PD ISO/TR 16224:2012



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Technical aspects of nut design

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee FME/9, Fasteners.

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

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ISBN 978 0 580 77425 6

ICS 21.060.20

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This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 July 2012.

Amendments issued since publication

Date	Text affected

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PD ISO/TR 16224:2012

TECHNICAL REPORT

ISO/TR 16224

First edition
2012-04-01

Technical aspects of nut design

Aspects techniques de conception des écrous

Reference number
ISO/TR 16224:2012(E)

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Contents

Page

Foreword ..... **iv**

1 Scope **1**

2 Normative references **1**

3 Symbols **1**

4 Design principle **3**
4.1 Possible fracture modes in bolt and nut assemblies subjected to tensile load **3**
4.2 Calculation of the fracture loads in bolt and nut assemblies **3**
4.3 Influencing factors on the loadability of bolt and nut assemblies **6**

5 Calculation methods of bolt and nut assemblies in accordance with Alexander's theory **8**
5.1 General **8**
5.2 Minimum nut height for nuts with specific hardness range **9**
5.3 Minimum hardness for nuts with specific nut height **10**
5.4 Proof load **11**

6 Comparison among specified values in ISO 898-2 and calculated results **11**
6.1 General considerations for obtaining the specified values **11**
6.2 Calculation of the minimum Vickers hardness (HV) and the stress under proof load (S_p) for individual nuts of style 1 and style 2 ..... **11**
6.3 Consequences for ISO nut design **14**

Bibliography **15**

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Foreword

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In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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/TR 16224 was prepared by Technical Committee ISO/TC 2, *Fasteners*, Subcommittee SC 12, *Fasteners with metric internal thread*.

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Technical aspects of nut design

1 Scope

This Technical Report gives information concerning the design criteria for nuts specified in ISO 898-2 so that, under static tensile overload, the stripping fracture mode is prevented.

The design criteria are also applicable to non-standardized nuts or internally threaded elements with ISO metric screw threads (in accordance with ISO 68-1) mating with bolts. However, dimensional factors such as the width across flats or other features related to rigidity of nuts, and thread tolerances can affect the loadability of the individual bolt and nut assemblies. Therefore, it is intended that verification tests be carried out.

NOTE The terms “bolt” and “nut” are used as the general terms for externally and internally threaded fasteners, respectively.

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 68-1, *ISO general purpose screw threads — Basic profile — Part 1: Metric screw threads*

ISO 724, *ISO general-purpose metric screw threads — Basic dimensions*

ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread*

ISO 898-2, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 2: Nuts with specified property classes — Coarse thread and fine pitch thread*

ISO 18265, *Metallic materials — Conversion of hardness values*

3 Symbols

The following symbols apply in this Technical Report.

A_s	actual stress area of the bolt, in mm^2
$A_{s,nom}$	nominal stress area of the bolt specified in ISO 898-1, in mm^2
A_{Sb}	shear area of the bolt threads, in mm^2
A_{Sn}	shear area of the nut threads, in mm^2
C_1	modification factor for nut dilation
C_2	modification factor for thread bending on the bolt stripping strength
C_3	modification factor for thread bending on the nut stripping strength
d	nominal thread diameter of the bolt, in mm
d_1	basic minor diameter conforming to ISO 724, in mm
d_2	basic pitch diameter of the thread according to ISO 724, in mm

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d_3	minor (root) diameter of the bolt, in mm
d_A	equivalent diameter of the stress area A_s, in mm
D	nominal thread diameter of the nut, in mm
D_1	minor diameter of the nut, in mm
D_2	pitch diameter of the nut, in mm
D_c	countersink diameter of the nut, in mm
D_m	mean diameter of bell mouthed section of nut in the effective nut height or the length of thread engagement m_{eff}, in mm
F	tensile load, (general)
F_{Bb}	bolt breaking load, in N
F_m	ultimate tensile load, in N
F_p	proof load, in N
F_S	stripping load of bolt and nut assembly, in N
F_{Sb}	bolt thread stripping load, in N
F_{Sn}	nut thread stripping load, in N
F_u	ultimate clamp force, in N
F_y	yield clamp force, in N
h_c	height of chamfer per end, in mm
H	height of the fundamental triangle of the thread according to ISO 68-1, in mm
m	height of a nut, in mm
m_c	critical nut height giving same probabilities of stripping and breaking failure modes, in mm
m_{eff}	effective nut height, in mm
$m_{eff,c}$	critical effective nut height giving same probabilities of stripping and breaking failure modes, in mm
P	thread pitch, in mm
R_m	tensile strength of the bolt material according to ISO 898-1, in MPa
R_{mn}	tensile strength of the nut material, in MPa
R_s	strength ratio
s	width across flats of the nut, in mm
S_p	stress under proof load, in MPa
x	shear strength/tensile strength ratio
μ_{th}	coefficient of friction between threads
τ_{Bb}	shear strength of the bolt material, in MPa
τ_{Bn}	shear strength of the nut material, in MPa

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