# Information, Requirements and Tests of Ageing-Resistant Restoration and Bookbinding Leathers (ARUB Leather)

## Produced at
## LEDERINSTITUT GERBERSCHULE REUTLINGEN


LGR "Ageing-resistant" Restoration and Bookbinding Leather (ARUB Leather)

The Lederinstitut Gerberschule Reutlingen has developed an "ageing-resistant" restoration and bookbinding leather. The appearance and processability of these leathers is similar to traditional vegetable leather types for these applications. The result of this development is based on experience from the European CRAFT project "Development of Archival Quality Leather" as well as different other projects carried out at the Lederinstitut Gerberschule Reutlingen since the 1970s.

The LGR-ARUB leather is produced from specially sorted hides of southern German calves and the skins of Dutch goats. The leather thickness is 1.2-1.3 mm. Any deviating thicknesses can be agreed and set individually. The control of the leather engineering process is based both on old-established craftsmen's recipes and modern requirements for bookbinding and restoration leathers. Some of the individual steps of the production process are stationary and without movement, while others involve movement, as in the established combination of pit and drum tannage. The total production process from raw material to finished leather takes about 3 months.

Two natural, hydrolysable, vegetable tanning agents are used for tanning. Special fatliquors and light-fast auxiliaries allow the desired posttreatment such as fibre drawing, skiving, embossing and dyeing to be carried out without any negative impact. In particular, this production method takes into account the ageing resistance.

In order to further develop this type of leather and to test it for its usability, laboratory tests are required during the production process which are carried out in-house by the material testing department of the Lederinstitut Gerberschule Reutlingen. The requirements for this type of leather are monitored continuously in line with the state of the art, and any necessary changes are taken into account in LGR's own requirement specifications.

*Ageing and freedom from harmful substances:*

The great demand in ageing-resistant bookbinding leathers, whether for restoration purposes or as binding material for new books, is indisputable. It is therefore hardly surprising that in the nineties, in particular, a large number of research projects were launched in this area in order to clarify the causes of the ageing of leather and thereby find ageing-resistant leathers for restoration purposes, above all in the bookbinding field.

In line with the philosophy of the Lederinstitut Gerberschule Reutlingen, proof of the environmentally compatible production of leather and its freedom from hazardous substances was of particular concern. These requirements have been tested and their fulfilment certified by issuing our environmental and quality seal "*LEATHER – manufactured in an environmentally suitable way*". The allocated test symbol has the number: L039/07.

The following pages provide an overview of the required test parameters. For the requirements of the LGR environmental seal of approval „Leather - produced in an environmentally compatible way, tested for harmful substances", refer to the relevant documents. These are not included in this report.

# 1. Requirements for a new, unprocessed leather, produced at LGR

Besides the requirements for physical and technical properties, requirements for processability must be taken into account.

The requirements for processability are not included in the following requirements; they should be laid down by an experienced bookbinder or book restorer. The most important parameters are embossability, dyeability, designability, skivability and bondability.

## 1.2 Requirements for physical parameters

| Test | Standard | Requirement |
|---|---|---|
| Sampling, physical | DIN EN ISO 2418 | -- |
| Sample preparation, physical | DIN EN ISO 2419 | -- |
| Thickness in mm | DIN EN ISO 2589 | Specific to article |
| Shrinkage temperature in °C | DIN EN ISO 3380 | >70 |
| Tensile strength in N/cm$^2$ | DIN EN ISO 3376 | ≥ 800 [2] |
| Elongation at break in % | DIN EN ISO 3376 | ≥ 30 [2] |
| Tear load –single edge tear in N/cm | DIN EN ISO 3377-1 | 150 |
| Light fastness rating blue scale | DIN EN ISO 105 B02 modified | Rating 4 (no change in shade) |
| Fastness to Water spotting<br>- wetting time in min<br>- assessment after 24 h | DIN EN ISO 15700 | <br>≤ 2<br>No spots |
| Flexing endurance (flexometer method) [1]<br>Number of flexes | DIN EN ISO 5402 | <br><br>50 000 |
| Determination of the behaviour at permanent folding of semi-flexible leathers [1]<br>Number of folds | DIN 53340 | <br><br>50 000 |
| Deformability in ° | Internal method | ≤ 75 |
| Odour (rating) | Internal method | ≤ 3 |

[1] *For finished leathers only*
[2] *Requirement may be adapted as a result of technical developments.*

## 2.2 Requirements for chemical parameters

| Test | Standard | Requirement |
|---|---|---|
| Sampling, chemical | DIN EN ISO 4044 | -- |
| Sample preparation, chemical | DIN EN ISO 4044 | -- |
| Water content in % | DIN EN ISO 4684 | 10 – 18 |
| Determination of matter soluble in dichloromethane (fats and others) [1] in % | DIN EN ISO 4048 | ≤ 5 |
| Water - soluble matter [1] in % | DIN EN ISO 4098 | ≤ 4 |
| -water soluble inorganic matter [1] in % | DIN EN ISO 4098 | ≤1 |
| - water soluble organic matter [1] in % | DIN EN ISO 4098 | ≤ 2 |
| Ash content (sulphated ash) [1] in % | DIN EN ISO 4047 | ≤ 2 |
| pH value | DIN EN ISO 4045 | ≥ 4 |
| -Difference figure | DIN EN ISO 4045 | ≤ 0,7 |
| $Cr_2O_3$ content [1] in % (mg/kg) | LGR-IPV-03 | < DL |
| $Al_2O_3$ content [1] in % (mg/kg) | LGR-IPV-03 | < DL |
| $TiO_2$ content [1] in % (mg/kg) (a.r.) | LGR-IPV-03 | < DL |
| $ZrO_2$ content [1] in % (mg/kg) (a.r.) | LGR-IPV-03 | < DL |
| Free sulphur / free sulphur compounds in % | Internal method | No free sulphur / free sulphur compounds detectable |
| Test of tanning agents used (vanillin test) qualitative | Internal method | No condensed tanning agents (no pyrocatechins) |

[1] *Results are calculated for 0% water content; the applicable target values also refer to 0% water*

DL = Determination limit of the test method used.

a.r. = as required

# 2. Requirements for artificially aged leather

## 2.1 Ageing method

5 days 70°C, examination after 24 h conditioning in atmosphere 23°C / 50 % r.h. in accordance with DIN EN ISO 2419. (This method may be adapted as a result of further investigations).

## 2.1 Physical tests following ageing

| Test | Standard | Requirement |
|---|---|---|
| Shrinkage temperature in °C | DIN EN ISO 3380 | ≥ 50 [1] max. reduction 20°C |
| Tensile strength in N/cm$^2$ | DIN EN ISO 3376 | ≥ 500 [1] max. reduction 40% |
| - Elongation at break in % | DIN EN ISO 3376 | ≥ 15% [1] max. reduction 20% |
| *Tear strength in N/cm* | *DIN EN ISO 3377-1* | ≥ 100 [1] max. reduction 40% |
| Flex resistance using the flexometer method | DIN EN ISO 5402 | 5 000 flexes [1] max. reduction 60% |
| Behaviour at permanent folding of semi-flexible leathers | DIN 53340 | 2 000 folds [1] max. reduction 60% |
| Light fastness rating blue scale | DIN EN ISO 105-B02 modified | Rating 3 [1](without change of shade) |
| Comparison of shade between original and aged leather in grey scale ratings | DIN EN ISO 20105-A02 | Rating 3 [1] (no change to red, no yellowing) |

[1] *Requirement may be adapted as a result of technical developments.*

## 2.2 Chemical tests following ageing

| Test | Standard | Requirement |
|---|---|---|
| pH value | DIN EN ISO 4045 | ≥3,0 [1] |
| -Difference figure | DIN EN ISO 4045 | *≤0,7* [1] |

[1] *Requirement may be adapted as a result of technical developments.*