

INTERNATIONAL STANDARD

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13533

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Petroleum and natural gas industries — Drilling and production equipment — Drill- through equipment

*Industries du pétrole et du gaz naturel — Équipements de forage et de
production — Équipements à travers lesquels s'effectue le forage*



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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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 13533 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum and natural gas industries*, Subcommittee SC 4, *Drilling and production equipment*.

Annexes A and B form a normative part of this International Standard. Annexes C, D, E, F, G and H are for information only.

Introduction

This International Standard is based on API Specification 16A, second edition, 1 June 1998.

This International Standard is intended to provide for the availability of safe and functionally interchangeable drill-through equipment utilized in the petroleum and natural gas industry.

Users of this International Standard should be aware that further or differing requirements may be needed for individual applications. This International Standard is not intended to inhibit a vendor from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This may be particularly applicable where there is innovative or developing technology. Where an alternative is offered, the vendor should identify any variations from this International Standard and provide details.

For the convenience of users of this International Standard, annex H provides a list of those normative International Standards cited in clause 2 with national or regional standards which have been found mutually applicable in the context of the requirements in the text. The user may optionally apply the national or regional standard in the context of the requirement for which the International Standard is cited.

Petroleum and natural gas industries — Drilling and production equipment — Drill-through equipment

1 Scope

This International Standard specifies requirements for performance, design, materials, testing and inspection, welding, marking, handling, storing and shipping of drill-through equipment used for drilling for oil and gas. It also defines service conditions in terms of pressure, temperature and wellbore fluids for which the equipment will be designed.

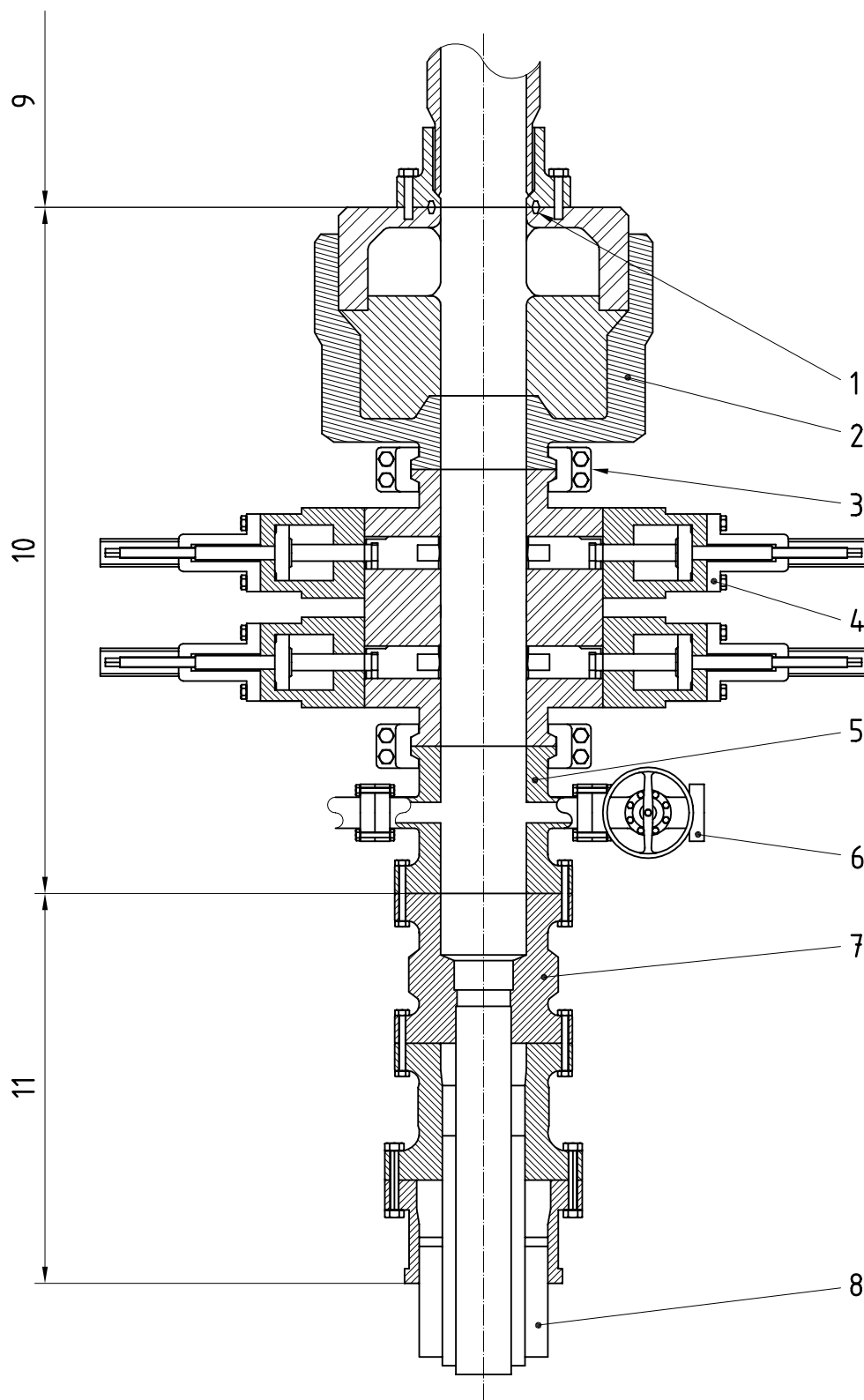
This International Standard is applicable to and establishes requirements for the following specific equipment:

- a) ram blowout preventers;
- b) ram blocks, packers and top seals;
- c) annular blowout preventers;
- d) annular packing units;
- e) hydraulic connectors;
- f) drilling spools;
- g) adapters;
- h) loose connections;
- i) clamps.

Dimensional interchangeability is limited to end and outlet connections.

Typical equipment defined by this International Standard is shown in Figures 1 and 2; recommendations for failure reporting are outlined in annex F.

This International Standard does not apply to field use or field testing of drill-through equipment.



Key

- | | | | |
|---|------------------------|----|-----------------------------------|
| 1 | Ring gaskets ISO 10423 | 7 | Wellhead |
| 2 | Annular BOP | 8 | Casing |
| 3 | Clamp | 9 | End and outlet connections |
| 4 | Ram BOP | 10 | Drill-through equipment ISO 13533 |
| 5 | Drilling spool | 11 | Wellhead equipment ISO 10423 |
| 6 | Valve ISO 10423 | | |

Figure 1 — Typical surface drill-through equipment

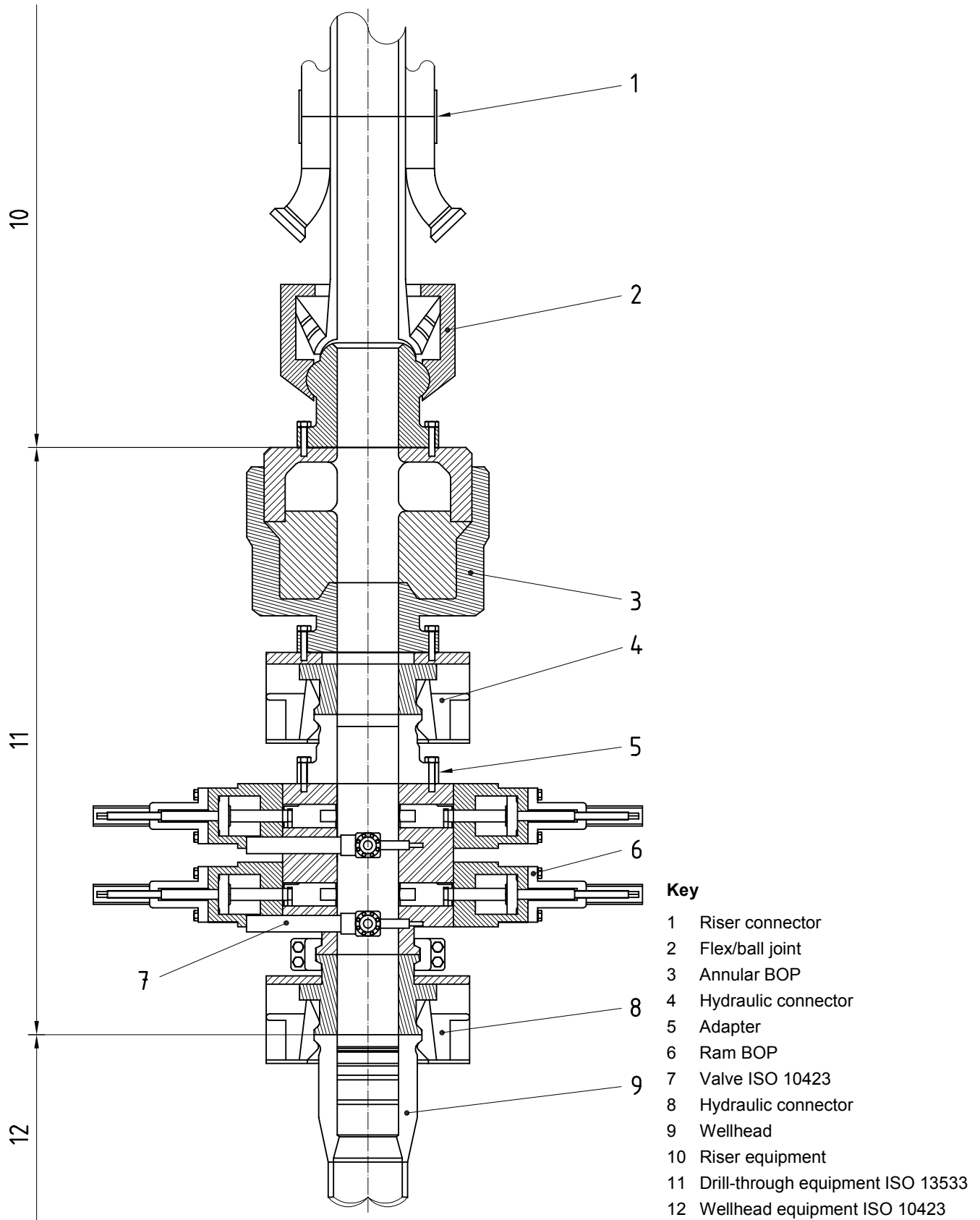


Figure 2 — Typical subsea drill-through equipment

2 Normative references

The following normative documents contain provisions, which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2859-1:1989, *Sampling procedures for inspection by attributes — Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)*

ISO 6892, *Metallic materials — Tensile testing at ambient temperature*

ISO 10423:2001, *Petroleum and natural gas industries — Drilling and production equipment — Wellhead and christmas tree equipment*

ISO 11961:1996, *Petroleum and natural gas industries — Steel pipes for use as drill pipe — Specification*

ISO 13665, *Seamless and welded steel tubes for pressure purposes — Magnetic particle inspection of the tube body for the detection of surface imperfections*

API Bulletin 6AF, *Capabilities of API flanges under combinations of load*

ASME Boiler and Pressure Vessel Code Section V, Article 5, *UT Examination Methods for Materials and Fabrication*

ASME Boiler and Pressure Vessel Code Section VIII, Division 1, Appendix 4, *Rounded Indication Charts Acceptance Standard for Radiographically Determined Rounded Indications in Welds*

ASME Boiler and Pressure Vessel Code Section VIII, Division 2, Pressure Vessel — Alternate Rules, Appendix 4, *Design Based on Stress Analysis*

ASME Boiler and Pressure Vessel Code Section VIII, Division 2, Pressure Vessel — Alternate Rules, Appendix 6, *Experimental Stress Analysis*

ASME Boiler and Pressure Vessel Code Section IX, Articles I, II, III and IV

ASTM A 193:1999, *Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service*

ASTM A 320:1999, *Specification for Alloy Steel Bolting Materials for Low Temperature Service*

ASTM A 370:1997, *Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM A 453:1999, *Specification for Bolting Materials, High Temperature, 50 to 120 ksi Yield Strength, with Expansion Coefficients Comparable to Austenitic Steels*

ASTM D 395:1998, *Standard Test Methods for Rubber Property — Compression Set*

ASTM D 412:1998, *Test Methods for Vulcanized Rubber, Thermoplastic Rubbers and Thermoplastic Elastomers*

ASTM D 471:1998, *Standard Test Method for Rubber Property — Effect of Liquids*

ASTM D 1414:1994, *Standard Test Methods for Rubber O-Rings*

ASTM D 1415:1994, *Standard Test Method for Rubber Property — International Hardness*

ASTM D 1418:1999, *Standard Practice for Rubber and Rubber Lattices — Nomenclature*

ASTM D 2240:1997, *Test Method for Rubber Property — Durometer Hardness*

ASTM E 94:1993, *Standard Guide for Radiographic Testing*

ASTM E 140:1999, *Hardness Conversion Tables for Metals*

ASTM E 165:1995, *Standard Test Method for Liquid Penetrant Examination*

ASTM E 569:1997, *Standard Practice for Acoustic Emission Monitoring of Structures During Controlled Simulation*

ASTM E 747:1997, *Standard Practice for Design, Manufacture, and Material Grouping Classification of Wire Image Quality Indicators (IQI) used for Radiography*

ASNT-SNT-TC-1A:1992, *Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing*

NACE MR0175–2000, *Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment*

SAE AMS-H-6875A:1998, *Heat Treatment of Steel Raw Materials*

3 Terms and definitions

For the purpose of this International Standard, the following terms and definitions apply.

3.1

acceptance criteria

defined limits placed on characteristics of materials, products or service

3.2

adapter

pressure-containing piece of equipment having end connections of different nominal size designation and/or pressure rating

3.3

annular blowout preventer

blowout preventer that uses a shaped elastomeric sealing element to seal the space between the tubular and the wellbore or an open hole

3.4

blind connection

end or outlet connection with no centre bore, used to completely close off a connection

3.5

blind-shear ram

closing and sealing component in a ram blowout preventer that first shears the tubular in the wellbore and then seals off the bore or acts as a blind ram if there is no tubular in the wellbore

3.6

blind ram

closing and sealing component in a ram blowout preventer that seals the open wellbore

3.7

blowout preventer

BOP

equipment (or valve) installed at the wellhead to contain wellbore pressure either in the annular space between the casing and the tubulars or in an open hole during drilling, completion, testing or workover operations

3.8

body

any portion of equipment between end connections, with or without internal parts, which contains wellbore pressure

3.9

bolting

threaded fasteners used to join end or outlet connections

3.10

calibration

comparison and adjustment to a standard of known accuracy

3.11

cast, verb

pour molten metal into a mould to produce an object of desired shape

3.12

casting, noun

object at or near finished shape obtained by solidification of a substance in a mould

3.13

chemical analysis

determination of the chemical composition of material

3.14

clamp, noun

device with internal angled shoulders used to fasten mating hubs

3.15

clamping load

axial load applied to clamp hubs by the clamp due to bolt tightening

3.16

closure bolting

threaded fasteners used to assemble pressure-containing parts other than end and outlet connections

3.17

conformance

compliance with specified requirements in every detail

3.18

corrosion-resistant ring groove

ring groove lined with metal resistant to metal-loss corrosion

3.19

critical component

part having requirements specified in this International Standard

3.20

data acquisition system

system for storing and/or providing permanent copies of test information

EXAMPLES Strip chart recorders, circular chart recorders or computer systems.

3.21**date of manufacture**

date of the manufacturer's final acceptance of finished equipment

3.22**drilling spool**

pressure-containing piece of equipment having end connections, used below or between drill-through equipment

NOTE When outlet connections are provided, they shall be manufactured in accordance with this International Standard.

3.23**end connection**

flange (studded or open-face), hub connection or **other end connection** (3.47) used to join together equipment and integral to that equipment

3.24**equipment**

any single completed unit that can be used for its intended purpose without further processing or assembly

3.25**fabrication weld**

weld joining two or more parts

3.26**flange**

protruding rim, with holes to accept bolts and having a sealing mechanism, used to join pressure-containing equipment together by bolting to another flange

3.27**forge, verb**

plastically deform metal, usually hot, into desired shapes with compressive force, with open or closed dies

3.28**forging, noun**

shaped metal part formed by the forging method

3.29**full-penetration weld**

weld that extends throughout the complete wall section of the parts joined

3.30**gasket-seating load**

that portion of the clamping load required to seat the gasket and bring the hub faces into contact

3.31**gasket-retaining load**

that portion of the clamping load required to offset the separating force the gasket exerts on the hubs when pressurized

3.32**heat-affected zone****HAZ**

that portion of the base metal which has not been melted, but whose mechanical properties or microstructure has been altered by the heat of welding or cutting

3.33**heat****cast lot**

material originating from a final melt

NOTE For remelted alloys, a heat is defined as the raw material originating from a single remelted ingot.

3.34

heat treatment

heat treating

alternate steps of controlled heating and cooling of materials for the purpose of changing physical or mechanical properties

3.35

heat treatment load

that material moved as a batch through one heat treatment cycle

3.36

hot-work, verb

deform metal plastically at a temperature above the recrystallization temperature

3.37

hub

protruding rim with an external angled shoulder and a sealing mechanism used to join pressure-containing equipment

3.38

hydraulic connector

hydraulically actuated drill-through equipment that locks and seals on end connections

3.39

indication

visual sign of cracks, pits or other abnormalities found during liquid penetrant and magnetic particle examinations

3.40

integral, adj

⟨parts⟩ joined by the forging, casting or welding process

3.41

job-lot traceability

ability for parts to be traced as originating from a job lot which identifies the included heat(s)

3.42

leakage

visible passage of pressurized fluid from the inside to the outside of the pressure-containment area of the equipment being tested

3.43

linear indication

⟨liquid penetrant or magnetic particle examination⟩ indication whose length is equal to or greater than three times its width

3.44

loose connection

flange (studded or open-face), hub connection or **other end connection** (3.47) used to join together equipment, but not integral to the equipment

3.45

major repair weld

weld whose depth is greater than 25 % of the original wall thickness or 25 mm, whichever is less

3.46

non-pressure-containing weld

weld whose failure will not reduce the pressure-containing integrity of the component

3.47**other end connection****OEC**

connection which is not specified in an ISO standard

NOTE This includes ISO flanges and hubs with non-ISO gasket preparations and manufacturer's proprietary connections.

3.48**part**

individual piece used in the assembly of a single unit of equipment

3.49**pipe ram**

closing and sealing component in a ram blowout preventer that seals around tubulars in the wellbore

3.50**post-weld heat treatment****PWHT**

any heat treatment subsequent to welding, including stress relief

3.51**pressure-containing part****pressure-containing member**

part exposed to wellbore fluids whose failure to function as intended would result in a release of wellbore fluid to the environment

EXAMPLES Bodies, bonnets and connecting rods.

3.52**pressure-containing weld**

weld whose failure will reduce the pressure-containing integrity of the component

3.53**pressure-controlling part****pressure-controlling member**

part intended to control or regulate the movement of wellbore fluids

EXAMPLES Packing elements, rams, replaceable seats within a pressure-containing member or part.

3.54**pressure end load**

axial load resulting from internal pressure applied to the area defined by the maximum seal diameter

3.55**pressure-retaining part****pressure-retaining member**

part not exposed to wellbore fluids whose failure to function as intended will result in a release of wellbore fluid to the environment

EXAMPLES Closure bolts and clamps.

3.56**product family**

model or type of specific equipment listed in clause 1 of this International Standard

3.57**qualified personnel**

individual with characteristics or abilities gained through training, experience or both, as measured against the manufacturer's established requirements

3.58

ram blowout preventer

blowout preventer that uses metal blocks with integral elastomer seals to seal off pressure on a wellbore with or without tubulars in the bore

3.59

rated working pressure

maximum internal pressure that the equipment is designed to contain and/or control

3.60

record, noun

retrievable information

3.61

relevant indication

⟨liquid penetrant or magnetic particle examination⟩ any indication with a major dimension over 1,6 mm (0,062 in)

3.62

remanufacture

process of disassembly, reassembly and testing of drill-through equipment, with or without the replacement of parts, in which machining, welding, heat treatment or other manufacturing operation is employed

3.63

repair

process disassembly, reassembly and testing of drill-through equipment, with or without the replacement of parts

NOTE Repair does not include machining, welding, heat treating, or other manufacturing operation of component parts and does not include the replacement of pressure-containing part(s) or member(s). Repair may include replacement of parts other than pressure-containing part(s) or member(s).

3.64

rounded indication

⟨liquid penetrant or magnetic particle examination⟩ any indication that is approximately circular or elliptical and whose length is less than three times its width

3.65

serialization

assignment of a unique code to individual parts and/or pieces of equipment to maintain records

3.66

special process

operation which converts or affects material properties

3.67

stabilized

⟨pressure testing⟩ in a state in which the initial pressure-decline rate has decreased to within the manufacturer's specified rate

NOTE Pressure decline can be caused by such things as changes in temperature, setting of elastomer seals or compression of air trapped in the equipment being tested.

3.68

stabilized

⟨temperature testing⟩ in a state in which the initial temperature fluctuations have decreased to within the manufacturer's specified range

NOTE Temperature fluctuation can be caused by such things as mixing of different-temperature fluids, convection or conduction.

3.69**standard connection**

flange, hub or studded connection manufactured in accordance with an ISO standard, including dimensional requirements

3.70**stress relief**

controlled heating of material to a predetermined temperature for the purpose of reducing any residual stresses

3.71**studded connection**

connection in which thread-anchored studs are screwed into tapped holes

3.72**surface finish**

Ra

measurement of the average roughness of a surface

NOTE 1 It is expressed in micrometres (μm).

NOTE 2 All of the surface finishes given in this International Standard are to be considered maxima.

3.73**trepan, verb**

produce a hole through a part by boring a narrow band or groove around the circumference of the hole and removing the solid central core of material

3.74**variable-bore ram****VBR**

closing and sealing component in a ram blowout preventer that is capable of sealing on a range of tubular sizes

3.75**visual examination**

examination of parts and equipment for visible defects in material and workmanship

3.76**volumetric non-destructive examination**

examination for internal material defects by radiography, acoustic emission or ultrasonic testing

3.77**weld groove**

area between two metals to be joined that has been prepared to receive weld filler metal

3.78**weld, verb**

act of fusing materials, with or without the addition of filler materials

3.79**weld joint**

fitting together of components in order to facilitate their joining by welding

3.80**wrought structure**

structure that contains no cast dendritic structure

3.81

yield strength

stress level, measured at room temperature, at which material plastically deforms and will not return to its original dimensions when the stress is released

NOTE 1 It is expressed in newtons per square millimetre (pounds per square inch) of loaded area.

NOTE 2 All yield strengths specified in this International Standard are considered as being the 0,2 % yield offset strength in accordance with ISO 6892.

4 Abbreviated terms

ANSI	American National Standards Institute
API	American Petroleum Institute
AQL	acceptance quality level
ASME	American Society of Mechanical Engineers
ASNT	American Society for Nondestructive Testing
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BOP	blowout preventer
HAZ	heat-affected zone
ID	inside diameter
LP	liquid penetrant
MP	magnetic particle
NACE	National Association of Corrosion Engineers
NDE	non-destructive examination
OD	outside diameter
OEC	other end connection
OEM	original equipment manufacturer
OS	operating system
PQR	procedure qualification record
VBR	variable-bore ram
WPS	welding procedure specification

5 Design requirements

5.1 Size designation

Equipment to which this International Standard is applicable shall have a vertical through-bore dimension (drift diameter) corresponding with the size designation as shown in Table 1.

Table 1 — Equipment size

Nominal size designation		Drift diameter	
mm	(in)	mm	(in)
179	7 1/16	178,61	7,032
228	9	227,84	8,970
279	11	278,64	10,970
346	13 5/8	345,31	13,595
425	16 3/4	424,69	16,720
476	18 3/4	475,49	18,720
527	20 3/4	526,29	20,720
540	21 1/4	538,99	21,220
680	26 3/4	678,69	26,720
762	30	761,24	29,970

5.2 Service conditions

5.2.1 Rated working pressure

Equipment to which this International Standard is applicable shall be rated in only the rated working pressures shown in Table 2.

Table 2 — Equipment rated working pressures

MPa	(psi)
13,8	2 000
20,7	3 000
34,5	5 000
69,0	10 000
103,5	15 000
138,0	20 000

5.2.2 Temperature ratings

Minimum temperature is the lowest ambient temperature to which the equipment may be subjected. Maximum temperature is the highest temperature of the fluid that may flow through the equipment.

Equipment shall be designed for metallic parts to operate within the temperature ranges shown in Table 3.

Equipment shall be designed for wellbore elastomeric materials to operate within the temperature classifications of Table 4.

All other elastomeric seals shall be designed to operate within the temperatures of the manufacturer's written specifications.

Table 3 — Temperature ratings for metallic materials

Classification	Operating range	
	°C	°F
T-75	– 59 to 121	– 75 to 250
T-20	– 29 to 121	– 20 to 250
T-0	– 18 to 121	0 to 250

Table 4 — Temperature ratings for non-metallic sealing materials

Lower limit (first digit)			Upper limit (second digit)		
Code	Temperature		Code	Temperature	
	°C	(°F)		°C	(°F)
A	– 26	– 15	A	82	180
B	– 18	0	B	93	200
C	– 12	10	C	104	220
D	– 7	20	D	121	250
E	– 1	30	E	149	300
F	4	40	F	177	350
G	Other	Other	G	Other	Other
X	See note	See note	X	See note	See note

NOTE These components may carry a temperature class of 4 °C to 82 °C (40 °F to 180 °F) without performing temperature verification testing provided they are marked as temperature class "XX".

EXAMPLE Material "EB" has a temperature rating of – 1 °C to 93 °C (30 °F to 200 °F).

5.2.3 Retained fluid ratings

All metallic materials which come in contact with well fluids shall meet the requirements of NACE MR0175 for sour service.

5.3 Equipment-specific design requirements

5.3.1 Flanged end and outlet connections

5.3.1.1 General

Flanged end and outlet connections shall conform to the dimensional requirements of ISO 10423.

Type 6B and API 6BX flange connections may be used as integral connections.

Type 6B and API 6BX flanges integral to drill-through equipment shall not contain test connections.

Type 6B and API 6BX flange connections shall be designed for use in the combination of size designation and pressure ratings shown in Table 5.

Table 5 — Pressure rating and size ranges of ISO 10423 flange connectors

Pressure rating		Type 6B	Type 6BX
MPa	(psi)		
13,8	2 000	2 1/6 to 21 1/4	26 3/4 to 30
20,7	3 000	2 1/16 to 20 3/4	26 3/4 to 30
34,5	5 000	2 1/16 to 11	13 5/8 to 21 1/4
69,0	10 000		1 13/16 to 21 1/4
103,5	15 000		1 13/16 to 18 3/4
138,0	20 000		1 13/16 to 13 5/8

5.3.1.2 API type 6B flange connections

Type 6B flange connections are of the ring joint type and are not designed for face-to-face make-up. The connection make-up bolting force reacts on the metallic gasket. The type 6B flange shall be of the through-bolted or studded design.

Dimensions for type 6B integral flanges shall conform to ISO 10423.

Dimensions for all ring grooves shall conform to ISO 10423.

5.3.1.3 API type 6BX flange connections

Type 6BX flanges are of the ring joint type and are designed with a raised face. Depending on tolerances, the connection make-up bolting force may react on the raised face of the flange when the gasket has been properly seated. This support prevents damage to the flange or gasket from excessive bolt torque. Therefore, one of the flanges in a 6BX connection shall have a raised face. The type 6BX flange shall be of the through-bolted or studded design.

Dimensions for type 6BX integral flanges shall conform to ISO 10423.

Dimensions for all ring grooves shall conform to ISO 10423.

Other weld preparations may be employed when the strength of the overlay alloy equals or exceeds the strength of the base material.

5.3.2 Studded end and outlet connections

5.3.2.1 General

The two types of studded end and outlet connections (6B and 6BX) referred to in this International Standard shall conform to ISO 10423.

6B and 6BX studded connections may be used as integral connections.

The design for studded end and outlet connections shall be the same as specified in 5.3.1.1, except as required in 5.3.2.2 and 5.3.2.3.

5.3.2.2 Type 6B studded connections

Dimensions for type 6B studded connections shall conform to ISO 10423 as it relates to the bore size, diameter of the bolt circle, and flange OD.

The studded connection shall be fully machined in accordance with ISO 10423.

Stud bolt holes shall be sized and located to conform to ISO 10423. The thread form of the tapped hole shall conform to the requirements of 5.3.3. The minimum depth of the full threads in the hole shall be equal to the diameter of the stud, and the maximum depth shall be in accordance with the manufacturer's written specification.

5.3.2.3 Type 6BX studded connections

Dimensions for Type 6BX studded connections shall conform to ISO 10423 concerning bore size, diameter of the bolt circle and flange OD.

The studded connection shall be fully machined in accordance with ISO 10423.

Stud bolt holes shall be sized and located in accordance with ISO 10423. The thread form of the tapped hole shall conform to the requirements of 5.3.3. The minimum depth of the full threads in the hole shall be equal to the diameter of the stud, and the maximum depth shall be in accordance with the manufacturer's written specification.

5.3.3 Studs, nuts and tapped stud holes (bolting)

Bolting for end and outlet connections, both studded and flanged, shall meet the requirements of ISO 10423.

5.3.4 Hubbed end and outlet connections

5.3.4.1 General

End and outlet hubs (16B and 16BX) shall be in accordance with this International Standard.

16B and 16BX hubs may be used as integral connections.

16B and 16BX hubs integral to drill-through equipment shall not contain test connections.

Type 16B and type 16BX hubs are designed for use in the combination of designated sizes and pressure ranges shown in Table 6.

Table 6 — Pressure ratings and size ranges of type 16B and 16BX hubs

Pressure rating		Type 16B	Type 16BX
MPa	(psi)		
13,8	2 000	7 1/6, 16 3/4, 21 1/4	
20,7	3 000	11, 13 5/8, 16 3/4	
34,5	5 000		2 1/16 to 21 1/4
69,0	10 000		1 13/16 to 21 1/4
103,5	15 000		1 13/16 to 18 3/4
138,0	20 000		1 13/16 to 11

5.3.4.2 Type 16B hubs

Type 16B hubs are of the ring joint type and are designed for face-to-face make-up. The type RX ring gasket is used for these connections. In order to accomplish a face-to-face make-up, the special type SR ring grooves shall be used as listed in Table 7 and Table 8.

Dimensions for type 16B integral hubs shall conform to Table 7 or Table 8 and to Figure 3.

Dimensions for type 16B blind hubs shall conform to Table 7 or Table 8 and to Figure 4.

Dimensions for ring grooves shall conform to Table 9 and Figure 5. All 23° surfaces of ring grooves shall have a surface finish no rougher than $Ra = 1,6 \mu\text{m}$ [$63 \mu\text{in}$ (micro-inch) RMS].

Type 16B hubs shall use type RX gaskets in accordance with 5.3.7.

Type 16B hub connections may be manufactured with corrosion-resistant overlays in the ring grooves. Prior to overlay, the ring groove shall be prepared as specified in Table 10 and Figure 6.

Other weld preparations may be employed when the strength of the overlay alloy equals or exceeds the strength of the base metal.

The counterbore in a type 16B hub is optional. If the counterbore is used, the depth of the counterbore shall not exceed the dimension and tolerance of the ring groove depth (E or C), as shown in the appropriate ring groove dimension table.

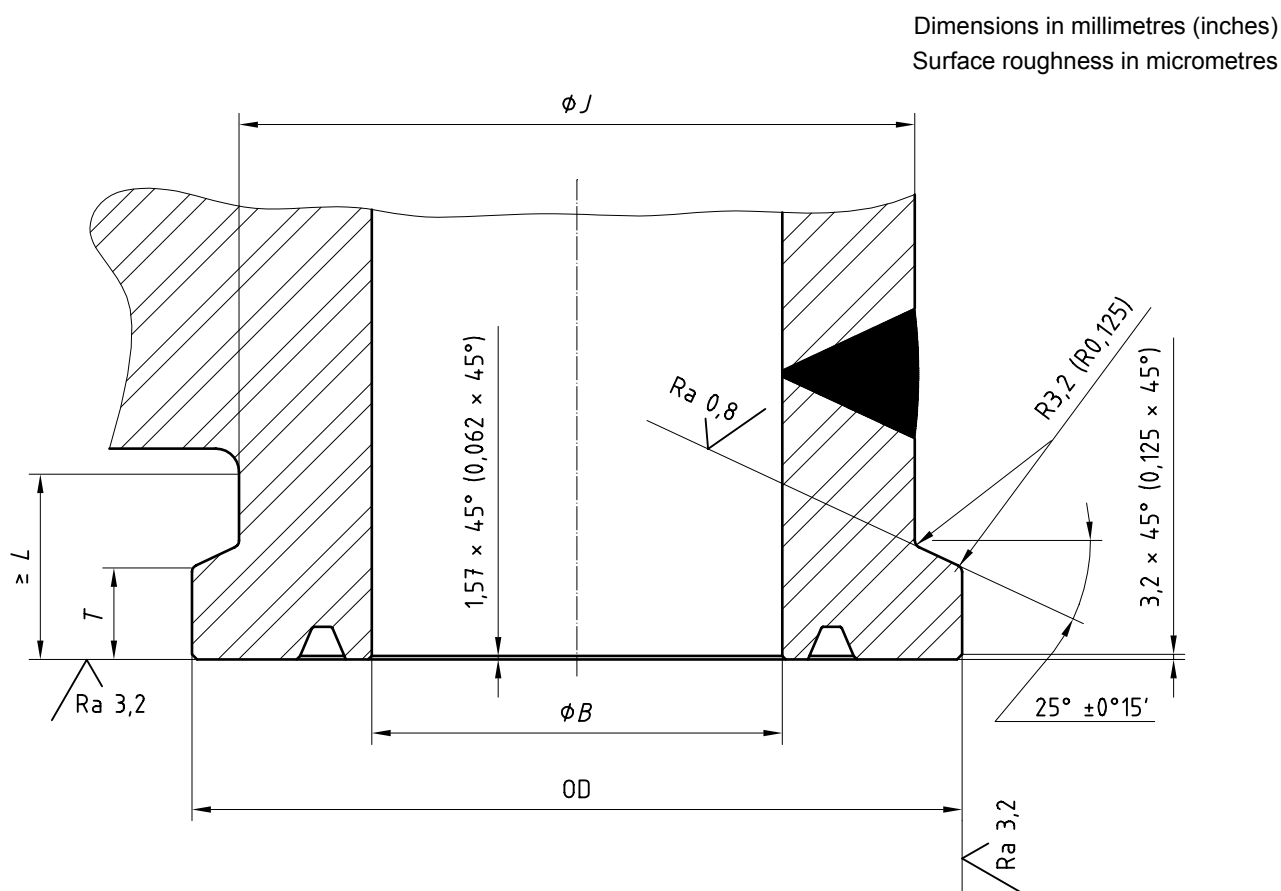
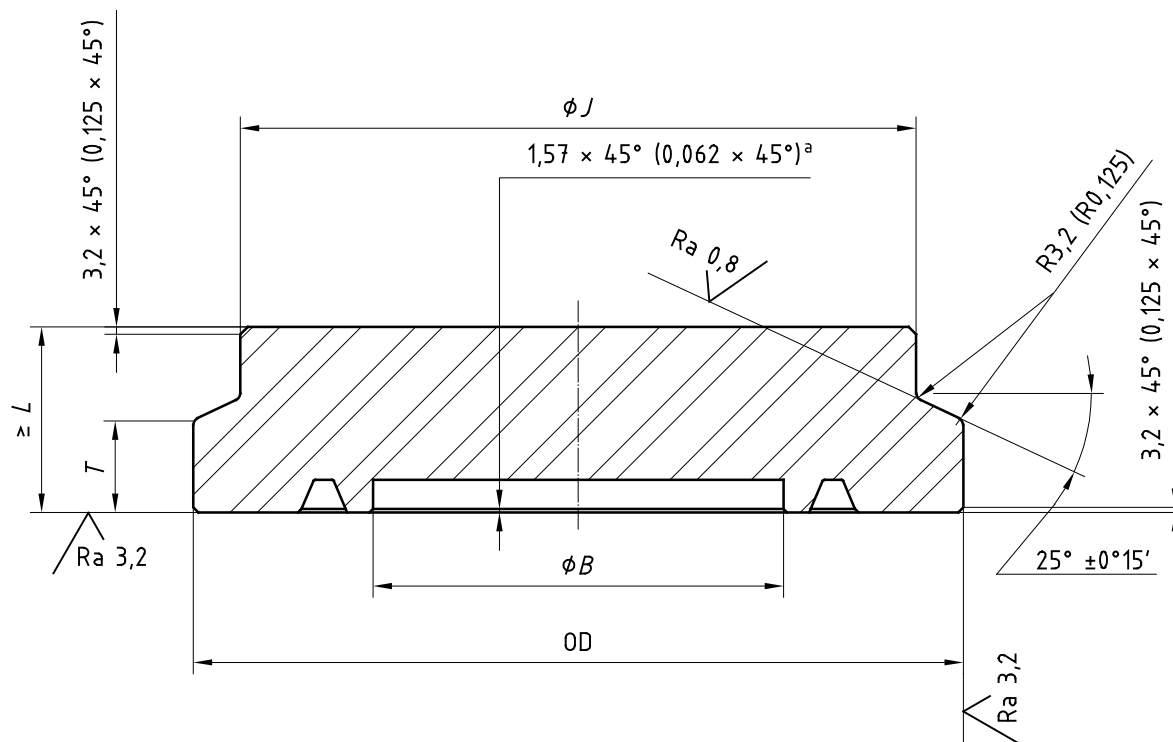


Figure 3 — Type 16B and 16BX integral hub connections

Dimensions in millimetres (inches)
Surface roughness in micrometres



NOTE 1 For 13,8 MPa (2 000 psi) and 20,7 MPa (3 000 psi) type 16B blind hubs, refer to Table 7 and Table 8 for hub dimensions, ring groove dimensions and tolerances. If corrosion-resistant inlay is used in ring grooves, refer to Table 9 for rough machining detail.

NOTE 2 For 34,5 MPa (5 000 psi), 69,00 MPa (10 000 psi), 103,5 MPa (15 000 psi) and 138,00 MPa (200 000 psi) type 16BX blind hubs, refer to Table 11, Table 12, Table 13 or Table 14 for hub dimensions, ring groove dimensions and tolerances. If corrosion-resistant inlay is used in ring grooves, refer to ISO 10423 for rough machining details.

^a The counterbore of a type 16B or 16BX hub is optional. If the counterbore is used, the depth of the counterbore shall not exceed the dimension and tolerance of *E* or *C*, as shown on the appropriate ring groove dimension table.

Figure 4 — Type 16B and 16BX blind hubs

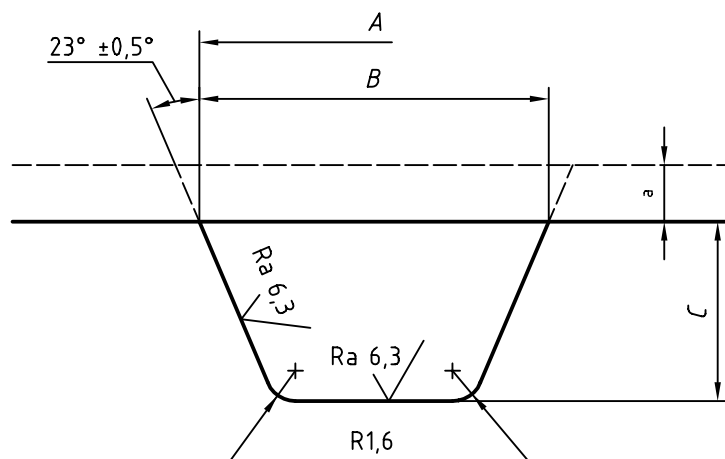
Table 7 — Type 16B integral hub connections for 13,8 MPa (2 000 psi) rated working pressure

Nominal size	Bore	Outside diameter	Total thickness	Large diameter of neck	Minimum neck length	Ring groove number	Clamp number
<i>B</i>	<i>B</i>	<i>OD</i>	<i>T</i>	<i>J</i>	<i>L</i>		
mm	mm	mm	mm	mm	mm		
(in)	(in)	(in)	(in)	(in)	(in)		
179	179,40	263,52	36,64	225,40	63,5	SR-45	25
(7 1/16)	(7,062)	(10,375)	(1,443)	(8,875)	(2,50)		
425	425,45	517,52	32,22	482,60	79,5	SR-65	12
(16 3/4)	(16,750)	(20,375)	(1,269)	(19,000)	(3,13)		
540	539,75	669,92	47,54	622,30	127,0	SR-73	18
(21 1/4)	(21,250)	(26,375)	(1,872)	(24,500)	(5,00)		
Tolerance	0,75	0,10	0	0	-1,4		
mm	0	-0,10	-0,22	-0,70			
(in)	(0,031)	(0,005)	(0,010)	(0,031)	(-0,06)		

Table 8 — Type 16B integral hub connections for 20,7 MPa (3 000 psi) rated working pressure

Nominal Size	Bore	Outside diameter	Total thickness	Large diameter of neck	Minimum neck length	Ring groove number	Clamp number
<i>B</i>	OD	<i>T</i>	<i>J</i>	<i>L</i>			
mm	mm	mm	mm	mm	mm		
(in)	(in)	(in)	(in)	(in)	(in)		
279	279,40	396,88	35,52	355,60	84,0	SR-53	9
(11)	(11,000)	(15,626)	(1,399)	(14,000)	(3,13)		
346	346,10	466,72	33,92	425,45	81,0	SR-57	11
(13 5/8)	(13,625)	(18,375)	(1,336)	(16,750)	(3,19)		
425	425,45	539,76	37,04	498,45	93,4	SR-65	14
(16 3/4)	(16,750)	(21,250)	(1,459)	(19,625)	(3,68)		
Tolerance							
mm	$\begin{smallmatrix} 0,75 \\ 0 \end{smallmatrix}$	$\begin{smallmatrix} 0,10 \\ -0,10 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0,22 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0,72 \end{smallmatrix}$	-1,4		
(in)	$\begin{pmatrix} 0,031 \\ 0 \end{pmatrix}$	$\begin{pmatrix} 0,005 \\ -0,005 \end{pmatrix}$	$\begin{pmatrix} 0 \\ -0,010 \end{pmatrix}$	$\begin{pmatrix} 0 \\ -0,031 \end{pmatrix}$	$\begin{pmatrix} -0,06 \end{pmatrix}$		

Dimensions in millimetres (inches)
Surface roughness in micrometres

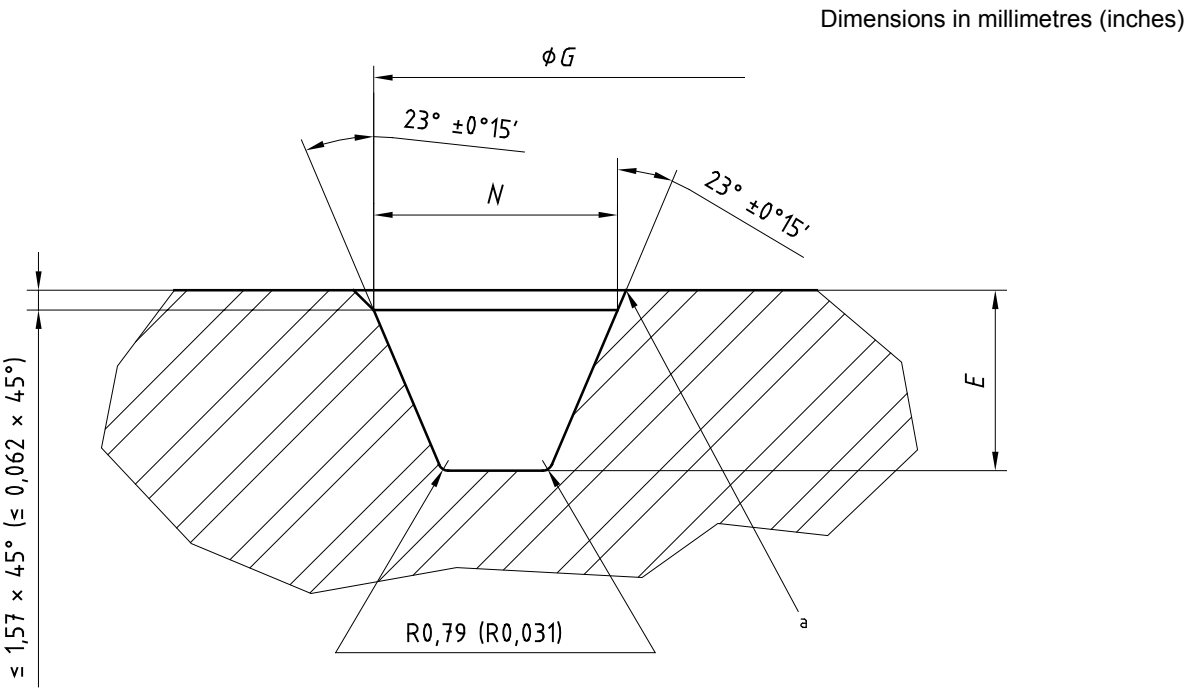


^a The counterbore of a type 16B or 16BX hub is optional. If the counterbore is used, the depth of the counterbore shall not exceed the dimension and tolerance of *E* or *C*, as shown on the appropriate ring groove dimension table.

Figure 5 — Rough machining of type SR ring grooves

Table 9 — Rough machining of type SR ring grooves

Ring groove number	Outside diameter of groove		Width of groove		Depth of groove	
	mm	(in)	mm	(in)	mm	(in)
SR-45	236,62	9,316	23,98	0,944	17,75	0,699
SR-53	349,08	13,743	23,98	0,944	17,75	0,699
SR-57	405,48	15,964	23,98	0,944	17,75	0,699
SR-65	494,38	19,464	23,98	0,944	17,75	0,699
SR-73	611,68	24,082	26,92	1,060	20,96	0,825
Tolerance	$\begin{smallmatrix} +7 \\ 0 \end{smallmatrix}$	$\begin{smallmatrix} +0,3 \\ 0 \end{smallmatrix}$	$\begin{smallmatrix} +7 \\ 0 \end{smallmatrix}$	$\begin{smallmatrix} +0,3 \\ 0 \end{smallmatrix}$	$\begin{smallmatrix} +7 \\ 0 \end{smallmatrix}$	$\begin{smallmatrix} +0,3 \\ 0 \end{smallmatrix}$
NOTE Allow 3,2 mm (1/8 in) or greater for final machining of overlay.						



a Break sharp corner

Figure 6 — Finish machining of type SR ring grooves

Table 10 — Finish machining of type SR ring grooves

Ring groove number	Outside diameter of groove		Width of groove		Depth of groove	
	<i>G</i>		<i>N</i>		<i>E</i>	
	mm	(in)	mm	(in)	mm	(in)
SR-45	228,27	8,987	16,97	0,668	14,28	0,562
SR-53	340,49	13,405	16,97	0,668	14,28	0,562
SR-57	397,13	15,635	16,97	0,668	14,28	0,562
SR-65	486,03	19,135	16,97	0,668	14,28	0,562
SR-73	603,33	23,753	19,92	0,784	17,48	0,688
Tolerance	$\begin{smallmatrix} +0,09 \\ 0 \end{smallmatrix}$	$\begin{smallmatrix} +0,004 \\ 0 \end{smallmatrix}$	$\begin{smallmatrix} +0,09 \\ 0 \end{smallmatrix}$	$\begin{smallmatrix} +0,004 \\ 0 \end{smallmatrix}$	$\begin{smallmatrix} +0,38 \\ 0 \end{smallmatrix}$	$\begin{smallmatrix} +0,016 \\ 0 \end{smallmatrix}$
NOTE Allow 3,2 mm (1/8 in) or greater for final machining of overlay.						

5.3.4.3 Type 16BX hubs

Type 16BX hubs are of the ring joint type and are designed for face-to-face make-up. Type BX ring gaskets are used for these connections.

Dimensions for type 16BX integral hubs shall conform to Table 11, Table 12, Table 13 or Table 14 and Figure 3.

Dimensions for type 16BX blind hubs shall conform to Table 11, Table 12, Table 13 or Table 14 and Figure 4.

Dimensions for all ring grooves shall conform to ISO 10423.

Type 16BX hubs shall use type BX gaskets in accordance with 5.3.7.

Type 16BX hubs may be manufactured with corrosion-resistant overlays in the ring grooves. Prior to overlay, the ring grooves shall conform to ISO 10423.

Other weld preparations may be employed when the strength of the overlay alloy equals or exceeds the strength of the base material.

The counterbore in a type 16BX hub is optional. If the counterbore is used, the depth of the counterbore shall not exceed the dimension and tolerance of the ring groove depth, *C* or *E*, as shown in the appropriate ring groove dimension table.

5.3.5 Clamps

5.3.5.1 General

This subclause provides the minimum design, material and dimensional requirements for clamps that shall be used in conjunction with type 16B and type 16BX hubs conforming to 5.3.4.

5.3.5.2 Design

Clamps shall be designed for use in the combination of designated size ranges and pressure ratings shown in Table 15. Clamps shall be designated by the clamp number shown in Table 15.

Clamp connectors shall be designed according to 5.4.2. Each clamp shall be designed for the highest loading that may be induced by any hub it is intended to fit.

Stresses shall be calculated at make-up, operating and test conditions.

Make-up stresses are directly proportional to the bolt loads and shall be determined based on the greater of:

- a) the bolt load required to seat the gasket and bring the hub faces into contact, or
- b) the bolt load required to retain the sum of the rated working pressure end load and the gasket-retaining load.

Make-up of the clamp shall be sufficient such that the hub faces meet and there is no facial separation at the hub OD at rated working pressure.

Operating stresses shall be determined using the stresses resulting from the sum of the rated working pressure end load and the gasket-retaining load.

Test condition stresses shall be determined using the stresses resulting from the sum of the test pressure end load and the gasket-retaining load.

The stresses shall be determined using the outside radius of the gasket as the sealing radius.

All clamps shall have grooves in their bores with angles of $25^\circ \pm 0,25^\circ$ to fit type 16B and type 16BX hubs.

All 25° surfaces in clamp grooves shall have a surface finish R_a of $0,8 \mu\text{m}$ ($32 \mu\text{in RMS}$) or less.

Table 11 — Type 16BX integral hub connections for 34,5 MPa (5 000 psi) rated working pressure

Nominal size	Bore	Outside diameter	Total thickness	Large diameter of neck	Minimum neck length	Ring groove number	Clamp number
<i>B</i>		OD	<i>T</i>	<i>J</i>	<i>L</i>		
mm	mm	mm	mm	mm	mm		
(in)	(in)	(in)	(in)	(in)	(in)		
52 (2 1/16)	52,40 (2,063)	127,78 (5,031)	29,60 (1,166)	92,85 (3,656)	56,3 (2,22)	BX-152	1
65 (2 9/16)	65,10 (2,563)	146,84 (5,781)	29,60 (1,166)	111,90 (4,406)	57,6 (2,27)	BX-153	2
78 (3 1/8)	79,40 (3,125)	160,32 (6,312)	29,60 (1,166)	125,40 (4,938)	59,9 (2,36)	BX-154	4
103 (4 1/16)	103,20 (4,063)	193,68 (7,625)	30,40 (1,197)	158,75 (6,250)	60,4 (2,38)	BX-155	5
178 (7 1/16)	179,40 (7,063)	336,54 (13,250)	41,18 (1,622)	295,25 (11,625)	85,8 (3,38)	BX-156	8
228 (9)	228,60 (9,000)	336,54 (13,250)	41,18 (1,622)	295,25 (11,625)	85,8 (3,38)	BX-157	8
279 (11)	279,40 (11,000)	412,76 (16,250)	42,00 (1,654)	371,45 (14,625)	104,9 (4,13)	BX-158	10
346 (13 5/8)	346,10 (13,625)	523,88 (20,625)	47,52 (1,871)	482,60 (19,000)	123,9 (4,88)	BX-160	13
425 (16 3/4)	425,45 (16,750)	650,88 (25,625)	45,16 (1,778)	609,60 (24,000)	139,7 (5,50)	BX-162	19
540 (21 1/4)	539,75 (21,250)	793,76 (31,250)	92,20 (3,630)	708,00 (27,875)	171,4 (6,75)	BX-165	27
Tolerance							
mm	0,75 0	0,10 -0,10	0 -0,22	0 -0,70	-1,4		
(in)	(0,031 0)	(0,005 -0,005)	(0 -0,010)	(0 -0,031)	(-0,06)		

Table 12 — Type 16BX integral hub connections for 69,0 MPa (10 000 psi) rated working pressure

Nominal size	Bore	Outside diameter	Total thickness	Large diameter of neck	Minimum neck length	Ring groove number	Clamp number
<i>B</i>	<i>B</i>	OD	<i>T</i>	<i>J</i>	<i>L</i>		
mm	mm	mm	mm	mm	mm		
(in)	(in)	(in)	(in)	(in)	(in)		
46 (1 13/16)	46,05 (1,813)	127,78 (5,031)	29,60 (1,166)	92,85 (3,656)	56,3 (2,22)	BX-151	1
52 (2 1/16)	52,40 (2,063)	146,84 (5,781)	29,60 (1,166)	111,90 (4,406)	57,6 (2,27)	BX-152	2
65 (2 9/16)	65,10 (2,563)	160,32 (6,312)	29,60 (1,166)	125,40 (4,938)	59,9 (2,36)	BX-153	4
78 (3 1/8)	79,40 (3,125)	193,68 (7,625)	30,40 (1,197)	158,75 (6,250)	60,4 (2,38)	BX-154	5
103 (4 1/16)	103,20 (4,063)	214,30 (8,437)	33,26 (1,310)	173,00 (6,812)	71,6 (2,82)	BX-155	6
178 (7 1/16)	179,40 (7,063)	412,76 (16,250)	41,98 (1,653)	371,45 (14,625)	104,9 (4,13)	BX-156	10
228 (9)	228,60 (9,000)	412,76 (16,250)	41,98 (1,653)	371,45 (14,625)	104,9 (4,13)	BX-157	10
279 (11)	279,40 (11,000)	523,88 (20,625)	51,68 (2,035)	473,05 (18,625)	120,6 (4,75)	BX-158	22
346 (13 5/8)	346,10 (13,625)	565,16 (22,250)	58,64 (2,309)	523,85 (20,625)	134,8 (5,31)	BX-159	15
425 (16 3/4)	425,45 (16,750)	711,20 (28,000)	76,32 (3,005)	635,00 (25,000)	156,7 (6,17)	BX-162	28
476 (18 3/4)	476,25 (18,750)	793,76 (31,250)	92,20 (3,630)	708,00 (27,875)	171,4 (6,75)	BX-164	27
540 (21 1/4)	539,75 (21,250)	863,60 (34,000)	101,72 (4,005)	774,70 (30,500)	208,7 (8,22)	BX-166	26
Tolerance							
mm	0,75 0	0,10 -0,10	0 -0,22	0 -0,70	-1,4		
(in)	(0,031 0)	(0,005 -0,005)	(0 -0,010)	(0 -0,031)	(-0,06)		

Table 13 — Type 16BX integral hub connections for 103,5 MPa (15 000 psi) rated working pressure

Nominal size	Bore	Outside diameter	Total thickness	Large diameter of neck	Minimum neck length	Ring groove number	Clamp number
<i>B</i>	<i>B</i>	OD	<i>T</i>	<i>J</i>	<i>L</i>		
mm	mm	mm	mm	mm	mm		
(in)	(in)	(in)	(in)	(in)	(in)		
46 (1 13/16)	46,05 (1,813)	146,84 (5,781)	29,60 (1,166)	111,90 (4,406)	57,6 (2,27)	BX-151	2
52 (2 1/16)	52,40 (2,063)	155,58 (6,125)	41,18 (1,622)	114,30 (4,500)	81,7 (3,22)	BX-152	3
65 (2 9/16)	65,10 (2,563)	155,58 (6,125)	41,18 (1,622)	114,30 (4,500)	81,7 (3,22)	BX-153	3
78 (3 1/16)	77,80 (3,063)	214,30 (8,437)	33,26 (1,310)	173,00 (6,812)	71,6 (2,82)	BX-154	6
103 (4 1/16)	103,20 (4,063)	336,54 (13,250)	41,18 (1,622)	295,25 (11,625)	85,8 (3,38)	BX-155	8
179 (7 1/16)	179,40 (7,063)	523,90 (20,626)	51,68 (2,035)	473,05 (18,625)	120,6 (4,75)	BX-156	22
279 (11)	279,40 (11,000)	565,16 (22,250)	58,64 (2,309)	523,85 (20,625)	134,8 (5,31)	BX-158	15
346 (13 5/8)	346,10 (13,625)	711,20 (28,000)	76,32 (3,005)	635,00 (25,000)	156,7 (6,17)	BX-159	28
476 (18 3/4)	476,25 (18,750)	863,60 (34,000)	101,72 (4,005)	774,70 (30,500)	208,7 (8,22)	BX-164	26
Tolerance							
mm	+0,75 0	+0,10 -0,10	0 -0,22	0 -0,70	-1,4		
(in)	$\left(\begin{smallmatrix} 0,031 \\ 0 \end{smallmatrix} \right)$	$\left(\begin{smallmatrix} 0,005 \\ -0,005 \end{smallmatrix} \right)$	$\left(\begin{smallmatrix} 0 \\ -0,010 \end{smallmatrix} \right)$	$\left(\begin{smallmatrix} 0 \\ -0,031 \end{smallmatrix} \right)$	$\left(\begin{smallmatrix} -0,06 \end{smallmatrix} \right)$		

Table 14 — Type 16BX integral hub connections for 138,0 MPa (20 000 psi) rated working pressure

Nominal size	Bore	Outside diameter	Total thickness	Large diameter of neck	Minimum neck length	Ring groove number	Clamp number
<i>B</i>	<i>B</i>	OD	<i>T</i>	<i>J</i>	<i>L</i>		
mm	mm	mm	mm	mm	mm		
(in)	(in)	(in)	(in)	(in)	(in)		
46 (1 3/16)	46,05 (1,813)	155,58 (6,125)	41,18 (1,622)	114,30 (4,500)	81,7 (3,22)	BX-151	3
52 (2 1/16)	52,40 (2,063)	155,58 (6,125)	41,18 (1,622)	114,30 (4,500)	81,7 (3,22)	BX-152	3
65 (2 9/16)	65,10 (2,563)	214,30 (8,437)	33,26 (1,310)	173,00 (6,812)	71,6 (2,82)	BX-153	6
78 (3 1/16)	77,80 (3,063)	336,54 (13,250)	41,18 (1,622)	295,25 (11,625)	85,8 (3,38)	BX-154	8
103 (4 1/16)	103,20 (4,063)	412,76 (16,250)	41,98 (1,653)	371,45 (14,625)	104,9 (4,13)	BX-155	10
179 (7 1/16)	179,40 (7,063)	565,16 (22,250)	58,64 (2,309)	523,85 (20,625)	134,8 (5,31)	BX-156	15
279 (11)	279,40 (11,000)	711,20 (28,000)	76,32 (3,005)	635,00 (25,000)	171,4 (6,17)	BX-158	28
Tolerance							
mm	+0,75 0	+0,10 -0,10	0 -0,22	0 -0,70	-1,4		
(in)	$\left(\begin{smallmatrix} 0,031 \\ 0 \end{smallmatrix} \right)$	$\left(\begin{smallmatrix} 0,005 \\ -0,005 \end{smallmatrix} \right)$	$\left(\begin{smallmatrix} 0 \\ -0,010 \end{smallmatrix} \right)$	$\left(\begin{smallmatrix} 0 \\ -0,031 \end{smallmatrix} \right)$	$\left(\begin{smallmatrix} -0,06 \end{smallmatrix} \right)$		

The coefficient of friction shall be considered and shall be + 0,1 at make-up and – 0,1 while operating. Friction, therefore, inhibits make-up and assists in holding the connection at operating and test conditions.

NOTE The coefficient of friction stated here is that used for clamp and hub design. This International Standard is not applicable to materials or coatings which have different coefficients of friction.

The clamp bore shall provide a minimum of 3 mm (0,125 in) radial clearance around the hub neck in the made-up condition on all hubs it is designed to fit.

All clamps shall have one or more bolts at each connecting point.

Spherical-face heavy hexagonal nuts or spherical washers shall be used to minimize potential bending in bolts.

Clamp-bolting stresses shall conform to 5.4.3. Torque values for clamp bolting shall be determined by the manufacturer to suit his design.

5.3.5.3 Material

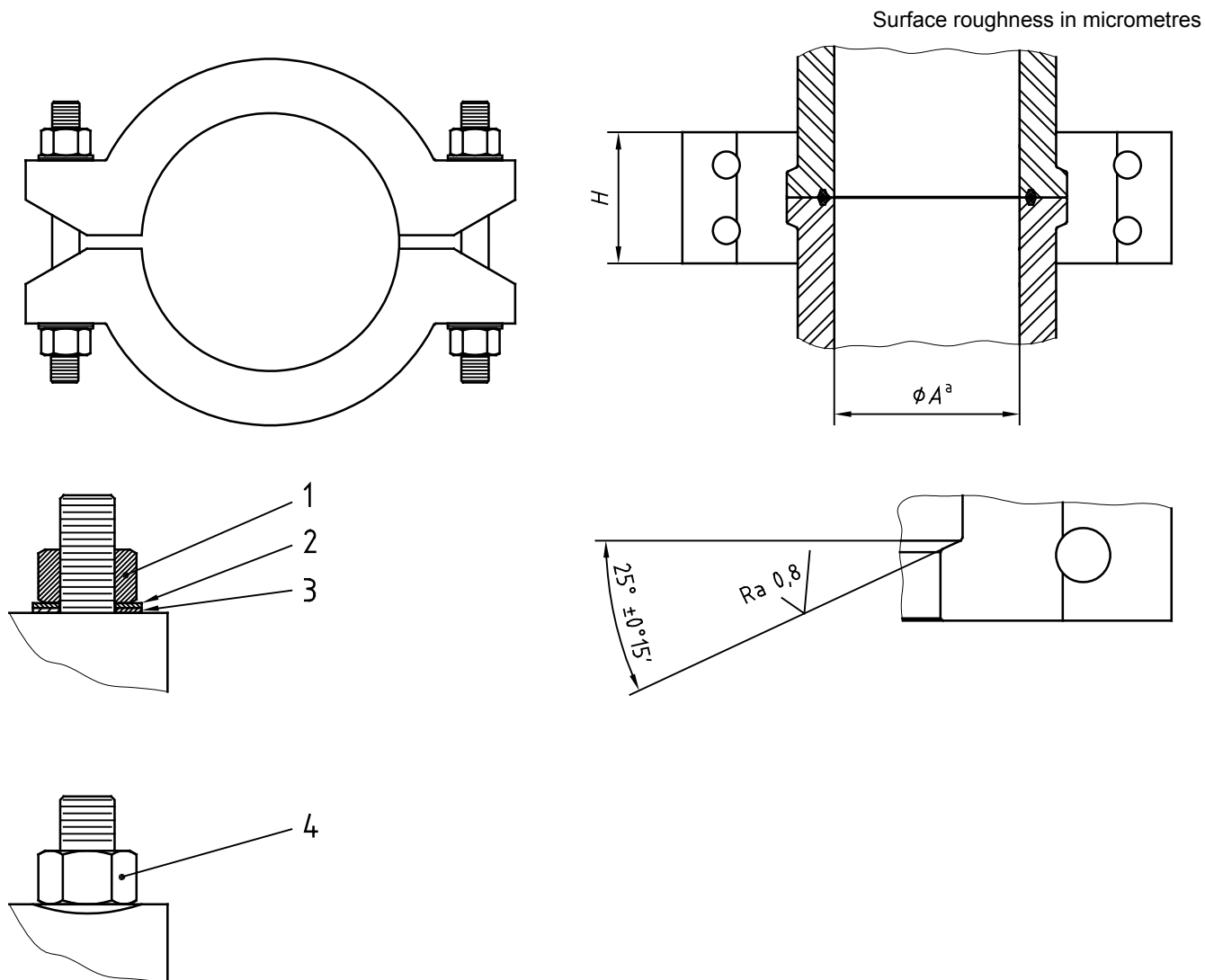
Clamps shall be manufactured from material conforming to this International Standard. Material requirements of NACE MR0175 are not necessary.

Bolting shall comply with 5.3.3.

Material for washers shall meet the manufacturer's written material specification.

Table 15 — Clamps for type 16B and 16BX hub connections

Clamp number	Hub			Clamp number	Hub		
	Designated size	Working pressure			Designated size	Working pressure	
		MPa	(psi)			MPa	(psi)
1	1 13/16	68,95	10 000	10	7 1/16	68,95	10 000
	2 1/16	34,45	5 000		9	68,95	10 000
2	1 13/16	103,4	15 000		11	34,45	5 000
	2 1/16	68,95	10 000	11	13 5/8	20,68	3 000
	2 9/16	34,45	5 000	12	16 3/4	13,79	2 000
3	1 13/16	137,9	20 000	13	13 5/8	34,45	5 000
	2 1/16	103,4	15 000	14	16 3/4	20,68	3 000
	2 1/16	137,9	20 000	15	7 1/16	137,9	20 000
	2 9/16	103,4	15 000		11	103,4	15 000
4	2 9/16	68,95	10 000		13 5/8	68,95	10 000
	3 1/8	34,45	5 000	18	21 1/4	13,79	2 000
5	3 1/16	68,95	10 000	19	16 3/4	34,45	5 000
	4 1/16	34,45	5 000	22	7 1/16	103,4	15 000
6	2 9/16	137,9	20 000		11	68,95	10 000
	3 1/16	103,4	15 000	25	7 1/16	13,79	2 000
	4 1/16	68,95	10 000	26	18 3/4	103,4	15 000
8	3 1/16	137,9	20 000		21 1/4	68,95	10 000
	4 1/16	103,4	15 000	27	18 3/4	68,95	10 000
	7 1/16	34,45	5 000		21 1/4	34,45	5 000
	9	9	34,45	5 000	28	11	137,9
9	11	20,68	3 000	13 5/8		103,4	15 000
10	4 1/16	137,9	20 000	16 3/4		68,95	10 000



Key

- 1 Nut
- 2 Outer washer
- 3 Inner washer
- 4 Spherical nut

^a Size designation as specified in Table 15

Figure 7 — Clamps for type 16B and 16BX hub connections

Table 16 — Ring gasket numbers for ISO 13533 equipment

Ring number	Designated size	Rated working pressure		Ring number	Designated size	Rated working pressure	
		MPa	(psi)			MPa	(psi)
Type 6B integral flange connections				BX 158	11	103,4	15 000
R or RX 45	7 1/16	13,79	2 000	BX 159	13 5/8		
R or RX 49	9			BX 164	18 3/4		
R or RX 53	11			BX 156	7 1/16	137,9	20 000
R or RX 57	13 5/8			BX 157	9		
R or RX 65	16 3/4			BX 158	11		
R or RX 73	21 1/4			BX 159	13 5/8		
R or RX 45	7 1/16	20,68	3 000	Type 16B integral hub connections			
R or RX 49	9			RX 45	7 1/16	13,79	2 000
R or RX 53	11			RX 65	16 3/4		
R or RX 57	13 5/8			RX 73	21 1/4		
R or RX 66	16 3/4			RX 53	11	20,68	3 000
R or RX 74	20 3/4			RX 57	13 5/8		
R or RX 46	7 1/16	34,45	5 000	RX 73	16 3/4		
R or RX 50	9			Type 16BX integral hub connections			
R or RX 54	11			BX 156	7 1/16	34,45	5 000
Type 6BX integral flange connections				BX 157	9		
BX 167	26 3/4	13,79	2 000	BX 158	11		
BX 303	30			BX 160	13 5/8		
BX 168	26 3/4	20,68	3 000	BX 162	16 3/4		
BX 303	30			BX 165	21 1/4		
BX 160	13 5/8	34,45	5 000	BX 156	7 1/16	68,95	10 000
BX 162	16 3/4			BX 157	9		
BX 163	18 3/4			BX 158	11		
BX 165	21 1/4			BX 159	13 5/8		
BX 156	7 1/16	68,95	10 000	BX 162	16 3/4		
BX 157	9			BX 164	18 3/4		
BX 158	11			BX 166	21 1/4		
BX 159	13 5/8			BX 156	7 1/16	103,4	15 000
BX 162	16 3/4			BX 158	11		
BX 164	18 3/4			BX 159	13 5/8		
BX 166	21 1/4			BX 164	18 3/4		
BX 156	7 1/16	103,4	15 000	BX 156	7 1/16	137,9	20 000
BX 157	9			BX 158	11		

5.3.6 Blowout preventers and drilling spools

5.3.6.1 Dimensions

Blowout preventers and drilling spools shall be identified by the size designation shown in Table 1.

The end-to-end dimension for blowout preventers and drilling spools shall be the overall height from the bottom face of the bottom connection to the top face of the top connection. This dimension shall be in accordance with the manufacturer's written specifications.

Blowout preventers and drilling spools shall have a cylindrical passage (bore) through the body, including end connections. The body bore diameter shall conform to the minimum bore dimension of the end connections as shown in Table 1.

5.3.6.2 Design

Design methods shall conform to 5.4.

End connections on all equipment within the scope of this International Standard shall conform to the requirements of 5.3.1, 5.3.2, 5.3.4 or 5.3.9.

Outlet connections shall conform to the requirements of 5.3.1, 5.3.2 or 5.3.4. The number of outlets is optional.

5.3.6.3 Material

Material used for pressure-containing parts or members shall comply with clause 6.

Closure bolting and other parts shall conform to the manufacturer's written specification.

5.3.7 Ring gaskets

Gaskets used for equipment manufactured to this International Standard shall meet all the requirements of ISO 10423.

Type R, RX and BX ring-joint gaskets are used in flanged, studded and hub connections. Types R and RX gaskets are interchangeable in type R ring grooves. Only type RX gaskets shall be used with SR ring grooves. Only type BX gaskets shall be used with 6BX ring grooves. Type RX and BX gaskets are not interchangeable. See Table 16 for a summary of groove and gasket usage.

5.3.8 Weld neck hubs

This International Standard is not applicable to weld neck hubs.

5.3.9 Other end connections (OECs)

5.3.9.1 General

This subclause provides requirements for other end connections which may be used for joining drill-through equipment and which are not specified in an International Standard. OECs include flanges and hubs in accordance with this International Standard, but with proprietary gasket preparations. OECs may also be in accordance with the manufacturer's specifications.

5.3.9.2 Design

OECs shall be designed in accordance with 5.4.

OECs shall be designed with the designated sizes shown in Table 1.