PUBLICLY AVAILABLE SPECIFICATION

ISO/PAS 22596

First edition
2022-05

Road vehicles — Brake lining friction materials — Dynamometer metal pick-up generation procedure for disc brakes

Véhicules routiers — Matériaux de friction des garnitures de freins — Procédure de génération de métal aggloméré sur freins à disque par dynamomètre

This document is a preview generated by EVS

Reference number
ISO/PAS 22596:2022(E)

© ISO 2022

This document is a preview generated by EVS

COPYRIGHT PROTECTED DOCUMENT

© ISO 2022

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

© ISO 2022 – All rights reserved

Contents

Page

Foreword ... **v**
Introduction ... **vi**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Symbols and abbreviated terms ... **3**
4.1 Symbols ... 3
4.2 Abbreviated terms ... 3
5 Test conditions and test preparation ... **3**
5.1 Inertia for the brake testing ... 3
5.2 Pressure ramp rate ... 4
5.3 Maximum pressure ... 4
5.4 Sampling rate ... 4
5.5 Initial brake temperature ... 4
5.6 Brake temperature measurement ... 4
5.7 Cooling air conditioning ... 4
5.8 Cooling air velocity or volume ... 4
5.9 Exhaust conditions ... 4
5.10 Conditioning settings for temperature and absolute humidity (humidity ratio) ... 4
5.11 Dynamometer rotational speed between brake applications ... 5
5.12 Orientation of brake set-up ... 5
5.13 Direction of air relative to the brake set-up ... 6
5.14 Wear measurement ... 6
5.15 Disc lateral run-out ... 6
5.16 Caliper, disc or drum and pads condition ... 6
5.17 Hot brake applications ... 6
5.18 Water specification ... 6
5.19 Specification of nozzles for water spraying ... 6
5.20 Saltwater specification ... 6
5.20.1 Recommended solution ... 6
5.20.2 Alternative solutions ... 7
5.20.3 Other solutions ... 7
5.21 Noise and vibration (NVH) measurements ... 7
5.22 Data collection ... 7
6 Test procedures ... **8**
6.1 Basic information ... 8
6.2 Test procedure: “heat and pressure MPU” ... 8
6.3 Test procedures “water and saltwater MPU” ... 9
6.3.1 Procedure 1 (core or early development testing) ... 9
6.3.2 Procedure 2 (DVP procedure; can also be used in vehicle testing) ... 10
6.4 Test procedure for “low load and pressure” ... 14
7 Test report ... **15**
7.1 General ... 15
7.2 Test conditions ... 15
7.2.1 Disc and lining identification ... 15
7.2.2 Disc surface characterisation ... 15
7.2.3 Photographs of the setup ... 15
7.2.4 Photographs of the test parts ... 15
7.2.5 Documentation of pad MPU number and area ... 16
7.2.6 Documentation of disc surface profile ... 17
7.2.7 Acceptance criteria ... 19
7.3 Graphical report ... 20

This document is a preview generated by EVS

© ISO 2022 – All rights reserved

7.4 Cooling air conditions and water spraying ... 20
7.5 Tabular data for each brake application ... 20
7.6 Wear measurement; pad and disc appearance ... 21

Annex A (informative) **MPU shapes** ... **22**

Annex B (informative) **Template proposal** ... **24**

Annex C (informative) **Reference calculation for cooling air speed and flow** ... **33**

Annex D (informative) **Specification of salt for "water and salt MPU"** ... **35**

Bibliography ... **36**

This document is a preview generated by EVS

© ISO 2022 – All rights reserved

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 22, *Road vehicles*, Subcommittee SC 33, *Vehicle dynamics and chassis components*.

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.

This document is a preview generated by EVS

© ISO 2022 – All rights reserved

Introduction

Metal pick-up (MPU) is a phenomenon/issue observed in automotive disc brakes during the braking process. Worn metallic particles may agglomerate under specific conditions and embed in the friction material. It may deteriorate brakes' appearance by scoring (grooves) on the surface of brake discs. MPU is also suspected to be a root cause of brakes NVH (noise, vibrations and harshness) issues as brake squeal or wire brush.

There is no single mechanism for creation of MPU in the automotive brakes so it cannot be only one specific condition for testing it. While the so-called NAO (non-asbestos-organic) friction materials are sensitive to high temperature and pressures, low metallic materials may create MPU under wet conditions or even more under the saltwater influence.

This document describes and covers all known critical conditions for generating MPU, it specifies which conditions are critical for a given friction material type. The methods described apply not only in the development of the material composition, but also in the selection of the materials for new brake applications and optimization of components for a recognised MPU issue.

This document includes three test procedures:

1. MPU generation under water/saltwater influence (typical for low metallic friction materials);
2. MPU generation at low temperatures and low brake pressures (typical for low metallic friction materials);
3. MPU generation at high brake temperatures and brake pressures (typical for NAO friction materials).

This document is a preview generated by EVS

© ISO 2022 – All rights reserved

Road vehicles — Brake lining friction materials — Dynamometer metal pick-up generation procedure for disc brakes

This document is a preview generated by EVS

1 Scope

This document describes test procedures for assessing the influence of pressure, temperature and water/salt water on the generation of metal pick-up (MPU) for a given friction material in combination with a specific brake disc. There are multiple tests to investigate the MPU generation issue for different types of friction materials (so called NAO and low metallic materials) under critical environmental and working conditions: influence of water and salt water, high temperatures and high pressures and low temperatures and low pressures.

This document supports the friction material development process and selection of friction materials for new brake applications.

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 611, *Road vehicles — Braking of automotive vehicles and their trailers — Vocabulary*

ISO 21920-2, *Geometrical product specifications (GPS) — Surface texture: Profile — Part 2: Terms, definitions and surface texture parameters*

ISO 15484, *Road vehicles — Brake lining friction materials — Product definition and quality assurance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 611, ISO 15484 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
MPU
metal pick-up
disc material agglomeration or compaction of high hardness on or in the pad material surface

Note 1 to entry: The MPU shapes could be different (flakes, grains with different aspect ratio, colloquially called “fishes”) and have different sizes (up to several millimetres).

3.2
groove
mechanical disc surface defect in the circumferential direction caused by *metal pick-up (MPU)* (3.1) collected in the pad material with a depth of more than several tens of micrometres

© ISO 2022 – All rights reserved