



BSI Standards Publication

Calculation of load capacity of bevel gears

Part 32: ISO rating system for bevel and hypoid gears —
Sample calculation for scuffing load capacity

National foreword

This Published Document is the UK implementation of ISO/TR 10300-32:2021.

The UK participation in its preparation was entrusted to Technical Committee MCE/5/-/13, Bevel gears.

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

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

This publication is not to be regarded as a British Standard.

© The British Standards Institution 2021
Published by BSI Standards Limited 2021

ISBN 978 0 539 16513 5

ICS 21.200

Compliance with a Published Document cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 April 2021.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

Calculation of load capacity of bevel gears —

Part 32: ISO rating system for bevel and hypoid gears — Sample calculation for scuffing load capacity





COPYRIGHT PROTECTED DOCUMENT

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols	1
5 Application	2
Annex A (informative) Sample 1: Rating of a spiral bevel gear pair without hypoid offset according to ISO/TS 10300-20	3
Annex B (informative) Sample 2: Rating of a hypoid gear set according to ISO/TS 10300-20	44
Annex C (informative) Sample 3: Rating of a hypoid gear set according to ISO/TS 10300-20	85
Annex D (informative) Sample 4: Rating of a hypoid gear set according to ISO/TS 10300-20	126
Bibliography	167

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 60, *Gears*, Subcommittee SC 2, *Gear capacity calculation*.

A list of all parts in the ISO 10300 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO 10300 series consists of International Standards, Technical Specifications (TS) and Technical Reports (TR) under the general title *Calculation of load capacity of bevel gears* (see [Table 1](#)).

- International Standards contain calculation methods that are based on widely accepted practices and have been validated.
- TS contain calculation methods that are still subject to further development.
- TR contain data that is informative, such as example calculations.

The procedures specified in ISO 10300 parts 1 to 19 cover fatigue analyses for gear rating. The procedures described in ISO 10300 parts 20 to 29 are predominantly related to the tribological behaviour of the lubricated flank surface contact. ISO 10300 parts 30 to 39 include example calculations. ISO 10300 series allows the addition of new parts under appropriate numbers to reflect knowledge gained in the future.

Requesting standardized calculations according to ISO 10300 without referring to specific parts requires the use of only those parts that are currently designated as International Standards (see [Table 1](#) for listing). When requesting further calculations, the relevant part or parts of ISO 10300 need to be specified. Use of a Technical Specification as acceptance criteria for a specific design need to be agreed in advance between manufacturer and purchaser.

Table 1 — Parts of ISO 10300 series (status as of DATE OF PUBLICATION)

Calculation of load capacity of bevel gears	International Standard	Technical Specification	Technical Report
<i>Part 1: Introduction and general influence factors^a</i>	X		
<i>Part 2: Calculation of surface durability (pitting)^a</i>	X		
<i>Part 3: Calculation of tooth root strength^a</i>	X		
<i>Part 4 to 19: to be assigned</i>			
<i>Part 20: Calculation of scuffing load capacity — Flash temperature method</i>		X	
<i>Part 21 to 29: to be assigned</i>			
<i>Part 30: ISO rating system for bevel and hypoid gears — Sample calculations</i>			X
<i>Part 32: ISO rating system for bevel and hypoid gears — Sample Calculations of scuffing load capacity</i>			X
^a Under revision.			

This document and the other parts of ISO 10300 series provide a coherent system of procedures for the calculation of the load capacity of bevel and hypoid gears. ISO 10300 series is designed to facilitate the application of future knowledge and developments, also the exchange of information gained from experience.

Calculation of load capacity of bevel gears —

Part 32:

ISO rating system for bevel and hypoid gears — Sample calculation for scuffing load capacity

WARNING — The user is cautioned that when the formulae are used for large average mean spiral angles, $(\beta_{m1} + \beta_{m2})/2 > 45^\circ$, for effective pressure angles, $\alpha_e > 30^\circ$ and/or for large face widths, $b > 13 m_{mn}$, the calculated results of the ISO 10300 series should be confirmed by experience.

1 Scope

This document provides calculation examples for different bevel gear designs regarding the scuffing load capacity according to ISO/TS 10300-20. The initial geometry data of the gear necessary for these calculations are in accordance with ISO 23509.

The term "bevel gear" is used to mean straight, helical (skew), spiral bevel, zerol and hypoid gear designs. Where this document pertains to one or more, but not all, the specific forms are identified.

The formulae in this document are based on virtual cylindrical gears and restricted to bevel gears whose virtual cylindrical gears have transverse contact ratios of $\varepsilon_{v\alpha} < 2$. The results are valid within the range of the applied factors as specified in ISO 10300-1 (see ISO 6336-2). Additionally, the given relations are valid for bevel gears of which the sum of profile shift coefficients of pinion and wheel is zero (see ISO 23509).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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/TS 10300-20, *Calculation of load capacity of bevel gears — Part 20: Calculation of scuffing load capacity — Flash temperature method*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Symbols

For the purposes of this document, the symbols and units given in ISO/TS 10300-20 apply.

5 Application

This document provides four sample calculations:

- Sample 1 is a rating of a spiral bevel gear pair without hypoid offset according to ISO/TS 10300-20 (see [Annex A](#));
- Sample 2 is a rating of a hypoid gear set according to ISO/TS 10300-20 (see [Annex B](#));
- Sample 3 is a rating of a hypoid gear set according to ISO/TS 10300-20 (see [Annex C](#));
- Sample 4 is a rating of a hypoid gear set according to ISO/TS 10300-20 (see [Annex D](#)).

Annex A

(informative)

Sample 1: Rating of a spiral bevel gear pair without hypoid offset according to ISO/TS 10300-20

A.1 Initial data

Sample 1 is for a spiral bevel gear pair without hypoid offset which uses Method 0 according to ISO 23509 for calculation of gear geometry. The initial data for pitch cone parameters for this sample is shown in [Table A.1](#) and the input data for tooth profile parameters in [Table A.2](#).

Table A.1 — Initial data for pitch cone parameters

Symbol	Description	Method 0	Method 1	Method 2	Method 3
Σ	shaft angle	90°	X	X	X
a	hypoid offset	0 mm	X	X	X
$z_{1,2}$	number of teeth	14/39	X	X	X
d_{m2}	mean pitch diameter of wheel	—	—	X	—
d_{e2}	outer pitch diameter of wheel	176,893 mm	X	—	X
b_2	wheel face width	25,4 mm	X	X	X
β_{m1}	mean spiral angle of pinion	35°	X	—	—
β_{m2}	mean spiral angle of wheel	35°	—	X	X
r_{c0}	cutter radius	114,3 mm	X	X	X
z_0	number of blade groups (only face hobbing)	—	—	X	X

Table A.2 — Input data for tooth profile parameters

Data type I		Data type II	
Symbol	Description	Symbol	Description
α_{dB}		20°	
α_{dC}		20°	
f_{adim}		0	
x_{hm1}	—	c_{ham}	0,247 37
k_{hap}	—	k_d	2,000
k_{hfp}	—	k_c	0,125
x_{smn}	—	k_t	0,091 5
		W_{m2}	—
j_{et2}		0,127 mm	
θ_{a2}		2,134 2°	
θ_{f2}		6,493 4°	
ρ_{a01}		0,8 mm/0,8 mm	
ρ_{a02}		1,2 mm/1,2 mm	
$s_{pr1D,C}$		0 mm/0 mm	
$s_{pr2D,C}$		0 mm/0 mm	

Table A.3 and Table A.4 show geometry and operational data and text for explanation.

Table A.3 — Geometry data from calculation according to ISO 23509

Symbol	Description	Values	Symbol	Description	Value
$d_{m1,2}$	mean pitch diameter of pinion/wheel	54,918 mm/ 152,987 mm	ζ_{mp}	offset angle on pitch plane	0°
$h_{am1,2}$	mean addendum of pinion/wheel	4,836 mm/ 1,591 mm	ζ_R	pinion offset angle on root plane	0°
$h_{fm1,2}$	mean dedendum of pinion/wheel	2,394 mm/ 5,639 mm	$R_{e1,2}$	outer cone distance on pinion/wheel	93,973 mm
$\alpha_{eD,C}$	effective pressure angle for drive side/coast side	20°/20°	$R_{m1,2}$	mean cone distance on pinion/wheel	81,273 mm
$\alpha_{nD,C}$	generated pressure angle for drive side/coast side	20°/20°	$\delta_{1,2}$	pitch angle on pinion/wheel	19,747°/ 70,253°
α_{lim}	limit pressure angle	0°	$\delta_{a1,2}$	face angle on pinion/wheel	26,240°/ 72,387°
m_{mn}	mean normal module	3,213 mm	$\delta_{f1,2}$	root angle on pinion/wheel	17,613°/ 63,760°
k_{hfp}	basic crown gear dedendum factor	1,25	$x_{sm1,2}$	thickness modification coefficient on pinion/wheel	0,037/ -0,055
ζ_m	pinion offset angle on axial plane	0,000°	m_{et2}	outer transverse module	4,536 mm
$s_{mn1,2}$	mean normal circular tooth thickness of pinion/wheel	6,465 mm/ 3,511 mm			

Table A.4 — Operation parameters and additional considerations

Symbol	Description	Value
Additional data		
	wheel profile	generated
	roughing/finishing method	face milling (ground)
b_{2eff}	effective face width on wheel	$0,85 \cdot b_2$
	profile crowning	low
	verification of contact pattern	checked under light test load for each gear
	mounting conditions of pinion and wheel	one member cantilever-mounted
Operation parameters		
T_1	pinion torque	300 Nm
n_1	pinion rotational speed	1 200 min ⁻¹
K_A	application factor	1,1
	active flank	drive
	Run-In-Status	Run-In
Material data for pinion and wheel (case hardened steel)		
E	modulus of elasticity	210 000 N/mm ²
ν	Poisson's ratio	0,3
$\sigma_{H lim}$	allowable stress number (contact)	1 500 N/mm ²
$\sigma_{F lim}$	nominal stress number (bending)	480 N/mm ²
ρ_M	density of pinion / wheel	7 800 kg/m ³ (according to ISO/TS 10300-20:2021, Table 5)

Table A.4 (continued)

Symbol	Description	Value
c_M	specific heat per unit mass of pinion / wheel	440 J/(kgK) (according to ISO/TS 10300-20:2021, Table 5)
λ_M	specific heat conductivity of pinion / wheel	45 W/(mK) (according to ISO/TS 10300-20:2021, Table 5)
surface hardness		same for pinion and wheel
Quality parameters		
R_z	flank roughness on pinion/wheel	8 μm /8 μm
R_a	flank roughness on pinion/wheel	1,33 μm /1,33 μm
R_z	tooth root roughness on pinion/wheel	16 μm /16 μm
f_{pt}	single pitch deviation on pinion/wheel	12 μm /26 μm
Lubrication parameters		
oil type		ISO-VG-150
θ_{oil}	oil temperature	90 °C
$\theta_{oil,Ref}$	reference oil temperature	90 °C
e_d	immersion depth	35,379 mm
T_{1T}	pinion torque of achieved load stage (load stage 12)	534,5 Nm (A/8,3/90 according to ISO 14635-1)
ν_{40}	kinematic viscosity at temperature 40 °C	150 mm ² /s
ν_{100}	kinematic viscosity at temperature 100 °C	15 mm ² /s
ρ_{15}	density at temperature 15 °C	890 kg/m ³

A.2 Calculation of scuffing load capacity of Sample 1

The calculation results of the virtual cylindrical gear are listed in [Table A.5](#), of stresses, velocities and coefficient of friction in [Table A.6](#). Results of the calculation of the occurring contact temperature are shown in [Table A.7](#), the permissible contact temperature in [Table A.8](#). The results of the calculated safety factor can be found in [Table A.9](#).

Table A.5 — Virtual cylindrical gear

Description	Formula	Result	References to ISO/TS 10300-20:2021
Length of path of contact in transverse section	$g_{v\alpha} = g_{va1} + g_{va2} = \frac{1}{2} \left[\left(\sqrt{d_{va1}^2 - d_{vb1}^2} - d_{v1} \sin \alpha_{vet} \right) + \left(\sqrt{d_{va2}^2 - d_{vb2}^2} - d_{v2} \sin \alpha_{vet} \right) \right]$	13,121 mm	Formula (3)
Point A on the transverse path of contact	$g_Y (A) = -g_{va2}$	-3,851 mm	Formula (1)
Point E on the transverse path of contact	$g_Y (E) = g_{va1}$	9,27 mm	Formula (2)
Contact point Y on the transverse path of contact	$g_Y (Y) = (g_Y (A) + k_s g_{v\alpha}) + Y \cdot \frac{(1 - 2k_s) g_{v\alpha}}{i}$ with $Y = 0 \dots i; i = 10$ NOTE In all following formulae, g_Y is a function of $Y (g_Y = g_Y (Y))$	-3,851 mm -2,539 mm -1,227 mm 0,085 mm 1,397 mm 2,709 mm 4,021 mm 5,334 mm 6,646 mm 7,958 mm 9,27 mm	Formula (4)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Distance of the middle contact line in the zone of action	$f_{m,Y} = (g_{va2} - g_{va} / 2 + g_Y) \cdot \cos \beta_{vb}$	-5,526 mm -4,421 mm -3,316 mm -2,21 mm -1,105 mm 0 mm 1,105 mm 2,210 mm 3,316 mm 4,421 mm 5,526 mm	Formula (5)
Coordinates of the ends of the contact line	$x_{1,Y} = \frac{f_Y \cos \beta_{vb} + \tan \beta_{vb} \left(f_Y \sin \beta_{vb} + \frac{b_{v,eff}}{2} \right) + \frac{1}{2} (g_{va} + b_{v,eff} \tan \gamma)}{\tan \gamma + \tan \beta_{vb}} \geq 0$	10,795 mm 12,846 mm 14,896 mm 16,947 mm 18,997 mm 21,048 mm 21,59 mm 21,59 mm 21,59 mm 21,59 mm 21,59 mm	Formula (10)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Coordinates of the ends of the contact line	$x_{2,Y} = \frac{f_Y \cos \beta_{vb} + \tan \beta_{vb} \left(f_Y \sin \beta_{vb} + \frac{b_{v,eff}}{2} \right) - \frac{1}{2} (g_{v\alpha} - b_{v,eff} \tan \gamma)}{\tan \gamma + \tan \beta_{vb}} \leq b_{v,eff}$	0 mm 0 mm 0 mm 0 mm 0 mm 0,542 mm 2,593 mm 4,643 mm 6,694 mm 8,744 mm 10,795 mm	Formula (11)
Coordinates of the ends of the contact line	$y_{1,Y} = -x_{1,Y} \tan \beta_{vb} + f_Y \cos \beta_{vb} + \tan \beta_{vb} \left(f_Y \sin \beta_{vb} + \frac{b_{v,eff}}{2} \right)$	-6,561 mm -6,561 mm -6,561 mm -6,561 mm -6,561 mm -6,561 mm -5,595 mm -4,283 mm -2,971 mm -1,659 mm -0,347 mm	Formula (12)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Coordinates of the ends of the contact line	$y_{2,Y} = -x_{2,Y} \tan \beta_{vb} + f_Y \cos \beta_{vb} + \tan \beta_{vb} \left(f_Y \sin \beta_{vb} + \frac{b_{v,eff}}{2} \right)$	0,347 mm 1,659 mm 2,971 mm 4,283 mm 5,595 mm 6,561 mm 6,561 mm 6,561 mm 6,561 mm 6,561 mm	Formula (12)
Correction factor for the length of contact lines	$C_{lb,Y} = \sqrt{\left(1 - \left(\frac{f_Y}{f_{max}} \right)^2 \right) \left(1 - \sqrt{\frac{b_{v,eff}}{b_v}} \right)^2}$	0,068 0,072 0,075 0,077 0,078 0,078 0,078 0,077 0,075 0,072 0,068	Formula (15)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Theoretical length of contact line	$l_{b0m,Y} = \sqrt{(x_{1,Y} - x_{2,Y})^2 + (y_{1,Y} - y_{2,Y})^2}$	12,816 mm 15,25 mm 17,685 mm 20,119 mm 22,554 mm 24,345 mm 22,554 mm 20,119 mm 17,685 mm 15,25 mm 12,816 mm	Formula (14)
Length of contact line	$l_{bm,Y} = l_{b0m,Y} (1 - C_{lb,Y})$	11,942 mm 14,154 mm 16,365 mm 18,579 mm 20,802 mm 22,445 mm 20,802 mm 18,579 mm 16,365 mm 14,154 mm 11,942 mm	Formula (13)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Distance of the tip contact line in the zone of action	$f_{t,Y} = f_{m,Y} + p_{vet} \cdot \cos \beta_{vb}$	3,959 mm 5,064 mm 6,17 mm 7,275 mm 8,38 mm 9,485 mm 10,59 mm 11,696 mm 12,801 mm 13,906 mm 15,011 mm	Formula (6)
Coordinates of the ends of the contact line	$x_{1,Y} = \frac{f_Y \cos \beta_{vb} + \tan \beta_{vb} \left(f_Y \sin \beta_{vb} + \frac{b_{v,eff}}{2} \right) + \frac{1}{2} (g_{v\alpha} + b_{v,eff} \tan \gamma)}{\tan \gamma + \tan \beta_{vb}} \geq 0$	21,59 mm 21,59 mm 21,59 mm 21,59 mm 21,59 mm 21,59 mm 21,59 mm 0 mm 0 mm 0 mm 0 mm	Formula (10)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Coordinates of the ends of the contact line	$x_{2,Y} = \frac{f_Y \cos \beta_{vb} + \tan \beta_{vb} \left(f_Y \sin \beta_{vb} + \frac{b_{v,eff}}{2} \right) - \frac{1}{2} (g_{v\alpha} - b_{v,eff} \tan \gamma)}{\tan \gamma + \tan \beta_{vb}} \leq b_{v,eff}$	7,887 mm 9,938 mm 11,989 mm 14,039 mm 16,09 mm 18,14 mm 20,191 mm 0 mm 0 mm 0 mm 0 mm	Formula (11)
Coordinates of the ends of the contact line	$y_{1,Y} = -x_{1,Y} \tan \beta_{vb} + f_Y \cos \beta_{vb} + \tan \beta_{vb} \left(f_Y \sin \beta_{vb} + \frac{b_{v,eff}}{2} \right)$	-2,207 mm -0,895 mm 0,417 mm 1,729 mm 3,041 mm 4,353 mm 5,665 mm 0 mm 0 mm 0 mm 0 mm	Formula (12)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Coordinates of the ends of the contact line	$y_{2,Y} = -x_{2,Y} \tan \beta_{vb} + f_Y \cos \beta_{vb} + \tan \beta_{vb} \left(f_Y \sin \beta_{vb} + \frac{b_{v,eff}}{2} \right)$	6,561 mm 6,561 mm 6,561 mm 6,561 mm 6,561 mm 6,561 mm 6,561 mm 0 mm 0 mm 0 mm 0 mm	Formula (12)
Correction factor for the length of contact lines	$C_{lb,Y} = \sqrt{\left(1 - \left(\frac{f_Y}{f_{max}} \right)^2 \right) \left(1 - \sqrt{\frac{b_{v,eff}}{b_v}} \right)^2}$	0,073 0,07 0,066 0,06 0,053 0,043 0,028 0 0 0 0	Formula (15)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300- 20:2021
Theoretical length of contact line	$l_{b0t,Y} = \sqrt{(x_{1,Y} - x_{2,Y})^2 + (y_{1,Y} - y_{2,Y})^2}$	16,268 mm 13,833 mm 11,399 mm 8,964 mm 6,53 mm 4,095 mm 1,661 mm 0 mm 0 mm 0 mm 0 mm	Formula (14)
Length of contact line	$l_{bt,Y} = l_{b0t,Y} (1 - C_{lb,Y})$	15,078 mm 12,867 mm 10,652 mm 8,428 mm 6,186 mm 3,92 mm 1,615 mm 0 mm 0 mm 0 mm 0 mm	Formula (13)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Distance of the root contact line in the zone of action	$f_{r,Y} = f_{m,Y} - p_{vet} \cdot \cos \beta_{vb}$	-15,011 mm -13,906 mm -12,801 mm -11,696 mm -10,59 mm -9,485 mm -8,38 mm -7,275 mm -6,17 mm -5,064 mm -3,959 mm	Formula (7)
Coordinates of the ends of the contact line	$x_{1,Y} = \frac{f_Y \cos \beta_{vb} + \tan \beta_{vb} \left(f_Y \sin \beta_{vb} + \frac{b_{v,eff}}{2} \right) + \frac{1}{2} (g_{v\alpha} + b_{v,eff} \tan \gamma)}{\tan \gamma + \tan \beta_{vb}} \geq 0$	0 mm 0 mm 0 mm 0 mm 1,399 mm 3,45 mm 5,5 mm 7,551 mm 9,601 mm 11,652 mm 13,703 mm	Formula (10)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Coordinates of the ends of the contact line	$x_{2,Y} = \frac{f_Y \cos \beta_{vb} + \tan \beta_{vb} \left(f_Y \sin \beta_{vb} + \frac{b_{v,eff}}{2} \right) - \frac{1}{2} (g_{v\alpha} - b_{v,eff} \tan \gamma)}{\tan \gamma + \tan \beta_{vb}} \leq b_{v,eff}$	0 mm 0 mm 0 mm 0 mm 0 mm 0 mm 0 mm 0 mm 0 mm 0 mm 0 mm	Formula (11)
Coordinates of the ends of the contact line	$y_{1,Y} = -x_{1,Y} \tan \beta_{vb} + f_Y \cos \beta_{vb} + \tan \beta_{vb} \left(f_Y \sin \beta_{vb} + \frac{b_{v,eff}}{2} \right)$	0 mm 0 mm 0 mm 0 mm -6,561 mm -6,561 mm -6,561 mm -6,561 mm -6,561 mm -6,561 mm -6,561 mm	Formula (12)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Coordinates of the ends of the contact line	$y_{2,Y} = -x_{2,Y} \tan \beta_{vb} + f_Y \cos \beta_{vb} + \tan \beta_{vb} \left(f_Y \sin \beta_{vb} + \frac{b_{v,eff}}{2} \right)$	0 mm 0 mm 0 mm 0 mm -5,665 mm -4,353 mm -3,041 mm -1,729 mm -0,417 mm 0,895 mm 2,207 mm	Formula (12)
Correction factor for the length of contact lines	$C_{lb,Y} = \sqrt{\left(1 - \left(\frac{f_Y}{f_{max}} \right)^2 \right) \left(1 - \sqrt{\frac{b_{v,eff}}{b_v}} \right)^2}$	0 0 0 0 0,028 0,043 0,053 0,06 0,066 0,07 0,073	Formula (15)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Theoretical length of contact line	$l_{b0r,y} = \sqrt{(x_{1,y} - x_{2,y})^2 + (y_{1,y} - y_{2,y})^2}$	0 mm 0 mm 0 mm 0 mm 1,661 mm 4,095 mm 6,53 mm 8,964 mm 11,399 mm 13,833 mm 16,268 mm	Formula (14)
Length of contact line	$l_{br,y} = l_{b0r,y} (1 - C_{lb,y})$	0 mm 0 mm 0 mm 0 mm 1,615 mm 3,92 mm 6,186 mm 8,428 mm 10,652 mm 12,867 mm 15,078 mm	Formula (13)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Related peak load for calculating the load sharing factor	$p_{t,Y}^* = \frac{w_Y}{w_{\max}} = 1 - \left(\frac{ f_{t,Y} }{ f_{\max} } \right)^e \geq 0 \text{ with } e = 3$	0,958 0,911 0,839 0,736 0,597 0,416 0,186 0 0 0 0	Formula (20)
Related peak load for calculating the load sharing factor	$p_{m,Y}^* = \frac{w_Y}{w_{\max}} = 1 - \left(\frac{ f_{m,Y} }{ f_{\max} } \right)^e \geq 0 \text{ with } e = 3$	0,884 0,941 0,975 0,993 0,999 1 0,999 0,993 0,975 0,941 0,884	Formula (20)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Related peak load for calculating the load sharing factor	$p_{r,Y}^* = \frac{w_Y}{w_{\max}} = 1 - \left(\frac{ f_{r,Y} }{f_{\max}} \right)^e \geq 0 \text{ with } e = 3$	0 0 0 0 0,186 0,416 0,597 0,736 0,839 0,911 0,958	Formula (20)
Related area for calculating the load sharing factor X_{LS}	$A_{t,Y}^* = \frac{1}{4} \pi \cdot p_{t,Y}^* \cdot l_{bt,Y}$	11,339 mm 9,207 mm 7,021 mm 4,874 mm 2,9 mm 1,279 mm 0,236 mm 0 mm 0 mm 0 mm 0 mm	Formula (19)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Related area for calculating the load sharing factor X_{LS}	$A_{m,Y}^* = \frac{1}{4} \pi \cdot p_{m,Y}^* \cdot l_{bm,Y}$	8,295 mm 10,459 mm 12,532 mm 14,484 mm 16,323 mm 17,628 mm 16,323 mm 14,484 mm 12,532 mm 10,459 mm 8,295 mm	Formula (19)
Related area for calculating the load sharing factor X_{LS}	$A_{r,Y}^* = \frac{1}{4} \pi \cdot p_{r,Y}^* \cdot l_{br,Y}$	0 mm 0 mm 0 mm 0 mm 0,236 mm 1,279 mm 2,9 mm 4,874 mm 7,021 mm 9,207 mm 11,339 mm	Formula (19)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Local load sharing factor	$X_{LS,Y} = \sqrt{\frac{A_{m,Y}^*}{A_{t,Y}^* + A_{m,Y}^* + A_{r,Y}^*}}$	0,65 0,729 0,801 0,865 0,916 0,934 0,916 0,865 0,801 0,729 0,65	Formula (18)
Curvature factor	$X_Y = \frac{\tan \alpha_{vet}}{\sqrt{\frac{(d_{v1} / 2 \cdot \sin \alpha_{vet} + g_Y)}{d_{vb1} / 2} \cdot \frac{(d_{v2} / 2 \cdot \sin \alpha_{vet} - g_Y)}{d_{vb2} / 2}}}$	1,193 1,113 1,049 0,997 0,953 0,916 0,884 0,856 0,831 0,809 0,79	Formula (17)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Local equivalent radius of curvature vertical to the contact line in the contact point Y	$\rho_{\text{rel},Y} = \rho_{\text{rel}} \frac{1}{X_Y^2}$	8,761 mm 10,059 mm 11,317 mm 12,537 mm 13,716 mm 14,857 mm 15,958 mm 17,02 mm 18,042 mm 19,025 mm 19,969 mm	Formula (16)
Auxiliary value	$a = \frac{1}{K_{H\beta} - 1}$	1,538	Formula (23)
Auxiliary value	$b_Y = \frac{2}{l_{\text{bm},Y}}$	0,167 mm ⁻¹ 0,141 mm ⁻¹ 0,122 mm ⁻¹ 0,108 mm ⁻¹ 0,096 mm ⁻¹ 0,089 mm ⁻¹ 0,096 mm ⁻¹ 0,108 mm ⁻¹ 0,122 mm ⁻¹ 0,141 mm ⁻¹ 0,167 mm ⁻¹	Formula (23)

Table A.5 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Auxiliary value	$z_Y = [M_Y Y] = \sqrt{\left(\frac{b_{v,eff}}{2} - \frac{x_{1,Y} + x_{2,Y}}{2} \right)^2 + \left(g_{va2} - \frac{g_{va}}{2} + g_Y - \frac{y_{1,Y} + y_{2,Y}}{2} \right)^2} \leq \frac{l_{bm,Y}}{2}$	5,971 mm 5,191 mm 3,973 mm 2,756 mm 1,539 mm 0 mm 1,539 mm 2,756 mm 3,973 mm 5,191 mm 5,971 mm	Formula (22)
Local face load factor for contact stress	$K_{H\beta,Y} = K_{H\beta} \cdot \left[1 - (b_Y \cdot z_Y)^a \right] \geq 0$	0 0,626 1,107 1,396 1,563 1,65 1,563 1,396 1,107 0,626 0	Formula (21)

Table A.6 — Stresses, velocities and coefficient of friction

Description	Formula	Result	References to ISO/TS 10300-20:2021
Surface velocity in lengthwise direction	$w_{t1,2s} = v_{mt1,2} \cdot \sin \beta_{m1,2}$	1,979 m/s 1,979 m/s	Formula (28)
Pinion local surface velocity in profile direction	$w_{t1h,Y} = v_{mt1} \cdot \cos \beta_{m1} \left(\sin \alpha_{nD,C} + \frac{g_Y}{d_{v1} / 2} \right)$	0,594 m/s 0,721 m/s 0,848 m/s 0,975 m/s 1,102 m/s 1,229 m/s 1,356 m/s 1,483 m/s 1,61 m/s 1,738 m/s 1,865 m/s	Formula (29)
Wheel local surface velocity in profile direction	$w_{t2h,Y} = v_{mt2} \cdot \cos \beta_{m2} \left(\sin \alpha_{nD,C} - \frac{g_Y}{d_{v2} / 2} \right)$	1,015 m/s 0,998 m/s 0,982 m/s 0,966 m/s 0,949 m/s 0,933 m/s 0,916 m/s 0,9 m/s 0,884 m/s 0,867 m/s 0,851 m/s	Formula (30)

Table A.6 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Pinion local surface velocity	$w_{t1,Y} = \sqrt{w_{t1s}^2 + w_{t1h,Y}^2}$	2,066 m/s 2,106 m/s 2,153 m/s 2,206 m/s 2,265 m/s 2,33 m/s 2,399 m/s 2,473 m/s 2,551 m/s 2,634 m/s 2,719 m/s	Formula (31)
Wheel local surface velocity	$w_{t2,Y} = \sqrt{w_{t2s}^2 + w_{t2h,Y}^2}$	2,224 m/s 2,217 m/s 2,209 m/s 2,202 m/s 2,195 m/s 2,188 m/s 2,181 m/s 2,174 m/s 2,167 m/s 2,161 m/s 2,154 m/s	Formula (31)

Table A.6 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Angle between the surface velocities in lengthwise and tooth profile direction	$\omega_{wt1,Y} = \arctan \frac{w_{t1h,Y}}{w_{t1s}}$	16,673 ° 19,996 ° 23,205 ° 26,241 ° 29,106 ° 31,856 ° 34,435 ° 36,841 ° 39,133 ° 41,31 ° 43,316 °	Formula (33)
Angle between the surface velocities in lengthwise and tooth profile direction	$\omega_{wt2,Y} = \arctan \frac{w_{t2h,Y}}{w_{t2s}}$	27,158 ° 26,757 ° 26,413 ° 26,012 ° 25,611 ° 25,21 ° 24,866 ° 24,465 ° 24,064 ° 23,663 ° 23,262 °	Formula (33)

Table A.6 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Pinion local surface velocity vertical to the contact line	$w_{t1\text{vert},Y} = w_{t1,Y} \cdot \sin(\beta_B + \omega_{wt1,Y})$	1,038 m/s 1,162 m/s 1,285 m/s 1,409 m/s 1,533 m/s 1,656 m/s 1,78 m/s 1,903 m/s 2,027 m/s 2,151 m/s 2,274 m/s	Formula (32)
Wheel local surface velocity vertical to the contact line	$w_{t2\text{vert},Y} = w_{t2,Y} \cdot \sin(\beta_B + \omega_{wt2,Y})$	1,448 m/s 1,432 m/s 1,416 m/s 1,4 m/s 1,384 m/s 1,368 m/s 1,352 m/s 1,336 m/s 1,32 m/s 1,304 m/s 1,288 m/s	Formula (32)
Local sum of velocities in tangential direction	$v_{\Sigma s} = w_{t1s} + w_{t2s}$	3,958 m/s	Formula (36)

Table A.6 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Local sum of velocities in profile direction	$v_{\Sigma h,Y} = w_{t1h,Y} + w_{t2h,Y}$	1,608 m/s 1,719 m/s 1,83 m/s 1,94 m/s 2,051 m/s 2,162 m/s 2,273 m/s 2,383 m/s 2,494 m/s 2,605 m/s 2,716 m/s	Formula (37)
Local sum of velocities	$v_{\Sigma,Y} = \sqrt{v_{\Sigma h,Y}^2 + v_{\Sigma s}^2}$	4,272 m/s 4,315 m/s 4,36 m/s 4,408 m/s 4,458 m/s 4,51 m/s 4,564 m/s 4,62 m/s 4,678 m/s 4,738 m/s 4,8 m/s	Formula (35)

Table A.6 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Local sum of velocities vertical to the contact line	$v_{\Sigma \text{vert}, Y} = w_{t1 \text{vert}, Y} + w_{t2 \text{vert}, Y}$	2,486 m/s 2,594 m/s 2,701 m/s 2,809 m/s 2,917 m/s 3,024 m/s 3,132 m/s 3,24 m/s 3,347 m/s 3,455 m/s 3,563 m/s	Formula (38)
Local sliding velocity in tooth lengthwise direction	$v_{gs} = v_{mt1} \cdot \cos \beta_{m1} \cdot (\tan \beta_{m1} - \tan \beta_{m2})$	0 m/s	Formula (40)
Local sliding velocity in profile direction	$v_{gh, Y} = 2 \cdot v_{mt1} \cdot g_Y \cdot \left(\frac{1}{d_{v1}} + \frac{1}{d_{v2}} \right)$	-0,514 m/s -0,339 m/s -0,164 m/s 0,011 m/s 0,187 m/s 0,362 m/s 0,537 m/s 0,712 m/s 0,887 m/s 1,062 m/s 1,238 m/s	Formula (41)

Table A.6 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Local sliding velocity	$v_{g,Y} = \sqrt{v_{gh,Y}^2 + v_{gs}^2}$	0,514 m/s 0,339 m/s 0,164 m/s 0,011 m/s 0,187 m/s 0,362 m/s 0,537 m/s 0,712 m/s 0,887 m/s 1,062 m/s 1,238 m/s	Formula (39)
Local sliding-rolling-ratio	$s_{x,Y} = \frac{v_{g,Y}}{v_{\Sigma vert,Y}}$	0,207 0,131 0,061 0,004 0,064 0,12 0,171 0,22 0,265 0,307 0,347	Formula (42)

Table A.6 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Local contact stress	$\sigma_{H,Y} = \sqrt{\frac{F_n \cdot K_A \cdot K_V \cdot K_{H\beta,Y} \cdot K_{H\alpha}}{l_{bm,Y} \cdot \rho_{rel,Y}}} \cdot Z_E \cdot X_{LS,Y}$	0 N/mm ² 1259,775 N/mm ² 1612,589 N/mm ² 1744,476 N/mm ² 1765,967 N/mm ² 1712,67 N/mm ² 1637,245 N/mm ² 1497,191 N/mm ² 1277,178 N/mm ² 916,008 N/mm ²	Formula (25)
Local modified contact stress	$\sigma_{H,mod,Y} = \sigma_{H,Y} + \left(\frac{1}{6} \cdot e + 0,25 \right) \cdot \max(\sigma_{H,Y}) \cdot \left(\frac{ g_Y }{g_{va,max}} \right)^4 \text{ with } e = 3$	39,462 N/mm ² 1267,231 N/mm ² 1612,996 N/mm ² 1744,476 N/mm ² 1766,651 N/mm ² 1722,335 N/mm ² 1684,154 N/mm ² 1642,338 N/mm ² 1627,039 N/mm ² 1635,31 N/mm ² 1324,476 N/mm ²	Formula (24)
Power loss	$P_{VZP} = \left(0,00012 \cdot a_{rel}^{1,234} + 1,993 \cdot 10^{-5} \right) \cdot T_1^{1,05} \cdot n_1^{0,65} \cdot Ra^{0,25} \cdot X_L$	0,857 kW	Formula (69)
Auxiliary variable	$[a \cdot b]_V = \frac{d_{m1} + d_{m2}}{2} \cdot \frac{b_1 + b_2}{2}$	2 640,394 mm	Formula (71)

Table A.6 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Lubrication factor	$0,8 < X_S = 0,8 \cdot \left[\frac{e_d}{d_{e2}} \right]^{-D} < 3,7$	1,297	Formula (73)
Tip relief factor	$X_{CA} = 1,0$ for $B > 5$	1,000	Formula (76)
Bulk temperature	$\theta_M = \theta_{Oil} + 7\,400 \cdot \left(\frac{P_{VZP}}{[a \cdot b]_V} \right)^{0,72} \cdot \frac{X_S}{1,2 X_{CA}}$	115 °C	Formula (70)
Density at bulk temperature	$\rho_\theta = \rho_{15} \cdot \left[1 - 0,7 \cdot \frac{(\theta_M + 273) - 288}{\rho_{15}} \right]$	820 kg/m ³	Formula (52)
Auxiliary variable	$A = \frac{\log[\log(v_{40} + 0,7) / \log(v_{100} + 0,7)]}{\log(313 / 373)}$	-3,419	Formula (50)
Auxiliary variable	$B = \log[\log(v_{40} + 0,7)] - A \cdot \log(313)$	8,870	Formula (51)
Kinematic viscosity at bulk temperature	$\log[\log(v_\theta + 0,7)] = A \cdot \log(\theta_M + 273) + B$	10,484 mm ² /s	Formula (49)
Dynamic viscosity at bulk temperature	$\eta_\theta = 10^{-6} \cdot v_\theta \cdot \rho_\theta$	0,0086 Ns/m ²	Formula (48)
Pressure-viscosity-coefficient at 38 °C	$\alpha_{38} = 2,657 \cdot 10^{-8} \cdot \eta_{38}^{0,1348}$	0,000 000 021 m ² /N	Formula (58)
Pressure-viscosity-coefficient at bulk temperature	$\alpha_{p,\theta} = \alpha_{38} \cdot \left[1 + 516 \cdot \left(\frac{1}{\theta_M + 273} - \frac{1}{311} \right) \right]$	0,000 000 014 m ² /N	Formula (57)
Auxiliary variable	$G = 10^6 \cdot \alpha_{p,\theta} \cdot E'$	3 180,934	Formula (56)

Table A.6 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Auxiliary variable	$U_Y = \frac{\eta_M \cdot V_{\Sigma \text{vert}, Y}}{2000 \cdot \rho_{\text{rel}, Y} \cdot E'}$	0,000 000 000 005 3 0,000 000 000 004 8 0,000 000 000 004 5 0,000 000 000 004 2 0,000 000 000 004 0 0,000 000 000 003 8 0,000 000 000 003 7 0,000 000 000 003 6 0,000 000 000 003 4 0,000 000 000 003 4 0,000 000 000 003 3	Formula (61)
Auxiliary variable	$W_Y = \frac{2 \cdot \pi \cdot \sigma_{H, \text{mod}, Y}^2}{E'^2}$	0,000 000 184 0,000 189 468 0,000 306 966 0,000 359 049 0,000 368 235 0,000 349 993 0,000 334 648 0,000 318 236 0,000 312 334 0,000 315 518 0,000 206 972	Formula (62)

Table A.6 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Lubricating film thickness according to Ertl/Grubin	$h'_{0,Y} = 1,95 \cdot 10^3 \cdot \rho_{\text{rel},Y} \cdot G^{0,73} \cdot U_Y^{0,73} \cdot W_Y^{-0,09}$	0,146 µm 0,084 µm 0,085 µm 0,089 µm 0,093 µm 0,098 µm 0,103 µm 0,108 µm 0,113 µm 0,117 µm 0,126 µm	Formula (55)
Temperature coefficient of the dynamic viscosity	$\alpha_{\text{th}} = \frac{\ln(\eta_{038} / \eta_{\text{th}})}{\theta_{\text{M}} - \theta_{38}}$	0,037	Formula (47)
Thermal load factor	$L_Y = 0,001 \cdot \frac{\eta_{\text{M}} \cdot \alpha_{\text{th}} \cdot v_{\Sigma \text{vert},Y}^2}{4 \cdot \lambda}$	0,000 004 0,000 004 0,000 005 0,000 005 0,000 005 0,000 006 0,000 006 0,000 007 0,000 007 0,000 008 0,000 008	Formula (46)

Table A.6 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Thermal correction factor	$C_{th,Y} = \frac{3,94}{3,94 + I_Y^{0,62}}$	0,999 89 0,999 89 0,999 88 0,999 87 0,999 87 0,999 86 0,999 86 0,999 85 0,999 84 0,999 84 0,999 83	Formula (45)
Lubricating film thickness	$h_{0,Y} = h'_{0,Y} \cdot C_{th,Y} \cdot 1,05 \cdot e^{-0,16 \cdot Rz}$	0,043 µm 0,024 µm 0,025 µm 0,026 µm 0,027 µm 0,029 µm 0,03 µm 0,032 µm 0,033 µm 0,034 µm 0,037 µm	Formula (44)

Table A.6 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Local relative lubricating film thickness	$\lambda_{z,y} = \frac{h_{0,y}}{R_z}$	0,005 0,003 0,003 0,003 0,003 0,004 0,004 0,004 0,004 0,004 0,005	Formula (43)
Lubricant factor	$X_L = 1,0$ for mineral oil	1	Table 4
Surface roughness structure factor	$G_{RS} = 1 + (0,30 \cdot \sin \beta_B)^\varepsilon$ with $\varepsilon = 2,0$	1,005	Formula (65)
Lubricating film thickness factor	$C_{\lambda,y} = 1$ for bevel and hypoid gears	1	Formula (64)

Table A.6 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Local coefficient of friction	$\mu_Y = 0,036 \cdot (\sigma_{H,mod,Y})^{0,10} \cdot (v_{\Sigma vert,Y})^{-0,2} \cdot (s_{x,Y})^{0,05} \cdot (C_{\lambda,Y} \cdot \lambda_{z,Y})^{-0,10} \cdot X_L \cdot C_{RS}$	0,068 0,098 0,096 0,084 0,095 0,096 0,097 0,097 0,096 0,096 0,094	Formula (63)

Table A.7 — Occurring contact temperature

Description	Formula	Result	References to ISO/TS 10300-20:2021
Driving direction factor	$X_Q \text{ for } (\varepsilon_f / \varepsilon_a) \leq 1,0$	1	Formula (81)
Running in factor according to Michaelis	$X_E = 1,0$	1	Formula (79)
Thermal contact coefficient	$B_{M1} = \sqrt{\rho_{M1} \cdot c_{M1} \cdot \lambda_{M1}}$	12 427,389	Formula (78)
Thermal contact coefficient	$B_{M2} = \sqrt{\rho_{M2} \cdot c_{M2} \cdot \lambda_{M2}}$	12 427,389	Formula (78)
Local flash temperature	$\theta_{fl,Y} = \frac{\sqrt{\pi}}{2} \cdot \mu_Y \cdot \sigma_{H,mod,Y} \cdot \frac{v_{g,Y} \cdot 10^6}{B_{M1} \sqrt{w_{t,vert1,Y}} + B_{M2} \sqrt{w_{t,vert2,Y}}} \cdot \sqrt{\frac{8 \rho_{rel,Y} \cdot \sigma_{H,mod,Y}}{1\,000 \cdot E'}} \cdot \frac{X_E}{X_Q}$	0 K 28 K 20 K 1 K 27 K 52 K 76 K 99 K 123 K 150 K 125 K	Formula (77)

Table A.7 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Local contact temperature	$\theta_{c,y} = \theta_M + \theta_{fi,y}$	115 °C 142 °C 134 °C 116 °C 141 °C 167 °C 191 °C 214 °C 238 °C 265 °C 240 °C	Formula (68)

Table A.8 — Permissible contact temperature

Description	Formula	Result	References to ISO/TS 10300-20:2021
Pinion torque of the load stage 12 in the scuffing test A/8,3/90	T_{1T}	534,5 Nm	Table 6
Structure factor	X_W for steel with average austenitic content	1	Table 7
Relative material structure factor	$X_{WrelIT} = \frac{X_W}{X_{WT}}$	1	Formula (91)
Limit temperature according to standard scuffing tests (A/8,3/90)	$\theta_{S,DIN} = 80 + 0,23 \cdot X_L \cdot T_{1T} + 1,4 \cdot X_L \cdot X_{WrelIT} \cdot T_{1T}^{0,83} \cdot \left(\frac{100}{V_{40}} \right)^{0,02}$	458 °C	Formula (87)
Temperature factor	$X_T = 0,45 \cdot \left(\frac{\theta_{Oil}}{\theta_{Oil,ref}} \right) \cdot \left(\frac{X_S}{1,0} \right) \cdot \left(\frac{\exp \frac{2 \cdot a_{ref}}{d_{m1} + d_{m2}}}{1,0} \right)^{0,8}$ with $a_{ref} = 91,5$ mm	1,18	Formula (97)
Permissible temperature considering the influence of the contact temperature	$\theta_{SC} = \theta_{S,DIN} + (X_T - 1) \cdot C_{Th}$ with $C_{Th} = 0$; for $X_T > 1,0$	458 °C	Formula (94)
Contact time	$t_{C,Y} = \max(t_{C1,Y}, t_{C2,Y})$ where $t_{C1,2,Y} = \frac{2 \cdot b_{H,Y}}{w_{t1,2,vert,Y}} \cdot 1000$	11,544 µs 380,357 µs 492,333 µs 541,558 µs 606,966 µs 648,406 µs 689,046 µs 725,185 µs 770,772 µs 826,872 µs 711,607 µs	Formula (102)

Table A.8 (continued)

Description	Formula	Result	References to ISO/TS 10300-20:2021
Permissible temperature considering the contact time	$\theta_{S,Y} = \theta_{SC} \text{ for } t_{c,Y} \geq t_K \text{ or } \theta_{S,Y} = \theta_{SC} + C_S \cdot (t_K - t_{c,Y}) \text{ for } t_{c,Y} < t_K$	574 °C 458 °C 458 °C 458 °C 458 °C 458 °C 458 °C 458 °C 458 °C 458 °C 458 °C	Formulae (100) and (101)