ICS 21.200
CCS J17

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/Z 3480.4-2024

Calculation of load capacity of spur and helical gears - Part 4: Calculation of tooth flank fracture load capacity

直齿轮和斜齿轮承载能力计算 第4部分：齿面断裂承载能力计算

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Standardization Administration of the PRC

Table of Contents

Foreword

This document is in accordance with GB/T (Z) 1:1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting of regulations: This document is part 4 of GB/T (Z) 3480 "Calculation of load capacity of spur and helical gears": GB/T (Z) 3480 has been published The following parts:

--- Part 1: Basic principles, overview and general influence coefficients;

--- Part 2: Calculation of tooth surface contact strength (pitting);

--- Part 3: Calculation of gear tooth bending strength;

--- Part 4: Calculation of tooth surface fracture load capacity;

--- Part 5: Strength and quality of materials;

--- Part 6: Calculation of service life under variable load conditions;

--- Part 22: Calculation of micropitting load-bearing capacity: This document is equivalent to ISO /T S6336-4:2019 "Calculation of load capacity of spur and helical gears Part 4: Tooth surface fracture load Capacity Calculation", the document type was adjusted from ISO technical specifications to my country's national standardization guiding technical documents: The following minimal editorial changes were made to this document:

--- Table 2 adds symbols vr1, CP and vr2, CP;

--- Added Figures 5 to 7 and some formulas mentioned in the text;

--- Added introductory words to the items in 6:2:4:2:4:3: Please note that some of the contents of this document may involve patents: The issuing organization of this document does not assume the responsibility for identifying patents: This document is proposed and coordinated by the National Technical Committee for Gear Standardization (SAC/TC52):

This document was drafted by: Zhengzhou Machinery Research Institute Co:, Ltd:, Jiangsu Huizhi High-end Engineering Machinery Innovation Center Co:, Ltd:, Zhengzhou Machinery Research Institute (Zhengzhou Zhou) Transmission Technology Co:, Ltd:, Wenling Minghua Gear Co:, Ltd:, Northwestern Polytechnical University, Nanjing High Speed Gear Manufacturing Co:, Ltd:, Chongqing University Shaanxi Fast Gear Co:, Ltd:, Chongqing Gearbox Co:, Ltd:, Jinhua Xinhua Gear Co:, Ltd:, Henan University of Science and Technology Guizhou Qunjian Precision Machinery Co:, Ltd:, Zhejiang Shuanghuan Transmission Machinery Co:, Ltd:, Taiyuan University of Technology, Guangdong Jinli Intelligent Transmission Technology Technology Co:, Ltd:, Chongqing Yongda Precision Machinery Co:, Ltd:, Zhejiang Beto Transmission Technology Co:, Ltd:, Chongqing Nanyan Industrial Group Longjian Machine Machinery Manufacturing Co:, Ltd:, Chongqing Suteng Machinery Manufacturing Co:, Ltd: The main drafters of this document are: Wang Zhigang, Cao Zhigang, Zhu Haoyue, Pei Bang, Yan Lingming, Yan Yaolong, Li Haixia, He Aimin, Fan Ruili, Zhang Yuanyuan, Li Jiqiang, Feng Jian, Li Shuitu, Long Jianbing, Jiang Chuang, Guo Qingqing, Wu Nan, Lu Zehua, Tang Heng, Zheng Hongyu, He Benyi, Zhou Zhiqiang, Tang Yixiang, Wei Bingyang, Xiong Yongqiang, Wang Chunmei, Wu Jizhan, Liu Huaiju, Guo Hui, Guan Hongjie, Zhao Jiadong, Zhang Ruiliang, Liu Hehe, Wang Xiaoyi, Dou Xiaopeng, Duan Hanhui, Tu Kehui, Li Dongyang, He Jian, Yang Xiaohu, Tao Xianyu:

GB/T (Z) 3480 "Calculation of load capacity of spur gears and helical gears" is widely used in my country's gear industry: The calculation system of the load-bearing capacity of involute cylindrical gears in my country will help my country's gear products to fully keep pace with international standards: GB/T (Z) 3480 mainly stipulates the calculation of the load capacity of involute spur gears and helical gears: The standard is divided into 11 parts, each of which is interrelated and independent, and together constitutes a relatively complete calculation framework: According to different research objects and calculation methods, GB/T (Z) 3480 is planned to consist of 11 parts:

--- Part 1: Basic principles, overview and general influence factors: The purpose is to establish the load capacity of involute spur gears and helical gears: The basic principles of force calculation are given, and the values of general influence coefficients and some correction coefficients are given:

--- Part 2: Calculation of tooth surface contact strength (pitting): The purpose is to give the tooth surface contact strength (pitting) based on Hertz contact theory: The calculation method of erosion) and the values of some correction coefficients:

1 Scope

GB/Z 3480.4-2024 addresses a gear failure that the classical calculations do not predict. Gear rating has long rested on two modes: bending fatigue at the tooth root and pitting on the flank. Tooth flank fracture is a third, and it originates well below the surface - a crack initiates at the transition between the hardened case and the softer core, where the local

stress from the contact combines with residual stress and material inhomogeneity, then propagates until the tooth breaks. It appears in case-hardened gears that pass every conventional check, and because it starts internally there is no surface indication to find during inspection. It has become prominent as gears have been pushed to higher torque density in wind turbine and vehicle drivetrains. This document describes the calculation method for the tooth flank fracture load capacity of external spur and helical cylindrical gears. It states explicitly that it is not intended as a rating method for gearbox design and certification - it is an analysis of a specific risk alongside the main rating standards. As a GB/Z it is a guiding document. Under ICS 21.200 and CCS J17, it is for gear designers and drivetrain engineers.

This document describes the calculation method for the fracture load capacity of the tooth flanks of external spur and helical cylindrical gears: This document is not intended to be used as a rating method during gearbox design and certification: The formulas in this document apply to driving and driven cylindrical gears with a tooth profile in accordance with ISO 53 and also to gears with a small actual end contact ratio (epsilonalpha): The method has been verified for carburized and hardened gears [15], and the formula given in this document is applicable to For carburized and hardened gears that meet the following conditions:

---Hertz stress: 500N/mm2<=pH<=3000N/mm2;

---Normal relative curvature radius: 5mm<=rhored<=150mm;

--- In the finished product state, the depth of the surface hardened layer at 550HV is: 0:3mm<=CHD<=4:5mm: This document is not applicable to the assessment of gear tooth damage of types other than tooth surface fracture:

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document: For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to This document:

GB/T 3374:1-2010 Gear terms and definitions Part 1: Geometric definitions (ISO 1122-1:1998, IDT) ISO 1328-

1 Cylindrical gears - ISO tooth flank tolerance classification system - Part 1: Definitions and permissible values of tooth flank deviations

GB/T 10095:1-2022 Cylindrical gears ISO tooth surface tolerance classification system Part 1: Definition and allowable values of tooth surface deviation (ISO 1328-1: 2013, IDT) ISO 6336-

1 Spur and helical gears - Calculation of load capacity - Part 1: Basic principles, overview and general influence factors (Calcula- ence factors)

GB/T 3480:1-2019 Calculation of load capacity of spur and helical gears Part 1: Basic principles, overview and general influence factors (ISO 6336- 1:2006,IDT) ISO 6336-

2 Calculation of load carrying capacity of spur and helical gears Part 2: Calculation of tooth contact strength (pitting)

GB/T 3480:2-2021 Calculation of load capacity of spur and helical gears Part 2: Calculation of tooth contact strength (pitting) (

ISO 6336-2: 2019, IDT) and gear pairs - Concepts and geometry)