

QUALITY STANDARDS

FOR THE *PAPERSAVE SWISS* PROCESS USED FOR THE
DEACIDIFICATION OF THE COLLECTIONS OF THE SWISS FEDERAL
ARCHIVES AND THE SWISS FEDERAL OFFICE OF CULTURE -
SWISS NATIONAL LIBRARY

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This is a translation. Only the German version of the quality standards is legally binding.

1. Goal

Mass deacidification must improve durably and at a reasonable cost, paper's resistance to aging and its actual lifespan must be multiplied at least several times. A thorough study of the existing treatment methods in use worldwide enabled us to choose a treatment procedure based on the Battelle process. Adapted and improved this process is now known under the name *papersave swiss*.

The planning and operating of the treatment plant is governed by the general conditions (chapter 2), the quality standards (chapter 3, 4 and 5) and the security, infrastructure and logistics requirements (chapter 6).

2. General conditions

Given the actual state of our knowledge concerning the *papersave swiss* process, we can safely assume that the following general conditions will be met and will not need to be verified specifically within the framework of quality control measures.

We consider these conditions to be *sine qua non*: if they were not met than the whole *papersave swiss* process could no longer be considered appropriate for the preservation treatment of the collections belonging to the archives and the libraries. If it appeared that the process failed to meet just one of these general conditions, immediate corrective measures would have to be undertaken.

2.1. Neutralisation (“deacidification”)

Even without the addition of a weak base as an alkaline reserve the process is adequate to neutralise the acids contained in non-treated paper. It is not possible to prove by direct measures that this weak base does indeed neutralise, at the molecular level, acids present in paper. However the indirect proof that neutralisation has taken place at the molecular level is that the aging process of the treated paper has slowed down significantly.

2.2. Alkaline reserve

Three months at the most after the end of the treatment, the alkaline reserve detected in the treated items is in the form of magnesium carbonate or a mixture of magnesium carbonate and magnesium hydroxide. It is never pure magnesium hydroxide.

2.3. Treatment process

The solution used in the treatment process does not carry, in significant quantities, agents that are harmful to paper.

2.4. Chemical residue from the treatment process

Chemical residues that remain in the items after treatment (hexamethyldisiloxane, for example) do not have any significant long-term harmful effects and do not impose significant limitations to the use of these items.

2.5. Mechanical resistance

- (a) The treatment doesn't reduce significantly the mechanical resistance of paper.
- (b) The mechanical resistance of paper aged artificially and treated is meaningfully superior to the resistance of the same paper which has not been treated. See the Laboratory report 416096 of the Swiss Federal Laboratory for materials testing and research (LFEM/EMPA).

3. Quality Standards I: Introduction and definitions

Definitions

Item	Single book or document from library or archives.
Batch of treated material	Number of items that fit in the treatment chamber.
Test material/test books	Bound papers chosen especially for test purposes that are treated with each batch and that serve as the basis for the control certificate.
Original material	Books and original archives documents, which are re-shelved after being treated and which can only be controlled by non-destructive measures.
Reference material/mackle	Books, archive documents or papers that correspond approximately to the original copies by their material and age but that are disposable after treatment and can therefore be used for destructive controls. This category includes documents from the Federal Archives that have been added to the crates for analysis purposes.
Controlled quantity	Amount of test material/test books added to each batch treated and then examined. Original material or reference material that is examined randomly in each batch.

It is only through the proper management of the plant's operations and the respect of the guidelines for the arrangement of the items in the metallic crates that we will meet the quality criteria described in the following chapters; plant managers and clients will be able to verify if these quality standards have been met during the quality control process.

Particular batches can be excluded from certain quality criteria, prior to the treatment. Plant operators and clients must discuss and agree on a protocol for these exceptions.

The physical/chemical controls fall under the plant operators' responsibilities while the responsibility of the visual/physical controls lies with the clients.

4. Quality Standards II: Physical/chemical controls

Physical/chemical controls verify the completion, intensity and homogeneity of the treatment as well as colour alteration.

The conformity to physical/chemical quality standards 4.1 to 4.4 must be guaranteed for each client during a complete calendar year. This guarantee refers to the quantities controlled each time, whether test material or reference material.

For test material, we will strive to conform to the physical/chemical quality standards 4.1 to 4.4 for each batch.

In the following cases, the client will be informed immediately and the plant operators and the client will be able to discuss and agree on a procedure:

- Test books
The non-respect of one or many limit values in a batch: the release of the batch requires a special authorisation from the client.
- Original material or reference material
The "observation of repeated deviations"; means that more than two items controlled in a same batch or more than four items of a same material (for example, same call number) controlled in five successive batches present the same deviation from the standard: the release of this batch requires a special authorisation from the client.

For each batch there is a set quantity of items controlled: three test books plus an optional amount of original or reference material.

For each batch, a control certificate is established listing all the values calculated on the test material and on the original or reference material. At the end of the calendar year, a yearly certificate is established for each client listing all the quality characteristics required each year.

4.1. Completion of treatment

At least 98% of the total quantity of material treated must be completely deacidified. The criteria are considered met if it can be proven that 98% of the quantity controlled (separately for test material and original or reference material) is entirely deacidified.

An item is considered completely deacidified:

- when the surface pH reaction (control guideline NCW PAW 6074) is ≥ 7.0 , or
- when the surface pH reaction is between 5.0 and 7.0 and the pH value per cold extraction (DIN 53124) is of ≥ 7.0 (this control can only be carried out on test or reference material because it is destructive), or else
- when the surface pH reaction is between 5.0 and 7.0 and that the alkali content (ISO 10716) is a positive value (this control can only be carried out on test or reference material because it is destructive), or finally
- when the surface pH reaction is between 5.0 and 7.0 and that an increase of $\geq 0.5\%$ MgCO_3 , due to treatment was observed by X-ray fluorescence (XRF) spectroscopy (non-destructive control applicable to original material).

Measurement: analysis according to the procedures mentioned. The place of measurement is the middle of the book for original or reference material with two measurement points per sheet. Scope of the measurement: one sheet per item.

4.2. Intensity of treatment (uptake of alkali)

At least 95% of the quantity of material treated must have absorbed a defined quantity of weak base (expressed in % of magnesium carbonate). The criteria are considered met if 95% of the quantity controlled (separately for test material and original or reference material) presents values within the following limits:

- Test material: average per item μ between 0.5 and 2.0 wt-% of magnesium carbonate
- Original and reference material: average per item μ between 0.3 and 2.3 wt-% of magnesium carbonate.

Measurement: for each control item, determine the quantity of alkali absorbed during the process in 7 fields of a sheet, in general by XRF spectroscopy, or if needed by wet chemical analysis, according to corresponding process instructions. The average μ of each item is calculated from the 7 values measured including the standard deviation s .

The intensity of the treatment (uptake of alkali) is the result of the addition of the acid content of the paper before the treatment and the alkali content (alkaline reserve) after the treatment.

Alkaline reserve and acid content can only be determined by destructive controls. If the acid content of the paper is known (test papers, for example), the alkaline reserve can be calculated any time from the intensity of the treatment, which can be obtained by non-destructive means.

4.3. Homogeneity of treatment

The goal is that at least 95% of the total quantity of material treated must present a homogeneous treatment. The criteria is considered met if, for 95% of the quantity controlled (separately for test material and original and reference material), the mean standard deviation s of the alkali content doesn't exceed 0.5 wt-% of weak base (expressed in magnesium carbonate).

Measuring and calculations same as in 4.2.

4.4. Colour changes

At least 95% of the total quantity treated must not present distinct colour alteration. The standard is considered met if 95% of the controlled quantity (separately for test material an original and reference material), respect the following values:

- test material: (limit value)
the mean per item is within an acceptability ellipsoid defined by the parts of the axes $\Delta L^* = \pm 1.5$, $\Delta a^* = \pm 0.5$ and $\Delta b^* = \pm 2.0$
- original or reference material (target value)
the mean per item is within an acceptability ellipsoid defined by the parts of the axes $\Delta L^* = \pm 2.0$, $\Delta a^* = \pm 1.0$ and $\Delta b^* = \pm 3.5$

As colour changes strongly depends on the type of paper and material and that it is not very sensitive to the regulation of the process, defining obligatory standards makes sense only for test books. For original or reference material, a target value is sufficient.

Measurement: the evaluation of colour changes is carried out on the basis of colorimetric determination in the chromatic field $L^*a^*b^*$, using a handheld spectrometer (type of light: D65; geometry of measurements: $d/10^\circ$). Scope of measurement: on test books, 6 pages by type of paper, on original and reference material, 6 pages per item. For test books, measurements are usually taken on the pages 2-7 of each bloc (1 surface measure per sheet), for original and reference material, they are taken on the non-printed zones in the margins. The mean of alteration per item on the three chromatic axes (ΔL^* , Δa^* , Δb^*) is calculated from the 6 values measured on original and reference material (18 for test books).

5. Quality Standards III: Visual/physical controls

5.1. General remarks

The visual/physical quality control determines statistically the percentage of alteration in each batch. All the changes to the criteria listed in 5.4 are taken into account, then they are weighted according to a scale from “slight”, “medium”, “severe”, “partial loss” to “total loss”. The alterations, if they can be recorded photographically, and the weighting of alterations are evaluated using photographs as comparison. The frame of survey of August 2001 (Swiss Federal Archives, SFA) and of November 2003 (Swiss National Library, SNL) are available (for the operating company) in standardised form. They are inherent elements of these quality standards. Because authenticity, informative value, usability and aesthetics do not hold the same importance for archival documents and library documents, the evaluation and weighting of alterations are done separately by each institution. The input principles of the SNL determine the tolerance or absence of tolerance for respective categories.

The visual/physical quality control helps determine the limit between profitability of the deacidification treatment on one hand and the security and quality of the process on the other hand.

If the limit values of a batch are exceeded, corrective actions must be undertaken. The operating company must adjust the parameters of the treatment and/or the client must take corrective measures or sort the material being shipped and treated. Certain parts of a shipment can be excluded from treatment if requested by the client or by the plant operators.

5.2. Visual-physical controls of archival documents

In each crate, control the first box from the left, and 32 boxes (16,000 items) per batch. The control rate is 25% (standard ISO 9003). If the same item shows more than one sign of deterioration, it is only counted once (alterations are not cumulated).

The quality standards 5.4.1 to 5.4.4 are met in a batch when alterations are detected in less than 5% of the items controlled.

5.3. Visual-physical control of library documents

In each batch, 6 in-4° bins or 8 in-8° crates are usually controlled which amounts to a control rate of 17%. The control rate can be adapted to a particular situation. If an item presents several alterations, which are not linked to each other, each alteration is accounted for (alterations are cumulated).

The quality standards 5.4.1 to 5.4.4 are met in a batch when alterations are detected in less than 5% of the items controlled.

5.4. Quality criteria

Please note: the systematic classification of quality criteria has been essentially taken from the Quality standards of 1998-10-7 (QS 98).

- 5.4.1. (QS 98 / 3.6) Visible deposits on the surface of items of chemical products used in the treatment, of inks, of colour from crayons, of printing colours or colours on the bindings and jackets.

Visual control

- 5.4.2. (QS 98 / 3.7) Alteration of inks and other printing material by bleeding.

Visual control

- 5.4.3. (QS 98 / 3.8) Modification of the structure of the paper's surface: formation of spots on the documents, of Newton's rings, glued surfaces, modification in the shine, sticky bindings.

Visual and physical controls

- 5.4.4. (QS 98 / 3.9) Reduction in the stability and function of all types of bindings, joints and bonds.

Visual and mechanical controls.

- 5.4.5. (QS 98 / 3.10 and 3.11) Visible alteration of the shape or thickening of the paper after treatment. (an increase of more than 3% of the space needed after re-shelving).

Visual and metric controls

- 5.4.6. (QS 98 / 3.12) Unpleasant odours.

To avoid personnel and users being affected by unpleasant odours resulting from the treatment, MAK values for all substances added during the treatment or produced during the process must be respected after the return of documents to the stacks. Volatile solvents are measured in the stacks with Dräger tubes.

6. Infrastructure, security and logistics

6.1. Conformity to standards and certification

The physical and chemical characteristics of the treatment process and the characteristics of the plant's premises must conform to the recognised technical norms and standards. The plant must be equipped with up to date technical procedure standards.

Prescriptions of international standards, in particular the ISO 9000 standard must be respected in every part of the infrastructure.

6.2. Modification of the treatment process

The organisation of the infrastructure must accommodate any and all modifications to the treatment process.

6.3. Handling errors

The necessary measures should be taken to ensure that potentials handling errors will result in the least possible damage to the documents being treated and that uncontrolled reactions cannot occur.

6.4. Guidelines for the handling of materials from archives and libraries

During the whole process (transportation to the plant, treatment, return to client) the guidelines in force must be respected for the handling of materials from archives and libraries.

6.5 Logistics

The logistics involved with the transportation and intermediate storage will conform to security guidelines for the handling of materials from archives and libraries. Avoid unnecessary storage and delays in the treatment or restitution of materials. Make sure that it is always possible to determine in which step of the treatment process a batch of documents is situated and that it can be located thanks to an effective integration of "logistics and management" functions. The infrastructure must be organised in such a way as to prevent any loss or misplacement of documents. After treatment, documents are returned to the client in the same order in which they were delivered.

6.6 Documentation concerning treatment

Plant managers will preserve in electronic form, during at least 10 years, the documentation describing all the steps in the treatment process as well as the related reference parameters, which characterize this process. This data can be communicated to the client at any time.

When a shipment of treated material is returned to the client, he also receives an acceptance test report (final certificate), which comprises the theoretical and effective values relating to the quality standards 4.1 to 4.4.

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