standard specifies requirements and gives recommendations for suitable steel structures for drilling and well-servicing operations in the petroleum industry, provides a uniform method of rating the structures, and provides two product specification levels.

This International Standard is applicable to all new designs of all standard steel derricks, special steel derricks, portable masts and substructures.

Annex A provides a number of standard supplementary requirements which apply only if specified by the purchaser.

2 Normative references

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

ISO 9712, *Non-destructive testing — Qualification and certification of personnel*

ISO 13535, *Petroleum and natural gas industries — Drilling and production equipment — Hoisting equipment*

ISO 10425, *Steel wire ropes for the petroleum and natural gas industries — Minimum requirements and terms of acceptance*

AISC[1)] 335, 1989, *Specification for structural steel buildings, allowable stress design and plastic design*

API[2)] RP 2A-WSD, *Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms — Working Stress Design*

API Spec 8A, *Specification for Drilling and Production Hoisting Equipment*

API RP 9B, *Recommended Practice on Application, Care and Use of Wire Rope for Oilfield Service*

ASTM[3)] A 370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM A 578/A 578M, *Standard Specification for Straight-Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications*

AWS[4)] D1.1/D1.1M:2002, *Structural Welding Code — Steel*

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1) American Institute of Steel Construction, 1 East Wacker Drive, Suite 3100, Chicago, Illinois 60601.

2) American Petroleum Institute, 1220 L Street, Northwest, Washington, DC 20005-4070.

3) American Society for Testing and Materials, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, Pennsylvannia 19428-2959.

4) American Welding Society, Incorporated, 550 Northwest LeJeune Road, Box 351040, Miami, Florida 33135.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
angle of roll
angle of pitch
angle of movement to one side from vertical

3.2
critical component
component which is necessary to maintain stability of a structure and which resides within the primary load paths of the structure when the structure is loaded under the design loadings of Clause 7

3.3
critical weld
weld which joins critical components

3.4
crown block assembly
stationary sheave or block assembly installed at the top of a derrick or mast

3.5
date of manufacture
date chosen by the manufacturer occurring between the initiation of manufacture and the delivery to the purchaser

3.6
derrick
semipermanent structure, of square or rectangular cross-section, having members that are latticed or trussed on all four sides

NOTE 1 This unit is assembled in the vertical or operation position, as it includes no erection mechanism.

NOTE 2 It may or may not be guyed.

3.7
design load
force or combination of forces which a structure is designed to withstand without exceeding the allowable stress in any member

3.8
dynamic loading
loading imposed upon a structure as a result of motion

3.9
erection load
load produced in the mast and its supporting structure during its raising and lowering, or in the substructure during its raising and lowering

3.10
guide track and dollies
equipment used to hold the travelling equipment in correct position relative to the derrick during various operations

NOTE A retractable dolly is used move the travelling equipment horizontally between the drilling position and the retracted position.

3.11
guy line
wire rope with one end attached to the mast assembly and the other end attached to a suitable anchor to provide structural and/or lateral support for a mast under design loading conditions

3.12
guying pattern
plan view showing the manufacturer's recommended locations for guy lines and their distance out to the anchors with respect to the centreline of the well

3.13
height of derrick and mast without guy lines
minimum vertical distance from the top of the working floor to the bottom of the crown block support beams

3.14
height of mast with guy line
minimum vertical distance from the ground to the bottom of the crown block support beams

3.15
impact loading
loading resulting from near-instantaneous changes of forces

3.16
mast
structural tower composed of one or more sections assembled in a horizontal position near the ground and then raised to the operating position

NOTE If the unit contains two or more sections, it may be telescoped or unfolded during the erection procedure.

3.17
mast set-up distance
distance from the centreline of the well to a designated point on the mast structure defined by a manufacturer to assist in the set-up of the rig

3.18
maximum rated static hook load
load composed of the weight of the travelling equipment and a static load applied to the travelling equipment

NOTE It is the largest load that can be applied to the structure within the guidelines imposed by this International Standard with a specified number of lines strung to the travelling block and in the absence of pipe setback, sucker rod or wind loading. A designated location of the deadline anchor and drawworks is assumed.

3.19
maximum rated wind velocity
largest wind velocity the derrick or mast assembly is designed to resist for a specified design loading

NOTE Maximum rated wind velocity is specified at 10 m above the ground or water surface.

3.20
nominal wire rope assembly strength
nominal strength of the wire rope, multiplied by the efficiency of the end attachment in accordance with API RP 9B

3.21
period
τ
⟨of roll, pitch or heave⟩ time required for a complete cycle

3.22
pipe lean
angle between the vertical and a typical stand of pipe in the setback

3.23
product specification level
level of material and process controls placed upon the primary load-carrying components of the covered equipment

3.24
racking platform
platform located at a distance above the working floor for laterally supporting the upper end of racked pipe

3.25
rated static rotary load
maximum weight which can be supported by the rotary-table support beams

3.26
rated setback load
maximum weight of tubular goods which can be supported by the substructure in the setback area

3.27
rod board
rod hanger
platform located at a distance above the working floor for supporting rods

3.28
substructure
any structure through which hook load, rotary load and/or setback load are transmitted

4 Product specification levels

This International Standard establishes requirements for two product specification levels (PSL) for drilling and well-servicing structures which define two levels of technical and quality requirements. These requirements reflect practices currently being implemented by a broad spectrum of the manufacturing industry. PSL 1 includes all the requirements of this International Standard unless specifically identified as PSL 2. PSL 2 includes all the requirements of PSL 1 plus additional requirements.

5 Marking and information

5.1 Nameplate

Drilling and well-servicing structures manufactured in accordance with this International Standard shall be identified by a nameplate bearing at least the information specified in 5.2 to 5.4, including the units of measurement where applicable. Markings shall be either raised or stamped. The nameplate shall be securely affixed to the structure in a conspicuous place.

5.2 Derrick and mast nameplate information

The following information shall be provided:

a) manufacturer's name;

b) manufacturer's address;

c) date of manufacture, including month and year;

d) serial number;

e) height;

f) maximum rated static hook load with guy lines, if applicable, for stated number of lines to travelling block;

g) maximum rated wind velocity with guy lines, if applicable, with rated capacity of pipe racked;

h) specification and edition of the specification under which the structure was designed and manufactured;

EXAMPLE ISO 13626:2003

i) manufacturer's guying diagram, if applicable;

j) the following text:

CAUTION — Acceleration, impact, setback and wind loads reduce the maximum rated static hook load capacity.

k) manufacturer's load distribution diagram (may be placed in mast instructions);

l) graph plotting maximum allowable static hook load versus wind velocity as defined in 6.2 f) and 6.4 e);

m) mast set-up distance for mast with guy lines;

n) PSL 2, if applicable;

o) supplementary information as specified in the particular supplementary requirement (SR), if applicable (see Annex A).

5.3 Substructure nameplate information

The following information shall be provided:

a) manufacturer's name;

b) manufacturer's address;

c) date of manufacture, including month and year;

d) serial number;

e) maximum rated static rotary capacity;

f) maximum rated pipe setback capacity;

g) maximum combined rated static rotary and rated setback capacity;

h) specification and edition of the specification under which the structure was designed and manufactured;

EXAMPLE ISO 13626:2003

i) PSL 2, if applicable;

j) supplementary information as specified in the particular supplementary requirement (SR), if applicable (see Annex A).

5.4 Crown block assembly nameplate information (required only for crown block assemblies for use with derricks)

The following information shall be provided:

a) manufacturer's name;

b) manufacturer's address;

c) date of manufacture, including month and year;

d) serial number;

e) maximum rated static hook load;

f) specification and edition of the specification under which the structure was designed and manufactured;

EXAMPLE ISO 13626:2003

g) PSL 2, if applicable;

h) supplementary information as specified in the particular supplementary requirement (SR), if applicable (see Annex A).

6 Standard ratings

6.1 General

Each structure shall be rated for the following applicable loading conditions. The structures shall be designed to meet or exceed these conditions in accordance with applicable specifications set herein. The following ratings do not include any allowance for impact. Acceleration, impact, setback and wind loads reduce the rated static hook load capacity.

6.2 Derrick (stationary base)

The following loading conditions are applicable to the derrick (stationary base):

a) maximum rated static hook load for a specified number of lines strung to the travelling block;

b) maximum rated wind velocity, in metres per second, without full pipe setback;

c) maximum rated wind velocity, in metres per second, with full pipe setback;

d) maximum number of stands and size of pipe in full setback;

e) maximum rated gin pole capacity;

f) rated static hook load for wind velocities varying from zero to maximum rated wind velocity, with full rated setback and with maximum number of lines to the travelling block.

6.3 Mast with guy lines

The following loading conditions are applicable to the mast with guy lines:

a) maximum rated static hook load capacity for a specified number of lines strung to the travelling block and manufacturer's specified guying pattern;

b) maximum rated wind velocity, in metres per second, without pipe setback;

c) maximum rated wind velocity, in metres per second, with full pipe setback;

d) maximum number of stands and size of pipe in full setback.

6.4 Mast without guy lines

The following loading conditions are applicable to the mast without guy lines:

a) maximum rated static hook load for a specified number of lines strung to the travelling block;

b) maximum rated wind velocity, in metres per second, without pipe setback;

c) maximum rated wind velocity, in metres per second, with full pipe setback;

d) maximum number of stands and size of pipe in full setback;

e) rated static hook load for wind velocities varying from zero to maximum rated wind velocity, with full rated setback and with maximum number of lines to the travelling block.

6.5 Derrick and mast under dynamic conditions

The following loading conditions are applicable to the derrick and mast under dynamic conditions:

a) maximum rated static hook load for a specified number of lines to the travelling block;

b) hook load, wind load, vessel motions, and pipe setback in combination with each other for the following:

   1) operating with partial setback;

   2) running case;

   3) waiting on weather;

   4) survival;

   5) in transit.

6.6 Substructure

The following loading conditions are applicable to the substructure:

a) maximum rated static hook load, if applicable;

b) maximum rated pipe setback load;

c) maximum rated static load on rotary table beams;

d) maximum rated combined load of setback and rotary table beams.

6.7 Substructure under dynamic conditions

The following loading conditions are applicable to the substructure under dynamic conditions:

a) maximum rated static hook load;

b) maximum rated pipe setback load;

c) maximum rated load on rotary table beams;

d) maximum rated combined load of setback and rotary table beams;

e) all ratings per 6.5 b).

6.8 Crown block assembly

The following loading condition is applicable to the crown block assembly:

a) maximum rated static hook load for a specified number of lines strung to the travelling block.

7 Design loading

7.1 General

Each structure shall be designed for the following applicable loading conditions. The structure shall be designed to meet or exceed these conditions in accordance with the applicable specifications set forth herein.

7.2 Derrick (stationary base)

The following loading conditions are applicable to the derrick (stationary base):

a) operating loads (no wind loads) composed of the following loads in combination:

   1) maximum rated static hook load, in combination with fastline and deadline loads, for each applicable string up condition;

   2) dead load of derrick assembly;

b) wind load without pipe setback composed of the following loads in combination (standard derrick sizes are defined in Annex B):

   1) wind load on derrick, derived from maximum rated wind velocity without setback;

      i) minimum wind velocity for standard derrick size 10 through size 18A is 48 m/s;

      ii) minimum wind velocity for standard derrick size 19 through size 25 is 55 m/s;

   2) dead load of derrick assembly;

c) wind load with rated pipe setback composed of the following loads in combination:

   1) wind load on derrick derived from maximum rated wind velocity with setback of not less than 48 m/s;

   2) dead load of derrick assembly;

   3) horizontal load at racking platform, derived from maximum rated wind velocity with setback of not less than 48 m/s acting on full pipe setback;

   4) horizontal load at racking platform from pipe lean.

7.3 Mast with guy lines

The following loading conditions are applicable to the mast with guy lines:

a) operating loads (no wind load) composed of the following loads in combination:

   1) maximum rated static hook load, in combination with fastline and deadline loads, for each applicable string-up condition;

   2) dead load of mast assembly;

   3) horizontal and vertical components of guy line loading;

b) wind load composed of the following loads in combination:

   1) wind load on mast with setback, derived from a maximum rated wind velocity of not less than 31 m/s;

   2) dead load of mast assembly;

   3) horizontal loading at racking board, derived from a maximum rated wind velocity with setback of not less than 31 m/s, acting on full pipe setback;

   4) horizontal and vertical components of guy line loading;

   5) horizontal and vertical loading at rod board, derived from a maximum rated wind velocity with setback of not less than 31 m/s, acting on rods in conjunction with deadweight of rods;

c) wind load composed of the following loads in combination:

   1) wind load on mast with setback, derived from a maximum rated wind velocity of not less than 31 m/s;

   2) dead load of mast assembly;

   3) horizontal loading at racking board, derived from a maximum rated wind velocity with setback of not less than 31 m/s, acting on full pipe setback;

   4) horizontal and vertical components of guy line loading;

d) wind load composed of the following loads in combination:

   1) wind load on mast with setback, derived from a maximum rated wind velocity of not less than 31 m/s;

   2) dead load of mast assembly;

   3) horizontal and vertical components of guy line loading;

e) erection loads (zero wind conditions) composed of the following loads in combination:

   1) forces applied to mast and supporting structure created by raising or lowering mast:

      i) from the horizontal position to the operating position,

      ii) to the horizontal position from the operating position;

   2) dead load of mast assembly;

f) guy line loading:

   1) maximum horizontal and vertical reactions from conditions of load applied to guy line in 7.3 a) through 7.3 e);

   2) dead load of mast assembly;

   3) initial tension in guy line, as specified by mast manufacturer.

7.4 Mast without guy lines

The following loading conditions are applicable to the mast without guy lines:

a) operating loads composed of the following loads in combination:

   1) maximum rated static hook load, in combination with fastline and deadline loads, for each applicable string-up condition;

   2) dead load of mast assembly;

b) wind load without pipe setback composed of the following loads in combination:

   1) wind loading on mast without setback, derived from a maximum rated wind velocity of not less than 48 m/s;

   2) dead load of mast assembly;

c) wind load with pipe setback composed of the following loads in combination:

   1) wind loading on mast with setback, derived from a maximum rated wind velocity of not less than 36 m/s;

   2) dead load of mast assembly;

   3) horizontal load at racking platform derived from a maximum rated wind velocity with setback of not less than 36 m/s acting on pipe setback;

   4) horizontal load at racking platform from pipe lean;

d) mast erection loads (zero wind load) composed of the following loads in combination:

   1) forces applied to mast and supporting structure created by raising or lowering mast

      i) from the horizontal position to the operating position,

      ii) to the horizontal position from the operating position.

   2) dead load of mast assembly;

e) mast-handling loads: mast assembly supported at its extreme ends.

7.5 Derrick and mast under dynamic conditions

All conditions listed under 6.5 shall be specified by the purchaser. Forces resulting from wind and vessel motion shall be calculated in accordance with formulas specified in 8.2 and 8.3.

7.6 Substructure

The following loading conditions are applicable to the substructure:

a) loads imposed by erection of mast, if applicable;

b) loads imposed by moving, skidding or erection, if applicable;

c) the substructure shall be designed for the following conditions:

   1) maximum rated static rotary load;

   2) maximum rated setback load;

   3) maximum rated static hook load, in combination with fastline and deadline loads (where applicable);

   4) maximum combined rated static hook and rated setback loads (where applicable);

   5) maximum combined rated static rotary and rated setback loads;

   6) wind loads resulting from maximum rated wind velocity acting from any direction on all exposed elements with rated setback loads, if applicable. Wind pressures and resultant forces shall be calculated in accordance with the equations and tables in 8.2. If a substructure is utilized to react guy lines to the mast, these reactions from the guy lines shall be designed into the substructure;

   7) dead load of all components in combination with each of the above.

7.7 Substructure under dynamic conditions

All conditions listed under 6.7 are to be specified by the purchaser. Forces resulting from wind and vessel motion shall be calculated in accordance with formulas specified in 8.2 and 8.3.

7.8 Guide tracks and dollies

All loads imposed by the attached equipment under all environmental and operating conditions applicable to the supporting derrick or mast.

7.9 Crown block assemblies

Maximum rated static hook load, in combination with fastline and deadline loads, for each applicable string-up condition.

8 Design specification

8.1 Allowable stresses

8.1.1 General

The steel structures shall be designed in accordance with AISC 335, except as further specified in this International Standard. The portion of AISC 335, *Allowable Stress Design*, commonly referred to as *Elastic Design*, shall be used in determining allowable unit stresses. Use of *Part 5, Chapter N — Plastic Design*, is not allowed. AISC 335 shall be used for determination of allowable unit stresses, except that current practice and experience do not dictate the need to follow AISC 335 for “members and their connections subject to fatigue loading” (Section K4), and for the consideration of secondary stresses.

For the purposes of this International Standard, stresses in the individual members of a latticed or trussed structure resulting from elastic deformations and rigidity of joints are defined as secondary stresses. These secondary stresses may be taken to be the differences between stresses from an analysis assuming fully rigid joints, with loads applied only at the joints, and those stresses from a similar analysis with pinned joints. Stresses arising from eccentric joint connection, or from transverse loading of members between joints, or from applied moments, shall be considered primary stresses.

Allowable unit stresses may be increased by 20 % when secondary stresses are computed and added to the primary stresses in individual members. However, primary stresses shall not exceed the allowable unit stress.

Earthquake loading and the related allowable stresses are addressed specifically in 8.4.

8.1.2 Wind and dynamic stresses (induced by floating hull motion)

Allowable unit stresses may be increased one-third over basic allowable stresses as provided in 8.1.1 when produced by wind or dynamic loading acting alone, or in combination with the design dead load and live load, provided the required section computed on this basis is not less than required for the design dead and live load and impact (if any), computed without the one-third increase.

The intent of this clause is to include dynamic loading due to floating hull motion, to the one-third increase in allowable stress. It is not intended to be additive to the one-third increase in allowable stress, due to wind loading as defined in AISC 335.

8.1.3 Wire rope

The size and type of wire shall be as specified in ISO 10425 and by API RP 9B.

NOTE For the purposes of this provision, API Spec 9A is equivalent to ISO 10425.

A mast raised and lowered by means of a wire rope assembly shall have the wire rope assembly designed to have a nominal strength of at least 2,5 times the maximum design load on the assembly during erection.

Guy lines shall be designed to have a nominal wire rope assembly strength of at least 2,5 times the maximum guy load resulting from a loading condition.

8.1.4 Crown shafting

Crown shafts, including fastline and deadline sheave support shafts, shall be designed to AISC 335 (see 8.1.1) except that the factor of safety in bending shall be a minimum of 1,67 to yield. Wire rope sheaves and bearings shall be specified in accordance with ISO 13535 or API Spec 8A.

NOTE For the purposes of this provision, API Spec 8C is equivalent to ISO 13535.

8.2 Wind

8.2.1 General

Wind forces shall be applied to the entire structure. Those wind directions shall be determined and considered which result in stresses having the highest magnitude for each component part of the structure. Wind forces for the various design wind speeds shall be calculated in accordance with the following equations and tables.

8.2.2 Wind force equation

$$F = p \times A \tag{1}$$

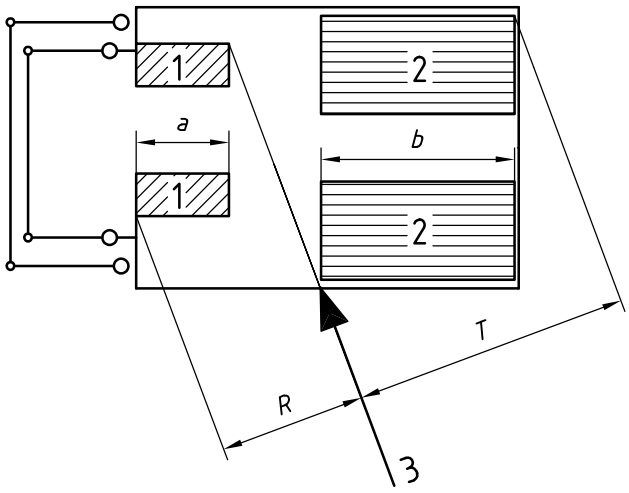
where

F is the wind force, expressed in newtons;

p is the wind pressure, expressed in newtons per square metre;

A is the total area projected on a plane, expressed in square metres, perpendicular to the direction of the wind, except that the exposed areas of two opposite sides of the mast or derrick shall be used.

If pipe or tubing is racked in more than one area (see e.g. 2 in Figure 1), the minimum area of setback shall be no less than 120 % of the area on one side, and if rods are racked in more than one area (see e.g. 1 in Figure 1), the minimum area of rods shall be no less than 150 % of the area of one side to account for the effect of wind on the leeward area. See Figure 1.



Key

1 rods
2 tubing
3 critical wind direction

Figure 1 — Diagram of projected area

In calculating the value of A:

If R, the projected width of the rods, is greater than 1,5a, use R. If not use 1,5a.

If T, the projected width of the tubing, is greater than 1,2b, use T. If not use 1,2b.

8.2.3 Wind pressure equation

$$p = 0{,}611 \times V_k{}^2 \times C_h \times C_s \tag{2}$$

where

p is the wind pressure, expressed in newtons per square metre;

V_k is the wind velocity, expressed in metres per second;

C_h is the height coefficient, (from Table 1);

C_s is the shape coefficient. For derricks and masts this value is 1,25.

Table 1 — Height coefficient, C_h

Height[a] m	C_h[b]
> 0 and ⩽ 15	1,00
> 15 and ⩽ 30	1,10
> 30 and ⩽ 46	1,20
> 46 and ⩽ 61	1,30
> 61 and ⩽ 76	1,37
> 76 and ⩽ 91	1,43
> 91 and ⩽ 107	1,48
> 107 and ⩽ 122	1,52
> 122 and ⩽ 137	1,56
> 137 and ⩽ 152	1,60
> 152 and ⩽ 168	1,63
> 168 and ⩽ 183	1,67
> 183 and ⩽ 198	1,70
> 198 and ⩽ 213	1,72
> 213 and ⩽ 229	1,75
> 229 and ⩽ 244	1,77
> 244 and ⩽ 259	1,79
> 259	1,80

[a] Height, in metres, is the vertical distance from ground or water surface to the centre of area.

[b] The base level of the derrick or mast above the ground or water surface used for calculating height coefficients shall be specified in the derrick or mast instructions.

Values for C_h and C_s were obtained from reference [1].

Table 2 gives results from Equation (2) for 0 m to 15,24 m height and C_s = 1,25.

Table 2 — Conversion values (for 0 m **to** 15,24 m **height and** C_s = 1,25**)**

Wind pressure p N/m^2	**Wind velocity** V_k m/s
477	25
734	31
990	36
1 222	40
1 479	44
1 760	48
2 065	52
2 310	55
2 569	58
2 750	60

8.3 Dynamic loading (induced by floating hull motion)

8.3.1 Dynamic forces equations

Forces shall be calculated according to the following formulas.

$$F_P = \left(\frac{WL_1}{g} \times \frac{4\pi^2}{\tau_P{}^2} \times \frac{\pi\phi}{180} \right) + W \sin(\phi) \tag{3}$$

$$F_R = \left(\frac{WL}{g} \times \frac{4\pi^2}{\tau_R{}^2} \times \frac{\pi\theta}{180} \right) + W \sin(\theta) \tag{4}$$

$$F_H = W + \frac{2W\pi^2 H}{\tau_H{}^2 g} \tag{5}$$

where

F_P is the force due to pitch, expressed in newtons;

F_R is the force due to roll, expressed in newtons;

F_H is the force due to heave, expressed in newtons;

W is the deadweight of the point under consideration, expressed in newtons;

L_1 is the distance, expressed in metres, from the pitch axis to the centre of gravity of the point under consideration;

L is the distance, expressed in metres, from the roll axis to the centre of gravity of the point under consideration;

H is the heave (total displacement), expressed in metres;

τ_P is the period of pitch, expressed in seconds;

τ_R is the period of roll, expressed in seconds;

τ_H is the period of heave, expressed in seconds;

ϕ is the angle of pitch, expressed in degrees;

θ is the angle of roll, expressed in degrees;

g is the acceleration of gravity (9,81 m/s^2).

8.3.2 Combined roll, pitch and heave

Unless otherwise specified, the force due to combined roll, pitch and heave shall be considered to be the larger of the following three:

a) force due to roll plus force due to heave;

b) force due to pitch plus force due to heave;

c) force due to roll and pitch determined as the square root of the sum of squares plus force due to heave.

8.4 Earthquake

Earthquake consideration is a special loading condition to be addressed if specified by the user. The user is responsible for furnishing the design criteria, which include design loading, the design analysis method and allowable response.

The design criteria for land-based units may be in accordance with local building codes, using equivalent static design methods.

For a unit based on an offshore platform, the design method for earthquake loading shall follow the strength level analysis guidelines outlined in API RP 2A-WSD. The drilling and well-servicing units shall be designed to resist the movement of the deck on which they are founded, i.e. the response of the deck to the ground motion prescribed for the design of the offshore platform. The allowable stresses for the combined earthquake, gravity and operational loading should be limited to those basic allowable stresses, with the one-third increase as specified in AISC 335, Part I. The computed stresses should include both the primary and the secondary stress components.

8.5 Design verification

See 11.8.2 for requirements.

9 Materials

9.1 General

This clause describes the various material qualifications, property and processing requirements for critical components, unless otherwise specified.

All materials used in the manufacture of equipment furnished under this International Standard shall be suitable for the intended service.

9.2 Written specifications

Material shall be produced to a written material specification. The specification requirements shall define at least the following parameters and limitations:

a) mechanical property requirements;

b) chemical composition and tolerances;

c) material qualification.

9.3 Mechanical properties

Materials shall meet the property requirements specified in the manufacturer's material specification.

If specified by the purchaser, the supplementary impact toughness requirements in Annex A, SR1, shall apply.

9.4 Material qualification

The mechanical tests required by this International Standard shall be performed on qualification test coupons representing the heat and heat-treatment lot used in the manufacture of the component. Tests shall be performed in accordance with the requirements of ASTM A 370 or equivalent standards, using material in the final heat-treated condition.

Qualification test coupons shall be either integral with the components they represent or separate from the components or a sacrificial product part. In all cases, test coupons shall be from the same heat as the components which they qualify, given the same working operations, and shall be heat-treated with the components.

9.5 Material manufacture

All wrought materials shall be manufactured using processes which produce a wrought structure throughout the component.

For PSL 2, all heat-treatment operations shall be performed utilizing equipment qualified in accordance with the requirements specified by the manufacturer or processor. The loading of the material within heat-treatment furnaces shall be such that the presence of any one part does not adversely affect the heat-treatment lot. The temperature and time requirements for heat-treatment cycles shall be determined in accordance with the manufacturer's or processor's written specification. Actual heat-treatment records shall be traceable to relevant components.

9.6 Bolts

Bolts which conform to a recognized industry standard shall be marked in accordance with such standard. Other bolts may be used provided the chemical, mechanical and physical properties conform to the limits guaranteed by the bolt manufacturer.

9.7 Wire rope

Wire rope for guy line or erection purposes shall conform to ISO 10425.

NOTE For the purposes of this provision, API Spec 9A is equivalent to ISO 10425.

10 Welding requirements

10.1 General

This clause describes requirements for the welding of critical components.

10.2 Welding qualifications

All welding undertaken on components shall be performed using welding procedures which are in accordance with AWS D1.1 or similarly recognized industry standard.

This welding shall only be carried out by welders or welding operators who are qualified in accordance with aforementioned standards. Workmanship and technique shall be in accordance with the same standard.

10.3 Written documentation

Welding shall be performed in accordance with welding procedure specifications (WPS) written in accordance with the applicable standard. The WPS shall describe all the essential variables as listed in the applicable standard.

The use of prequalified joint details as specified in AWS D1.1 is acceptable. The manufacturer shall have a written WPS for prequalified joints.

Weld joints and/or process not meeting AWS D1.1 requirements for prequalification shall be qualified in accordance with the applicable standard. The procedure qualification record (PQR) shall record all essential and supplementary essential (when required) variables of the weld procedure used for the qualification tests. Both WPS and the PQR shall be maintained as records in accordance with the requirements of Clause 12 of this International Standard.

10.4 Control of consumables

Welding consumables shall conform to American Welding Society (AWS) or consumable manufacturers' specifications.

The manufacturer shall have a written procedure for storage and control of weld consumables. Materials of low hydrogen type shall be stored and used as recommended by the consumable manufacturer to retain their original low hydrogen properties.

10.5 Weld properties

For all procedures requiring qualification, the mechanical properties of the weld, as determined by the procedure qualification test, shall at least meet the minimum specified mechanical properties required by the design. If impact testing is required for the base material, it shall also be a procedure qualification requirement. Results of testing in the weld and base material heat-affected-zone (HAZ) shall meet the minimum requirements of the base material. In the case of attachment welds, only the HAZ of materials requiring impact testing shall meet the above requirements.

All weld testing shall be undertaken with the test weldment in the applicable post-weld heat-treated condition.

10.6 Post-weld heat treatment

Post-weld heat treatment of components shall be in accordance with the applicable qualified welding procedure specification (WPS).

10.7 Quality control requirements

Requirements for quality control of permitted welds shall be in accordance with Clause 11.

10.8 Specific requirement — repair welds

10.8.1 Access

There shall be adequate access to evaluate, remove and inspect the nonconforming condition which is the cause of the repair.

10.8.2 Fusion

The selected welding procedure specification (WPS) and the available access for repair shall be such as to ensure complete fusion with the base material.

10.8.3 Heat treatment

The welding procedure specification used for qualifying a repair shall reflect the actual sequence of weld repair and heat treatment imparted to the repaired item.

11 Quality control

11.1 General

This clause specifies the quality control requirements for equipment and material. All quality control work shall be controlled by the manufacturer's documented instructions which shall include appropriate methodology, quantitative and qualitative acceptance criteria.

The manufacturer shall have a programme to ensure that the quality of products is planned, implemented and maintained. The quality programme shall be described in a quality manual, the issuance and revision of which shall be controlled and shall include a method to identify the latest revisions in the manual.

The acceptance status of all equipment, parts and materials shall be indicated either on the item or in the records related to the equipment, parts or materials.

11.2 Quality control personnel qualifications

11.2.1 Non-destructive examination (NDE) personnel shall be qualified and/or certified in accordance with ISO 9712.

NOTE For the purposes of this provision, ASNT TC-1A is equivalent to ISO 9712.

11.2.2 Personnel performing visual inspection of welding operations and completed welds shall be qualified and certified as follows:

a) AWS certified welding inspector, or

b) AWS certified associate welding inspector, or

c) a welding inspector certified by the manufacturer's documented procedures.

11.3 Measuring and test equipment

Equipment used to inspect, test or examine material or other equipment shall be identified, controlled, calibrated and adjusted at specific intervals in accordance with the manufacturer's documented procedures, and consistent with a recognized industry standard to maintain the required level of accuracy.

11.4 Non-destructive examination

11.4.1 General

Instructions for non-destructive examination (NDE) activities shall be detailed regarding the requirements of this International Standard and those of all applicable referenced specifications. All NDE instructions shall be approved by an examiner qualified to ISO 9712, level 3.

NOTE For the purposes of this provision ASNT TC-1A level III is equivalent to ISO 9712, level 3.

If examination is required it shall be done after final heat treatment.

The requirements of 11.4 shall apply to all critical components as designated by manufacturer's design engineering department unless specified otherwise.

11.4.2 Visual examination

All critical welds shall be 100 % visually examined.

11.4.3 Surface NDE

Twenty percent (20 %) of critical welds shall be inspected using magnetic particle (MP) or liquid penetrant (LP) method in accordance with Section 6 of AWS D1.1. The manufacturer's inspector shall choose areas for random inspection coverage.

11.4.4 Volumetric NDE

All full- or partial-penetration welds loaded in tension to 70 % or greater of their allowable stress, as determined by design, shall be ultrasonically or radiographically inspected in accordance with Section 6 of AWS D1.1. The manufacturer's design engineering department shall document the welds which require volumetric NDE.

For PSL 2, through-thickness NDE connections in critical components with through-thickness tensile stresses greater than 70 % of allowable stress, as determined by design, shall be ultrasonically inspected for laminations and internal discontinuities in accordance with ASTM A 578, with the following changes.

a) The area to be examined shall include the weld area and adjacent areas up to 76 mm from the weld. The area shall be 100 % scanned.

b) The following discontinuities shall be recorded and referred to the manufacturer's design engineering department for disposition:

   1) all discontinuities causing a 50 % loss of initial backwall regardless of size;

   2) all discontinuities with amplitudes greater than 50 % of initial backwall which cannot be contained in a 25 mm circle;

   3) any discontinuities which in the technician's judgment would interfere with the ultrasonic inspection of the completed weldment.

c) The manufacturer's design engineering department shall review all recordings and determine repair requirements, if any.

d) All recordings and dispositions shall be documented and records retained in accordance with Clause 12.

11.4.5 Acceptance criteria

The acceptance criteria in Section 8 of AWS D1.1 shall be used for visual, surface and volumetric NDE examination.

For PSL 2, acceptance criteria for NDE examination for mast and derrick critical welds shall be in accordance with Section 9 of AWS D1.1.

11.5 Dimensional verification

Verification of dimensions shall be carried out on a sample basis as defined and documented by the manufacturer.

11.6 Workmanship and finishing

11.6.1 Structural steel

Structures and products produced shall conform to applicable sections of the AISC 335, concerning fabrication.

11.6.2 Castings

All castings shall be thoroughly cleaned, and all cored holes shall be drifted to ensure free passage of proper size bolt.

11.6.3 Protection

All forged, rolled structural steel shapes and plates, and castings shall be cleaned, primed and painted with a good grade of commercial paint or other specified coating before shipment. Machined surfaces shall be protected with a suitable lubricant or compound.

11.6.4 Socketing

Socketing of raising, erection, or telescoping mast wire ropes shall be performed in accordance with practices outlined by API RP 9B. Socketed connections shall be proof-tested in accordance with 11.8.3.

11.7 Purchaser's inspection and rejection

11.7.1 Inspection notice

If the inspector representing the purchaser requests to inspect the product, the product at the works or witness test, the manufacturer shall give the inspector reasonable notice as to available inspection dates.

11.7.2 Inspection

While work on the purchaser's product is being performed, the purchaser's inspector shall have free entry at all times to all parts of the manufacturer works concerned with the manufacture of the products ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the product is being manufactured in accordance with this International Standard. All inspections should be made at the place of manufacture prior to shipment, unless otherwise specified on the purchase order, and shall be so conducted as not to interfere unnecessarily with operation of works. Such interference shall be grounds for refusal of inspection by the manufacturer.

11.7.3 Rejection

Material which shows injurious defects on inspection subsequent to acceptance at manufacturer's works, or which proves defective when properly applied in service, may be rejected and the manufacturer so notified in writing. If tests that require the destruction of material are made, the purchaser shall pay for the material which meets the specification, but shall not pay for the material which fails to meet the specification.

11.7.4 Records

Full records of all calculations and tests shall be maintained by the manufacturer. If requested by the purchaser, the manufacturer shall make available for examination details of computations, drawings, test, or other supporting data as may be necessary to demonstrate compliance with this International Standard. It shall be understood that such information is for the sole use of the user or prospective purchaser for the purpose of checking the equipment rating for compliance with this International Standard, and that the manufacturer shall not be required to release the information from his custody.

11.8 Testing

11.8.1 Proof load testing

Proof load testing of products manufactured to this International Standard is not a requirement of this International Standard. If specified by the purchaser, proof load testing shall be in accordance with Annex A, SR2.

11.8.2 Design verification

The accuracy of the standard design ratings of each structure shall be tested by proof loading or by a computer model such as FEA (finite element analysis). The intent of such testing shall be to verify the structure for the design loadings specified in Clause 6.

Testing methods and assumptions shall be documented. Computer modelling documentation shall include loads, member properties, model geometry and connectivity, member effective-length factors and unbraced lengths, support conditions, member end fixities and analysis results demonstrating compliance with Clause 7. Documentation shall be verified by a qualified individual other than the designer of the test.

11.8.3 Wire rope connections

Wire rope end connections used for erection purposes shall be proof-tested to 50 % of wire rope nominal assembly strength.

11.8.4 Cylinders and winches

Cylinders and winches used for erection of masts or substructures shall be pressure-tested to 1,5 times the system design working pressure. The test pressure shall be maintained for a duration of 10 min.

11.9 Traceability

The manufacturer shall obtain and retain a material test report on all steel material received having a specified yield strength greater than the following:

a) structural shapes or plate 248 MPa;

b) tubing 317 MPa;

c) solid round bars 414 MPa.

Any substitution of an alternative material to that called out in the engineering drawing or instructions should be documented and traceable to the specific unit by serial number or similar specific identification.

For PSL 2, critical components shall be traceable by heat and heat-treatment lot identification. Identification shall be maintained through all stages of manufacturing, traceable to the specific unit by a serial number.

For PSL 2, certified reports shall constitute sufficient evidence of conformity for nonferrous materials and bearings.

For PSL 2, bolts shall be exempt from the traceability requirements, provided they are manufactured and marked in accordance with recognized industry standards.

12 Documentation

12.1 General

Full records of any documentation referenced in this International Standard shall be kept by the manufacturer for a period of five years after the equipment has been manufactured and sold. Documentation shall be clear, legible, reproducible, retrievable and protected from damage, deterioration or loss.

All quality control records required by this International Standard shall be signed and dated. Computer-sorted records shall contain originator's personal code.

If requested by a purchaser of the equipment, authorities or certifying agencies, the manufacturer shall make available all records and documentation for examination to demonstrate compliance with this International Standard.

12.2 Documentation to be kept by the manufacturer

The following documentation shall be kept by the manufacturer:

a) design documentation (see 8.5);

b) written specifications (see Clauses 9, 10 and 11);

c) qualification records such as:

   1) weld-procedure qualification records;

   2) welder qualification records;

   3) NDE-personnel qualification records;

   4) measuring and test equipment calibration records;

d) inspection and test reports covering the following tests, as applicable:

   1) Material test reports covering the following tests, as applicable:

      i) chemical analysis;

      ii) tensile tests;

      iii) impact tests;

      iv) hardness tests;

2) NDE records covering the surface and/or volumetric NDE requirements of Clause 10;

3) performance test records, where applicable, including:

   i) proof load-testing records;

   ii) hydrostatic pressure-testing records;

   iii) slingline socket proof-testing records;

4) special process records, where applicable.

12.3 Documentation to be delivered with equipment

12.3.1 Instructions

The manufacturer shall furnish to the purchaser one set of instructions that covers operational features, block reeving diagram, and lubrication points for each drilling or well-servicing structure. Instructions shall be included to include erection and lowering of the mast and/or substructure. A facsimile of the nameplate shall be included in the instructions.

12.3.2 Data book

If specified by the purchaser, a comprehensive data book shall be provided in accordance with Annex A, SR3.

Annex A
(normative)

Supplementary requirements

A.1 SR1 — Low-temperature testing

This supplementary requirement shall apply when specified by purchaser. In all cases, the purchaser and manufacturer shall agree upon the minimum design temperature and impact-test result requirements.

Critical components shall be fabricated from materials possessing the specified notch toughness at the required minimum design temperature. Impact testing shall be performed in accordance with the requirements of ASTM A 370.

If it is necessary for sub-size impact test pieces to be used, the acceptance criteria shall be multiplied by the appropriate adjustment factor listed in Table A.1. Sub-size test pieces of width less than 5 mm are not permitted.

Table A.1 — Adjustment factors for sub-size impact specimens

Specimen dimensions mm × mm	Adjustment factor
10,0 × 7,5	0,833
10,0 × 5,0	0,667

Products meeting this supplementary requirement shall have their nameplate stamped with SR1 and with the design minimum temperature, in degrees Celsius, and the impact value, in joules.

A.2 SR2 — Proof load test

The equipment shall be load-tested to a load agreed by the purchaser and manufacturer. After load testing, the equipment shall be visually examined in accordance with 11.4.2 of this International Standard.

The equipment shall have its nameplate stamped with SR2 and the ratio of load test to design load (load test/design load), for example SR2-1,0.

A.3 SR3 — Data book

If specified by the purchaser, records shall be prepared, gathered and properly collated in a data book by the manufacturer. The data book shall include for each unit at least:

a) statement of compliance;

b) equipment designation/serial number;

c) assembly and critical-area drawings;

d) nominal capacities and ratings;

e) list of components;

f) traceability codes and systems (marking on parts/records on file);

g) steel grades;

h) heat-treatment records;

i) material test reports;

j) NDE records;

k) performance test records, including functional hydrostatic and load-testing certificates (when applicable);

l) supplementary requirements certificates as required;

m) welding-procedure specifications and qualification records;

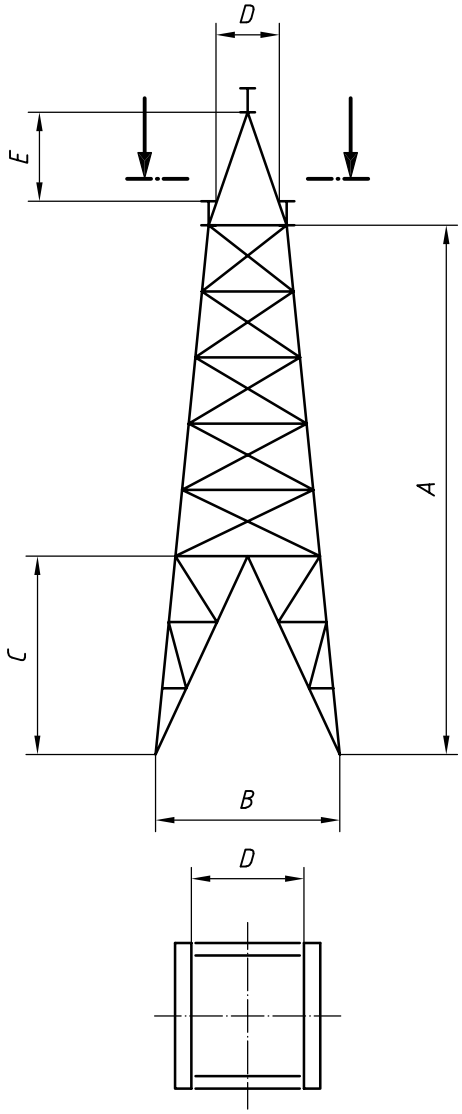
n) instructions.

Annex B
(normative)

Standard derricks

B.1 Derrick structure

A standard derrick is a structure of square cross-section whose dimensions are in accordance with a derrick size shown in Table B.1, with dimensions as designated in Figure B.1.



Key

A vertical distance from the top of baseplate to the bottom of the crown-block support beam
B heel-to-heel distance between adjacent legs at the top of the baseplate
C window opening, measured in the clear and parallel to the centreline of the derrick side from top of base plate
D smallest clear dimension at the top of the derrick that would restrict passage of crown block
E clearance between the horizontal header of the gin pole and the top of the crown-block support beam.

Figure B.1 — Derrick dimensions

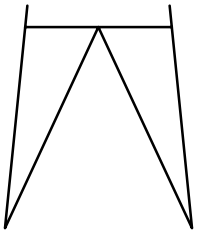
Table B.1 — Derrick sizes and general dimensions

Dimensions in metres

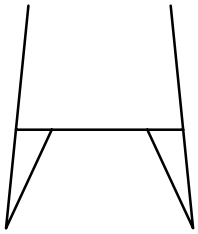
Derrick size No.	Height	Nominal base square	Window opening C ± 1 067 mm		Opening	Gin pole clearance
			Drawworks	V-window		
	A ± 152 mm	B ± 127 mm			D ± 51 mm	E ± 152 mm
10	24,38	6,10	2,29	7,21	1,68	2,44
11	26,52	6,10	2,29	7,21	1,68	2,44
12	28,65	7,32	2,29	7,21	1,68	2,44
16	37,19	7,32	2,29	7,21	1,68	2,44
18	41,45	7,92	2,29	7,21	1,68	3,66
18A	41,45	9,14	2,29	7,21	1,68	3,66
19	42,67	9,14	2,29	8,08	2,29	5,18
20	44,81	9,14	2,29	8,08	1,98	5,18
25	57,61	11,28	2,29	8,08	2,29	5,18

B.2 Derrick window

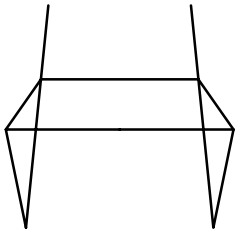
The derrick window is shown in Figure B.2. Window arrangement types A, C, D and E shall be interchangeable. The sizes and general dimensions of the V-window opening and drawworks window openings are shown in Table B.1.



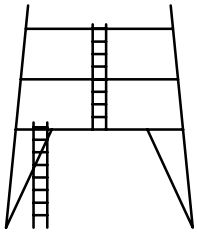
a) V-window type A



b) Drawworks window type C



c) Drawworks window type D



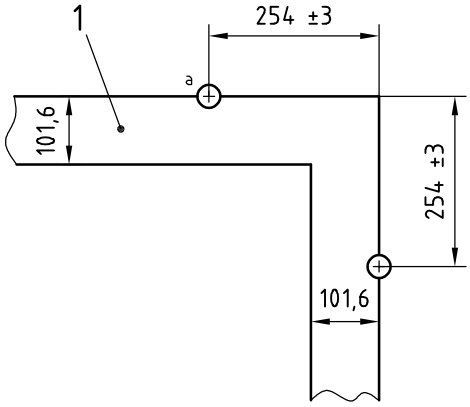
d) Ladder window type E

Figure B.2 — Derrick windows

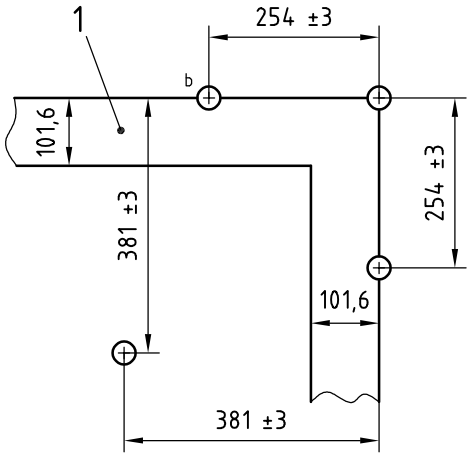
B.3 Foundation bolt settings

Foundation bolt sizes and patterns are shown in Figure B.3. Bolt sizes are minimum and should be increased if stresses dictate larger diameter. Maximum reaction (uplift, compression and shear) as produced by the standard derrick loading of 7.2, and foundation bolt size and setting plan shall be furnished, on request, to the original user.

Dimensions in millimetres

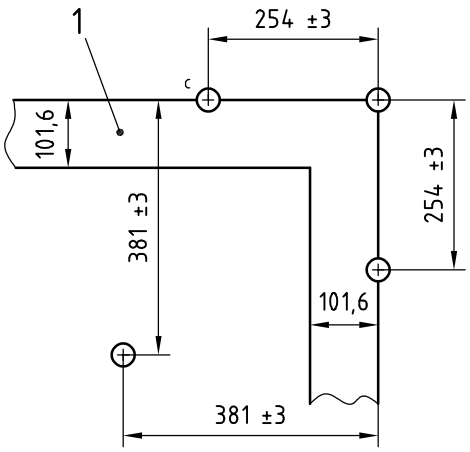


a) For derrick size numbers 10, 11, 11, 16 and 18



b) For derrick size numbers 19 and 20

Dimensions in millimetres



c) For derrick size number 25

Key

1 nominal base square

a Two 25,4 mm or 31,75 mm bolts at each corner, with 34,9 mm holes in baseplate.

b Four 38,1 mm bolts at each corner, with 44,5 mm holes in baseplate.

c Four 50,8 mm bolts at each corner, with 60,3 mm holes in baseplate.

Figure B.3 — Foundation bolt size and patterns for derrick leg

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[1] ABS[5] *Rules for Building and Classing Offshore Drilling Units*, 1991

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[3] API Spec 8C, *Specification for Drilling and Production Hoisting Equipment (PSL 1 and PSL 2)*

[4] ASNT[6] TC-1A, *Recommended Practice for Personnel Qualification and Certification in Non-Destructive Testing,* (also known as ASNT 2055)

[5] API Spec 9A, *Specification for Wire Rope*

5) American Bureau of Shipping, ABS Plaza, 16855 Northchase Drive, Houston, TX 77060, USA.

6) American Society for Nondestructive Testing, PO Box 28518, 1711 Arlingate Lane, Columbus, Ohio 43228-0518.

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