
**Road vehicles — Brake linings friction
materials — Visual inspection**

*Véhicules routiers — Matériaux de friction des garnitures de freins —
Inspection visuelle*

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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.

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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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, chassis components and driving automation systems testing*.

This first edition cancels and replaces the first edition (ISO/PAS 22574:2007), which has been technically revised.

The main changes are as follows:

- product characteristics of metal lining carriers have been included.

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

Friction linings are composite materials with complex structure. Due to their composition and their production process, visual appearance characteristics can occur which in a precisely defined design are to be regarded as specific to the product. In this document, the product characteristics of metal lining carriers, for example, of bonded lined brake shoes or backing plates for disc brake linings, have been included.

This document is based on the “Catalogue of characteristic features for friction materials” of the Federation of European Manufacturers of Friction Materials (FEMFM) issued for the first time in 1980. The FEMFM is a European organization of national associations formed by companies engaged in the development and production of friction materials of various product forms. The description of the characteristic features and their design was reviewed in 1996 when technological processes, especially safety aspects and the demands made by the brake and automobile industry, were given careful consideration.

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Road vehicles — Brake linings friction materials — Visual inspection

1 Scope

This document defines visual aspects for the identification and assessment of product characteristics for friction materials in terms of quality and for commercial and technical agreements. The sequence of the product characteristics represents no order of priority. Inspection is carried out in unused, “as supplied” condition.

In some characteristic features, there are differences between brake linings with an effective lining pad area less than 120 cm² and larger than 120 cm². The acceptance criteria ensure exclusion of any characteristics that could impact the function and performance of brake linings and applies unless other agreements between the customer and the supplier.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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

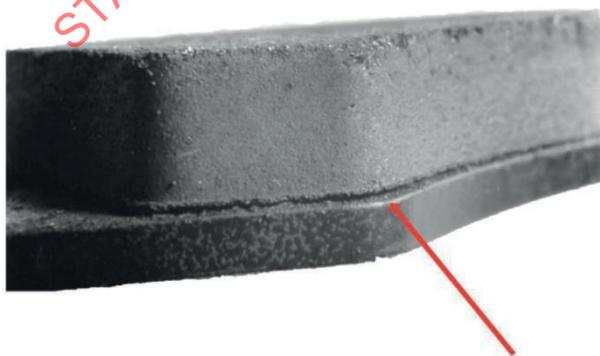
- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 Characteristic features for friction materials

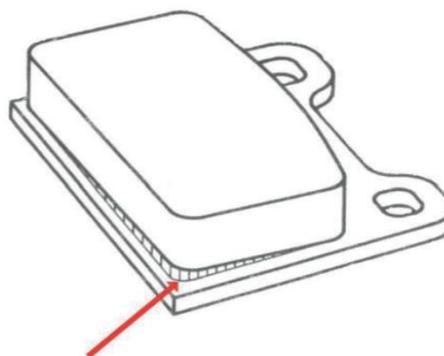
4.1 Characteristic features for disc brake pads

4.1.1 Gapping between material and plate

Gaps as shown in [Figure 1](#) are not acceptable.



a) Photo view



b) Schematic view

Figure 1 — Example for gapping

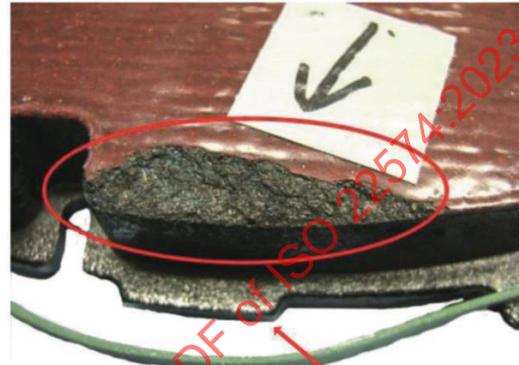
4.1.2 Edge chipping

In the case of a disc brake pad [see Figure 2 a)] with an area less than 120 cm², a maximum of 1 % of the edge may chip.

In the case of a disc brake pad [Figure 2 b)] with an area equal or more than 120 cm², a maximum of 0,5 % of the edge may chip.



a) Example less than 120 mm²

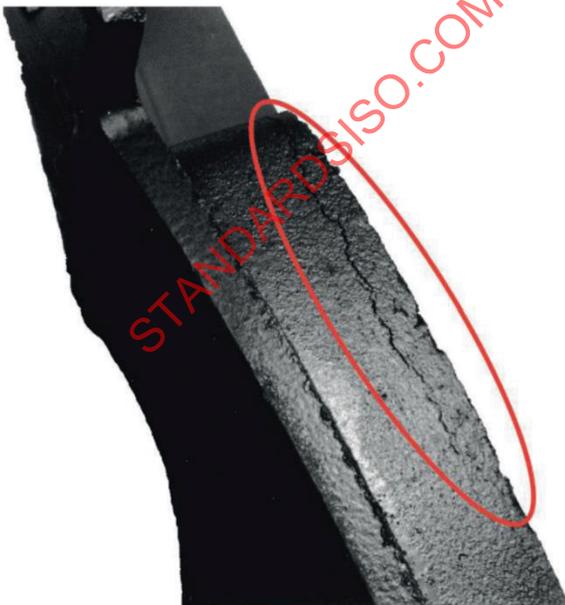


b) Example larger than 120 mm²

Figure 2 — Example for edge chipping

4.1.3 Splits

Splits having a length of more than 30 mm or more than 10 mm on corners or deeper than 1,5 mm shall not be accepted [see Figure 3 a) and b)].



a) Example of length split



b) Example of deep split

Figure 3 — Example for splits

4.1.4 Minor splits

Splits having a length of less than 30 mm or less than 10 mm on corners or with a depth less than 1,5 mm may be accepted (see [Figure 4](#)).



Figure 4 — Example for minor split

4.1.5 Plucked and indented spigots

The disc brake pad shown in [Figure 5](#) is acceptable on each spigot up to 50 % of area and 0,5 mm deep.

NOTE Spigots physically indented in the pad design are included in this description.



Figure 5 — Example for plucked and indented spigots

4.1.6 Poor consolidated spigot holes

The disc brake pad shown in [Figure 6](#) is acceptable if only one spigot is affected with up to 20 % of the volume being low density. This definition also applies where spigots have been physically indented in the pad design.



Figure 6 — Poor consolidated spigot holes

4.1.7 Excess adhesive on plate

Excess adhesive on plate is acceptable provided the fitment of the part is not affected [see [Figure 7](#) a) and b)].



a) Example 1

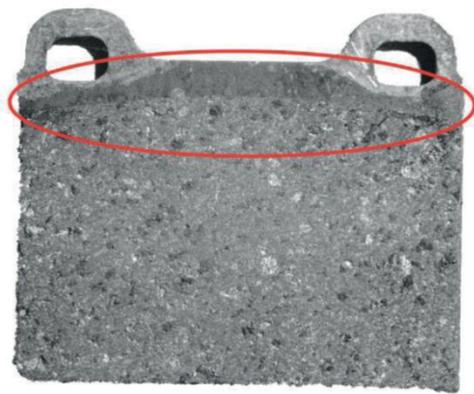


b) Example 2

Figure 7 — Example for adhesive on plate

4.1.8 Material flash on plate

A material flash on plate is acceptable up to 1 mm thick outside functional zones. Flash shall be secured to back plate [see [Figure 8](#) a) and b)].



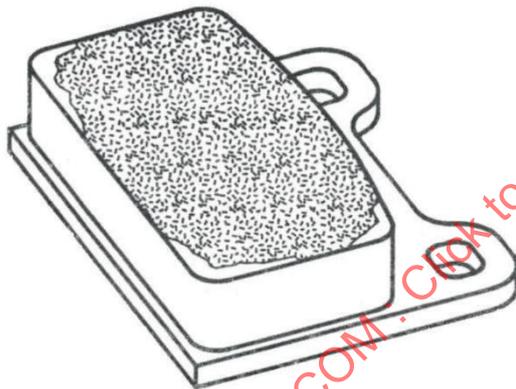
a) Example 1



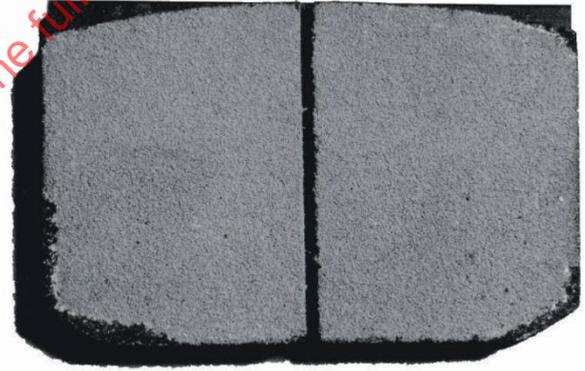
b) Example 2

Figure 8 — Example material flash on plate**4.1.9 Abrasive coating**

The disc brake pad is acceptable if at least 90 % of the surface is coated [see [Figure 9](#) a) and b)].



a) Example with schematic view



b) Example with photo view

Figure 9 — Example material flash on plate**4.1.10 Anti-noise coating runs**

The anti-noise coating runs is acceptable provided fitment of part is not affected [see [Figure 10](#) a) and b)].

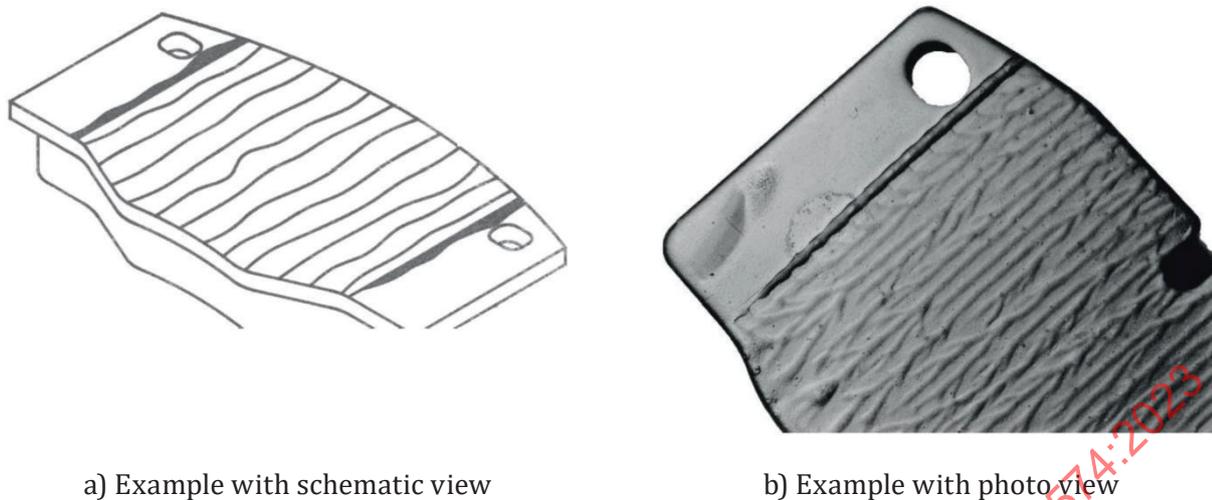


Figure 10 — Example noise-coating runs

4.1.11 Skin crazing

Skin crazing as shown in [Figure 11](#) is acceptable.

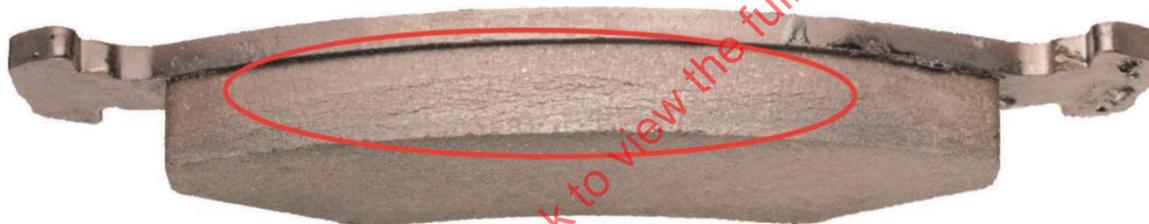


Figure 11 — Example for skin crazing

4.1.12 Underlayer distribution

Presence of underlayer is acceptable on pad surface up to 2 % of area if the distribution is according to the specification (see [Figure 12](#)).

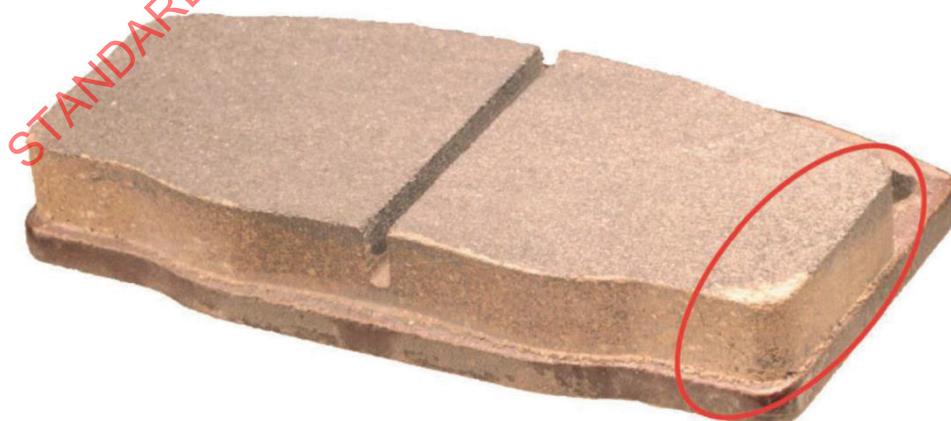


Figure 12 — Example for underlayer distribution

4.1.13 Marking

The marking shall be clear and legible [see [Figure 13](#) a) and b)].



a) Example 1



b) Example 2

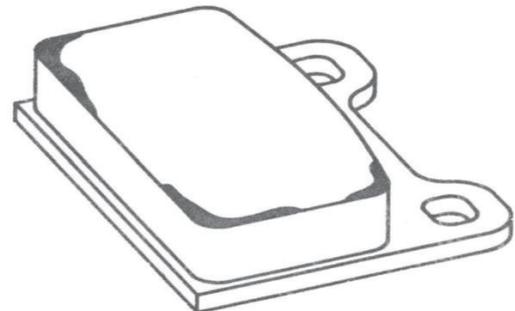
Figure 13 — Examples for marking

4.1.14 Unground material surface

An unground material surface equal or less than 10 % of the area is acceptable provided flatness and parallelism tolerances are not exceeded [see [Figure 14](#) a) and b)].



a) Example as photo view

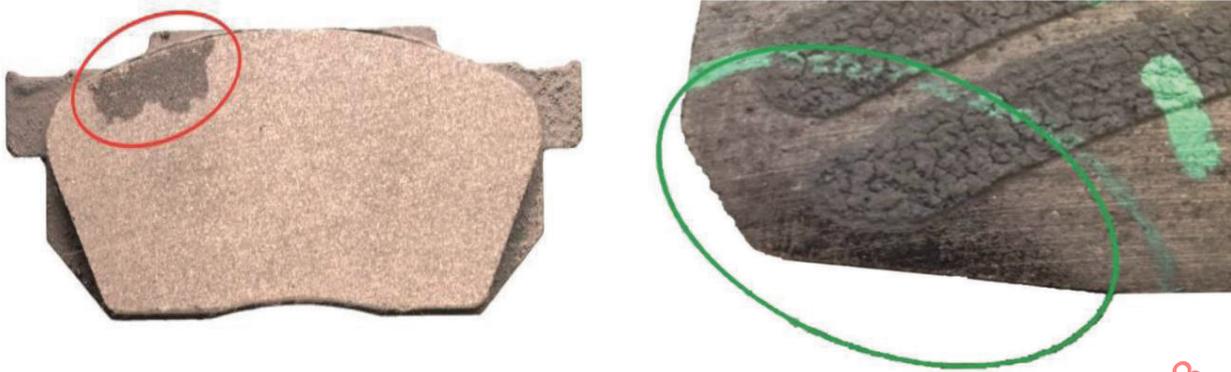


b) Example as schematic view

Figure 14 — Examples for underground material surface

4.1.15 Paint on friction material surface

Paint on friction material surface is acceptable up to 10 % of the surface area [see [Figure 15](#) a) and b)].



a) Example 1

b) Example 2

Figure 15 — Examples for paint on friction material surface

4.1.16 Surface blisters

Surface blisters are acceptable if no surface lift is detectable (see [Figure 16](#)).

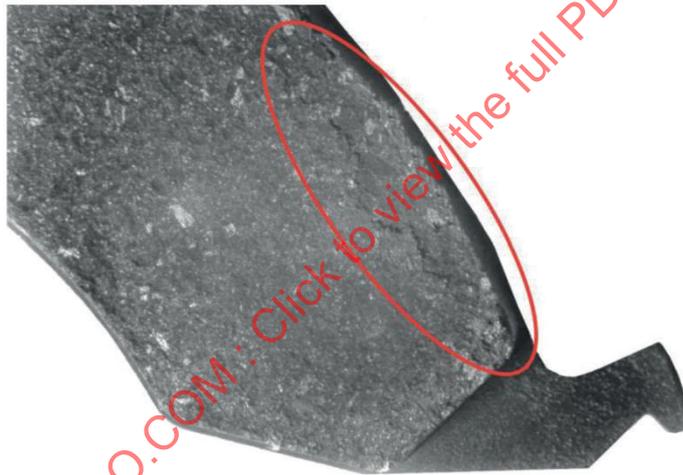


Figure 16 — Example on surface blister

4.1.17 Surface indentations

Surface indentations are acceptable up to 2 % of the surface in total, but a single indentation shall not exceed 1 % of the material surface [see [Figure 17](#) a) and b)].



a) Example 1

b) Example 2

Figure 17 — Examples for surface indentations**4.1.18 Grinding marks on friction surface**

Grinding marks on friction material surface are acceptable (see [Figure 18](#)).

**Figure 18 — Example for grinding marks on friction material surface****4.1.19 High porosity area**

In the case of an effective material surface of less than 120 cm², a maximum of 5 % surface area with a higher porosity is acceptable, provided the material contours are not affected.

The percentage of allowable higher porosity shall be equal or less than 2 % in the case of an effective material surface equal or more than 120 cm² (see [Figure 19](#)).



Figure 19 — Example of higher porosity area

4.1.20 Poorly consolidated friction material

In the case of an effective material surface of less than 120 cm², a maximum of 1 % surface area with poorly consolidated friction material is acceptable.

The percentage of poor consolidation shall be equal or less than 0,5 % in the case of an effective lining surface equal or more than 120 cm² (see [Figure 20](#)).



Figure 20 — Example for poorly consolidated friction material

4.1.21 Surface contamination with foreign matters

Such contamination is not acceptable [see [Figure 21 a](#)) and b)].

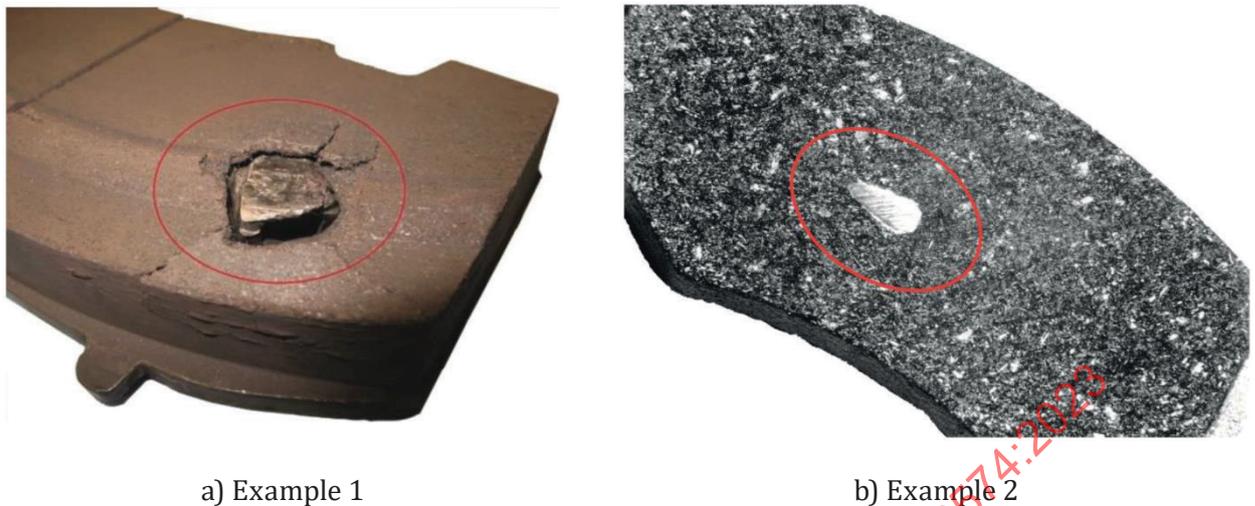


Figure 21 — Examples for surface contamination

4.1.22 Surface contamination with similar friction materials

Spots on friction material with an area equal or less than 1 % of the total surface are acceptable.

Spots on friction material with a surface equal or less than 2 % of the total surface are acceptable, only if the friction properties are not affected (see [Figure 22](#)).

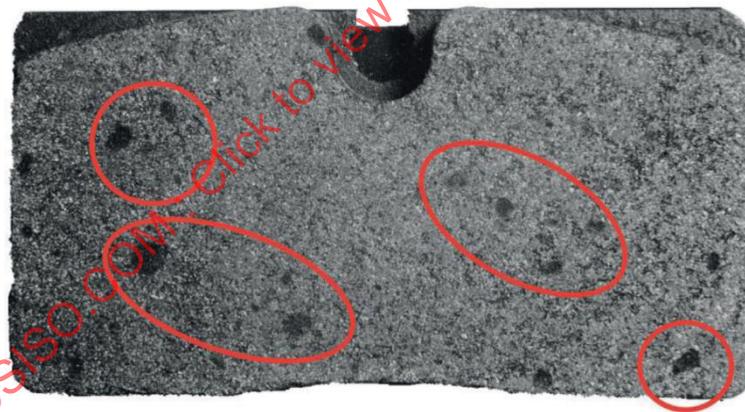


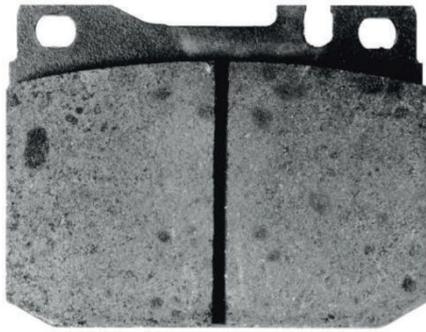
Figure 22 — Example for friction surface structure

4.1.23 Friction surface structure

In the case of an effective material surface of less than 120 cm², the concentration of self-contained ingredients is acceptable up to 5 % of the surface area but not continuous.

In the case of an effective material surface equal or more than 120 cm², the concentration of self-contained ingredients is acceptable up to 3 % of the surface area but not continuous [see [Figure 23](#) a), b) and c)].

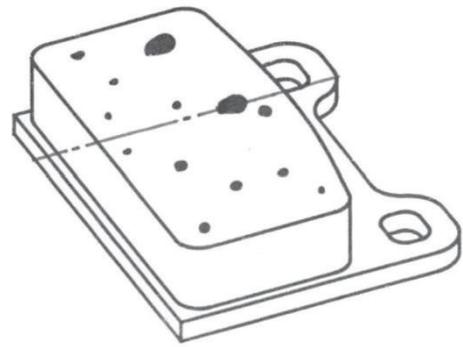
Non homogenous appearance is accepted for special qualities including surface plucking.



a) Example 1



b) Example 2

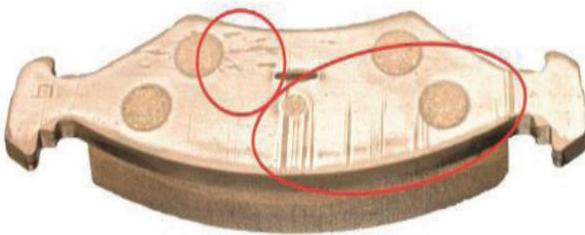


c) Example 3

Figure 23 — Examples for surface

4.1.24 Plate scratched and dents

Examples of dents and scratches on the plate surface are shown in [Figure 24](#) a) and b).



a) Example 1



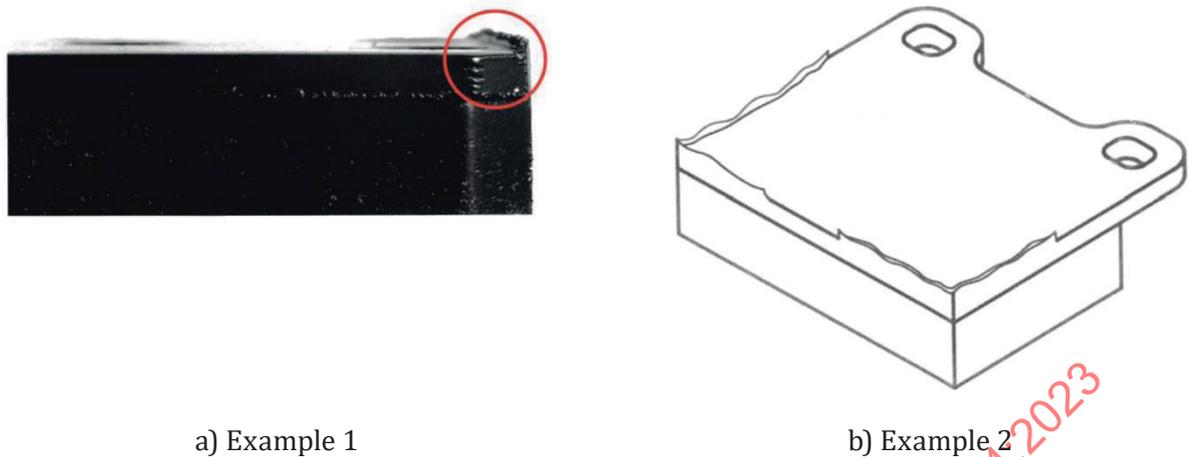
b) Example 2

Figure 24 — Examples for plate surface

4.1.25 Blanking burrs

In the case of an effective material surface of less than 120 cm², outside functional areas on the backing plate ≤ 0,3 mm are acceptable.

In the case of an effective material surface equal or more than 120 cm², outside functional areas on the backing plate ≤ 0,3 mm is acceptable [see [Figure 25](#) a) and b)].



a) Example 1

b) Example 2

Figure 25 — Examples for burrs on backing plate**4.1.26 Deformation by blanking and edge chipping at functional area**

In the case of an effective material surface of less than 120 cm², deformation by blanking and edge chipping is allowed, but the base area of function surface shall be more than 75 % [see [Figure 26](#) a) and b)].



a) Example 1

b) Example 2

Figure 26 — Examples for deformation by blanking**4.1.27 Edge chipping at pin area**

In the case of an effective material surface of less than 120 cm², exceeding of tolerances caused by edge chipping is locally allowed if assembling of the pad or accessories fitment are not affected.

In the case of an effective material surface equal or more than 120 cm², a maximum of 0,5 % of the edge may chip provided assembling of the pad or accessories fitment or its operation is not affected (see [Figure 27](#)).



Figure 27 — Backing plate

4.1.28 Pinholes (Side-cut cavity)

In the case of an effective material surface equal or more than 120 cm², pinholes are acceptable to an area of 4 mm² and to a depth of maximum 1 mm, provided assembling of the pad or accessories fitment or its operation is not affected [see [Figure 28](#) a), b) and c)].

When pinholes are located on the edge, they are not admissible.



Figure 28 — Examples for cast iron backing plate

4.1.29 Grinding marks on the carrier

In the case of an effective material surface of less than 120 cm², cleaning cast burrs by grinding is allowed, but the base area of function surface shall be plane and more than 75 % [see [Figure 29](#) a) and b)].

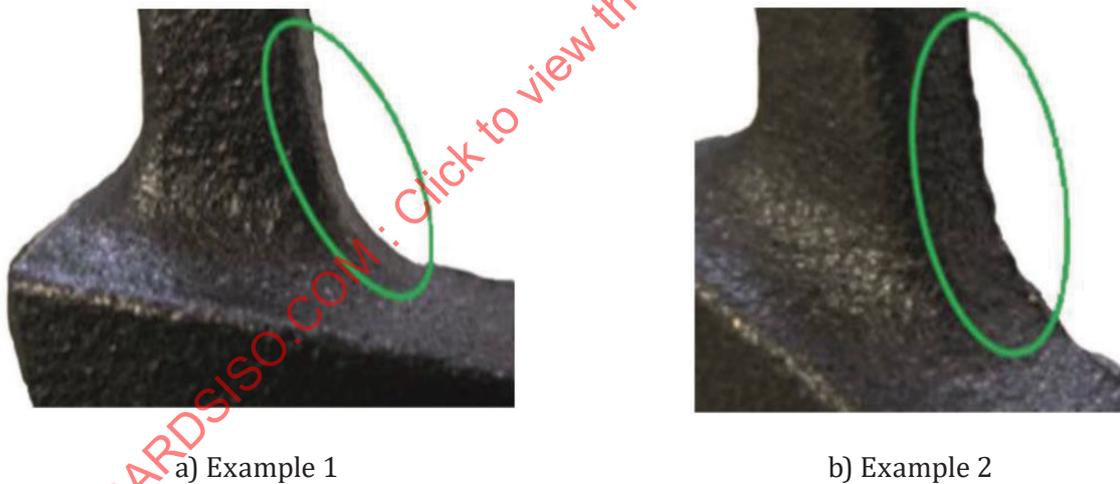


a) Example 1

b) Example 2

Figure 29 — Examples for grinding marks**4.1.30 Spring holder defects**

In the case of an effective material surface equal or more than 120 cm², minor casting defects on spring holder is accepted provided assembling or fitment of the spring and its operation is not affected [see [Figure 30](#) a) and b)].



a) Example 1

b) Example 2

Figure 30 — Examples for spring holder defects**4.1.31 Surface deepening**

In the case of an effective material area of less than 120 cm², a surface deepening $\leq 0,5$ mm around the location of the wear indicator is acceptable, provided the assembling of the pad or the fitment of accessories are not impaired.

In the case of an effective material area equal or more than 120 cm², surface deepening $\leq 1,0$ mm around the location of the wear indicator is acceptable provided assembling of the pad or accessories fitment are not affected (see [Figure 31](#)).



Figure 31 — Example for surface deepening

4.1.32 Cold laps

In the case of an effective material area equal or more than 120 cm², cold laps are not acceptable (see [Figure 32](#)).

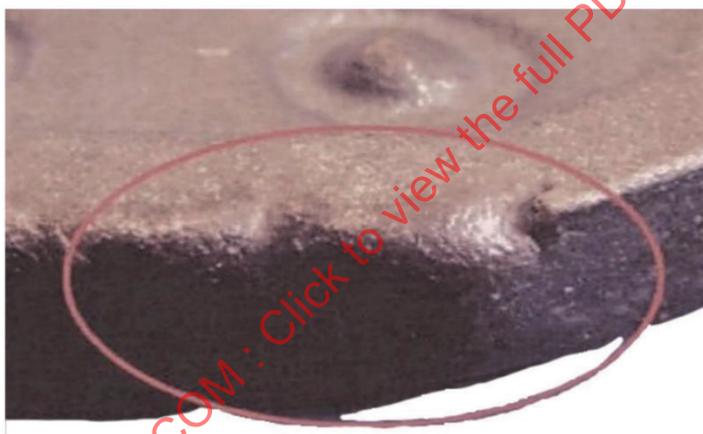


Figure 32 — Example for cold laps

4.2 Characteristic features for drum brake linings

4.2.1 Chipped edges/corners

In the case of a lining surface of less than 120 cm², chipped edges/corners are acceptable up to 10 mm² and half the lining thickness. No more than 2 are allowed per lining [see [Figure 33](#) a) and b)].

In the case of a lining surface equal or more than 120 mm², chipped edges/ corners are acceptable up to 20 mm² and half the lining thickness. No more than 2 are allowed per lining [see [Figure 34](#) a) and b)].

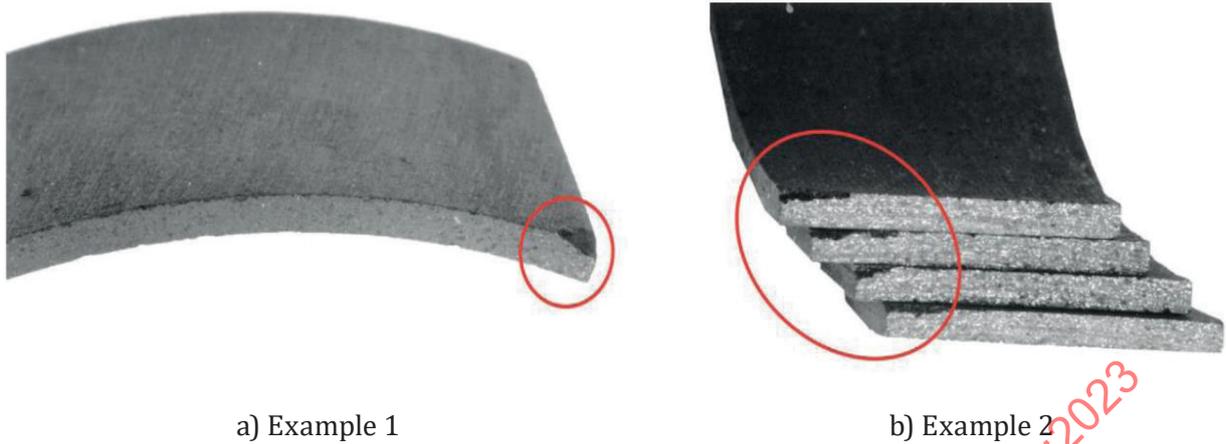


Figure 33 — Example for chipped edges/corners on linings less than 120 mm²



Figure 34 — Example for chipped edges/corners on linings larger than 120 mm²

4.2.2 Edge splits

Edge splits are not acceptable [see [Figure 35](#) a) and b)].

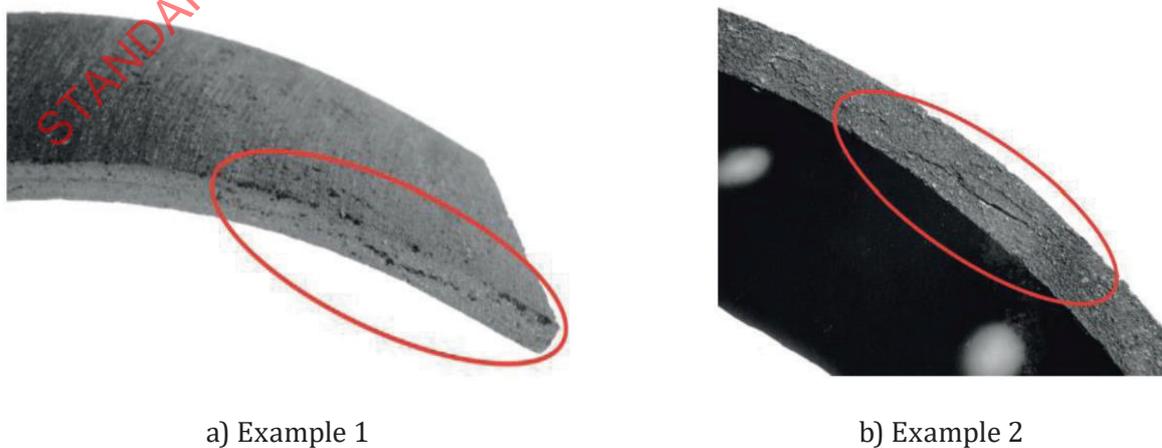
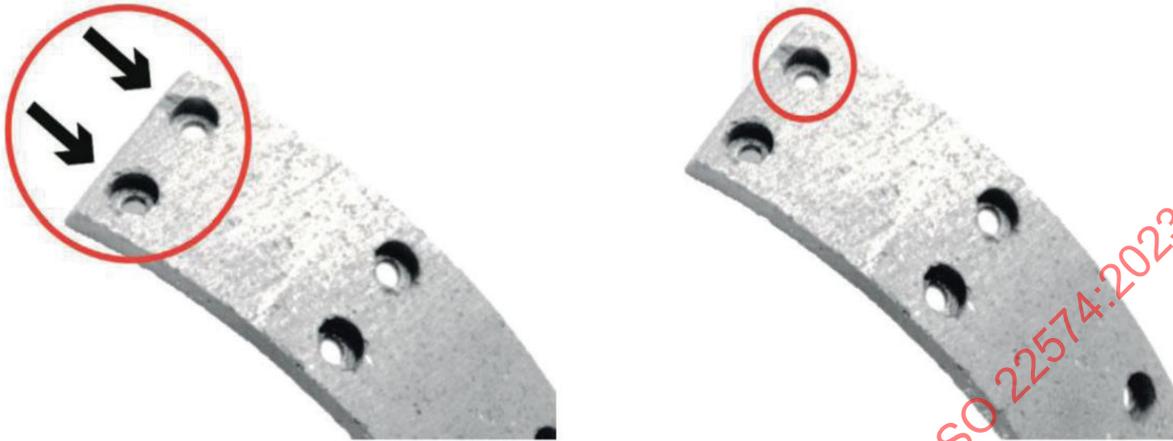


Figure 35 — Example for Example for edge splits

4.2.3 Drill hole chipping at lining ends

For acceptable and not acceptable lining ends, see [Figure 36](#) a). Acceptable is, if only one hole is concerned, see [Figure 36](#) b).



a) Example for not acceptable lining ends

b) Example for acceptable lining ends

Figure 36 — Example lining ends

4.2.4 Drill hole burrs inside the surface

Drill hole burrs on the inside the surface are not acceptable (see [Figure 37](#)).

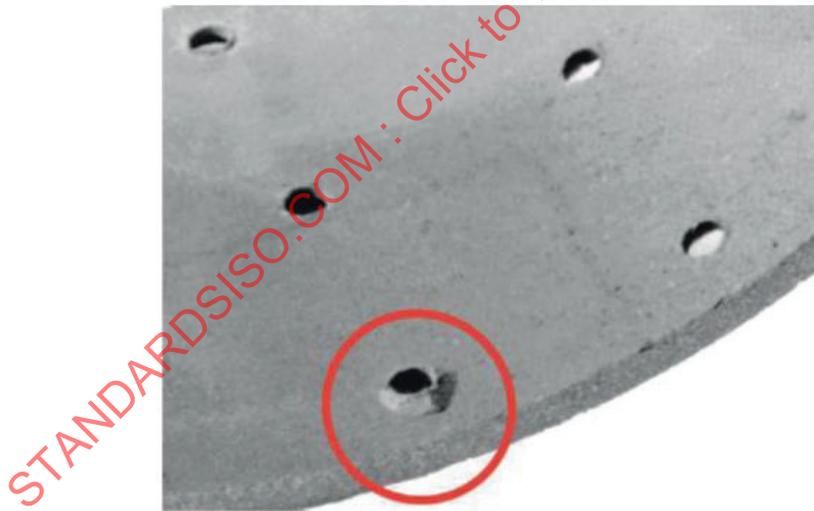


Figure 37 — Drill hole burrs inside the surface

4.2.5 Drill hole burrs outside the surface

Drill hole burrs outside the surface are acceptable up to a height of 1 mm (see [Figure 38](#)).

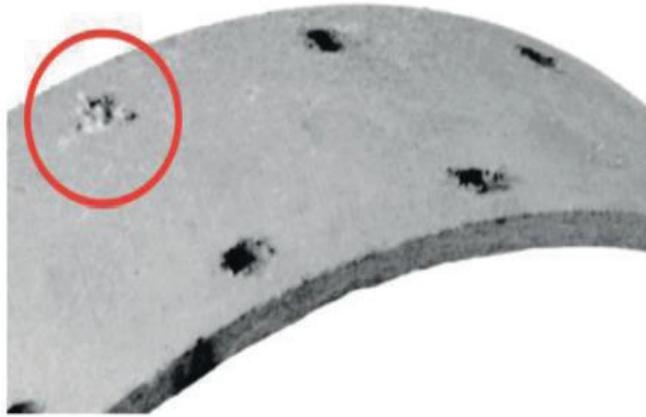


Figure 38 — Drill hole burrs outside the surface

4.2.6 Cracks radiating from the rivet hole

Cracks radiating from the rivet hole are not acceptable (see [Figure 39](#)).

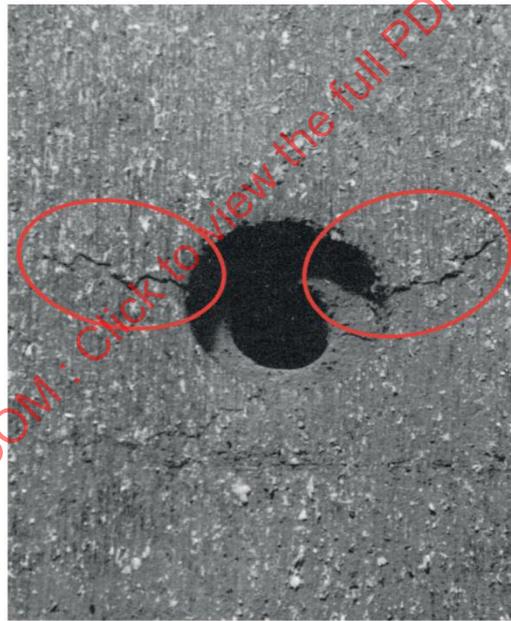


Figure 39 — Cracks radiating from the rivet hole

4.2.7 Paint on surface – Lining for riveting and bonding

Paint on surface is acceptable up to 5 % of the area on both inside and outside surfaces, paint runs are not acceptable [see [Figure 40](#) a) and b)].

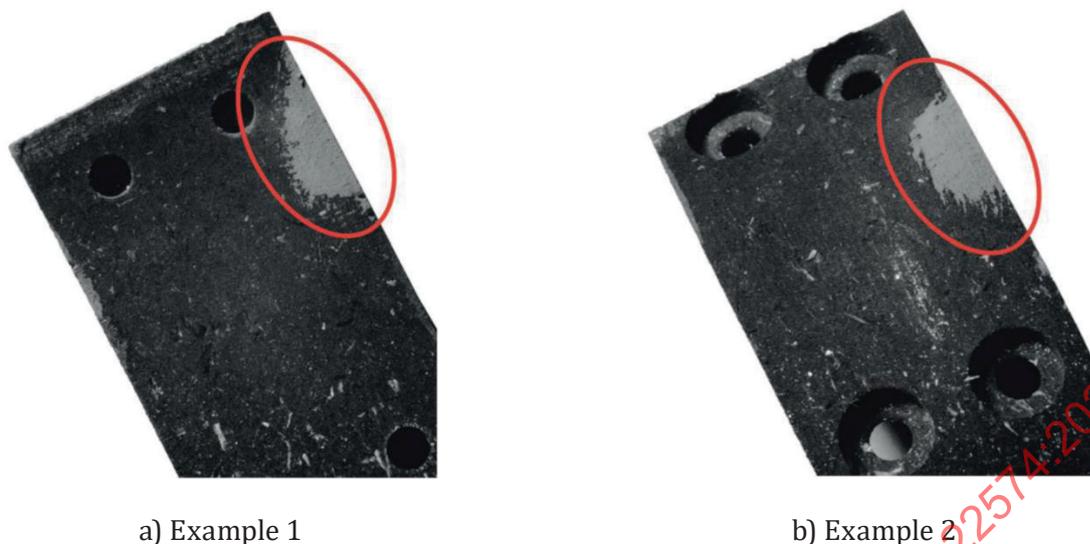


Figure 40 — Example paint on surface

4.2.8 Surface cracks

Surface cracks are acceptable up to 25 % of lining width up to 0,2 mm deep. They are not acceptable across full lining width independent of depth [see [Figure 41](#) a) and b)].

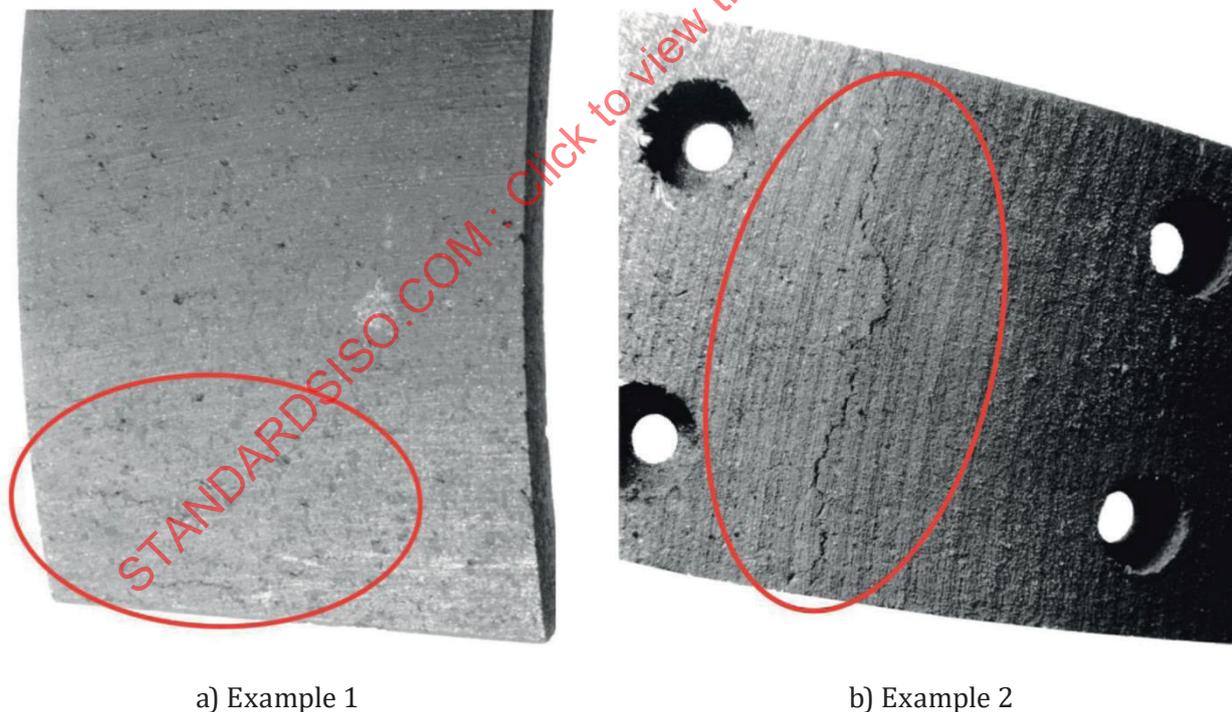


Figure 41 — Example surface cracks

4.2.9 Marking

Marking shall be legible according to [Figure 42](#).



Figure 42 — Example for marking

4.2.10 Moulding skin on inside radius surface - linings for bonding and riveting

Where inside ground finish is specified for linings for bonding, up to 3 % of surface are acceptable provided the unground area is not at the lining ends and dimensional specifications are maintained.

Where inside ground finish is specified for linings for riveting, up to 10 % of surface are acceptable provided the unground area is not at the lining ends and dimensional specifications are maintained (see [Figure 43](#)).

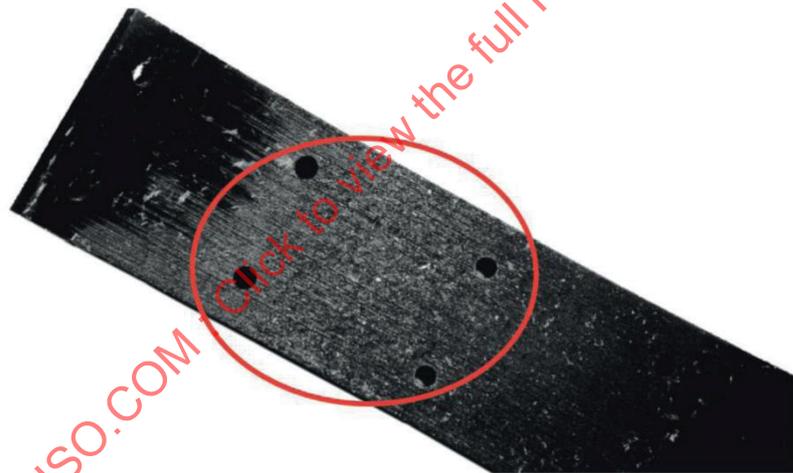


Figure 43 — Moulding skin on inside radius surface

4.2.11 Moulding skin on outside radius surface - linings for riveting or bonding

Moulded skin is acceptable up to 3 % of surface area provided dimensional specifications are maintained (see [Figure 44](#)).

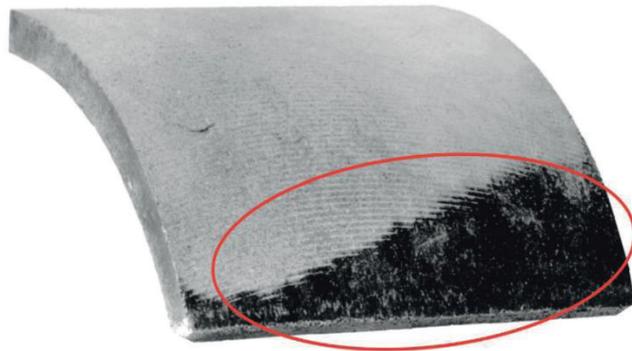


Figure 44 — Example for moulding skin on outside radius surface

4.2.12 Surface blisters

Surface blisters are not acceptable (see [Figure 45](#)).

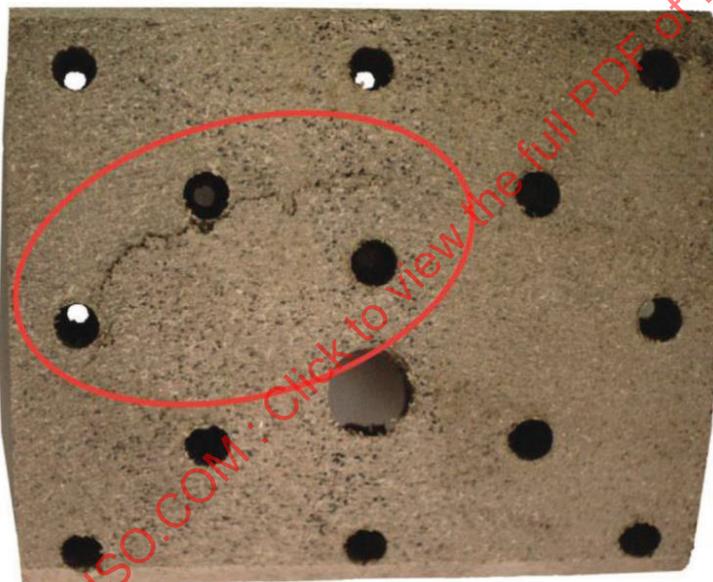


Figure 45 — Example for surface blisters

4.2.13 Surface grind marks

Surface grind marks are acceptable if dimensional specifications are maintained (see [Figure 46](#)).

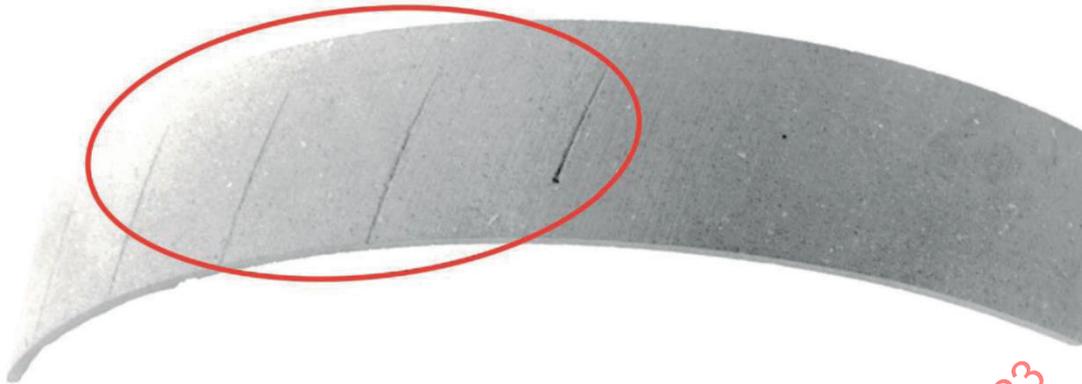


Figure 46 — Example for surface grind marks

4.2.14 Pitted surface (plucked surface)

Pitted surface which is typical of certain materials is acceptable (see [Figure 47](#)).



Figure 47 — Example for pitted surface

4.2.15 Surface structure

In case of surface contamination by self-contained ingredients (poor distribution) i.e. unopened fibres, the lining is acceptable if the contamination equals or is less than 2 % of the friction side area and if the contamination equals or is less than 4 % of the non-friction side area (see [Figure 48](#)).



Figure 48 — Examples for surface structure

4.2.16 Poor consolidated friction material

The poor consolidated friction material as shown in [Figure 49](#) is not acceptable.



Figure 49 — Example for poor material consolidation

4.2.17 Inside surface indentations

In the case of an effective lining surface of less than 120 cm², inside surface indentations are acceptable up to 30 mm² and 1 mm deep. No more than two is allowed and each shall be more than 5 mm from a drill hole.

In the case of an effective lining surface equal or more than 120 cm², inside surface indentations are acceptable up to 30 mm² and 1 mm deep. No more than two are allowed and each shall be more than 10 mm from a drill hole (see [Figure 50](#)).

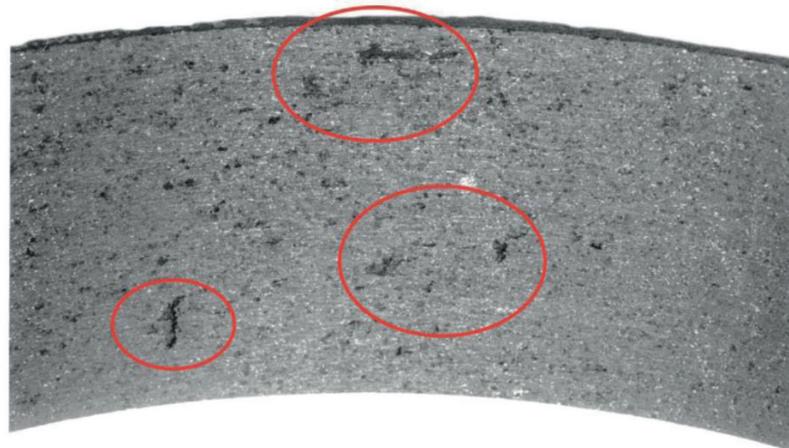


Figure 50 — Example for inside surface indentations

4.2.18 Outside surface indentations

4.2.18.1 Linings > 120 cm²

Outside surface indentations are acceptable up to 30 mm² and 1 mm deep. No more than two are allowed (see [Figure 51](#)).



Figure 51 — Example for outside surface indentations larger than 120 cm²

4.2.18.2 Linings < 120 cm²

Outside surface indentations are acceptable up to 20 mm² and 1 mm deep. No more than two are allowed [see [Figure 52](#) a) and b)].

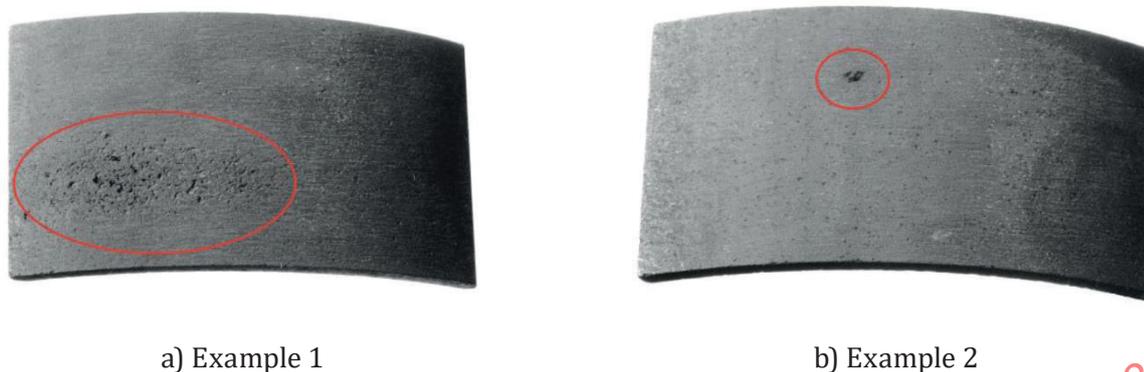


Figure 52 — Example for outside surface indentations smaller than 120 cm²

4.2.19 Concentration of self-contained ingredients unless typical of the formulation

In the outside radius a maximum of 1 % of the surface is acceptable, but each concentration area to be a maximum area of 25 mm² (see [Figure 53](#)).



Figure 53 — Example of Concentration of self-contained ingredients (Outside radius)

In the inside radius a maximum of 2 % of the surface is acceptable, each to be a maximum area of 50 mm² (see [Figure 54](#)).

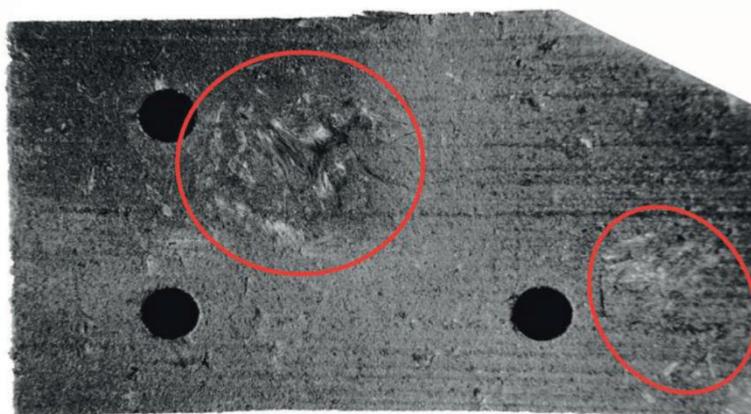


Figure 54 — Example of Concentration of self-contained ingredients (Inside radius)

4.2.20 High porosity area

A high porosity area is acceptable provided the overall density of linings is specified and the profile is not affected (see [Figure 55](#)).



Figure 55 — Example of High porosity area

4.2.21 Metal wire or plastic reinforcement

4.2.21.1 Showing on the inside surface

View in [Figure 56](#) is acceptable.

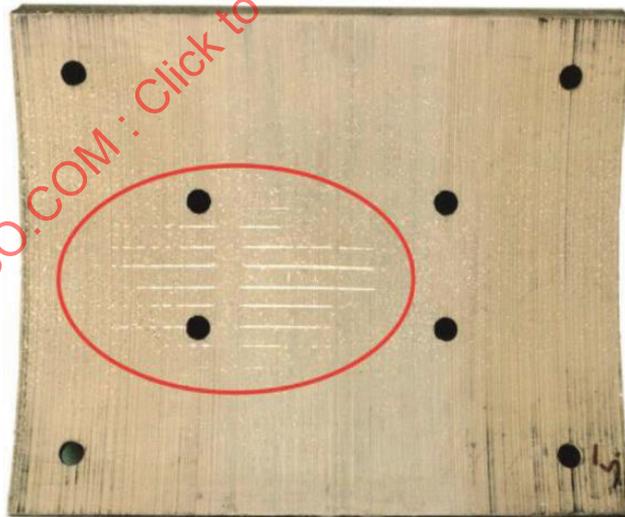


Figure 56 — Example of inside surface

4.2.21.2 Showing in rivet hole

Plastic reinforcement is acceptable. Metal reinforcement is not acceptable (see [Figure 57](#)).