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Library Binding

Abstract: Describes the technical specifications and materials specifications for first-time hardcover binding of serials publications and paperbound books for library use, and rebinding of hardcover books and serials intended for library use.

An American National Standard
Developed by the
National Information Standards Organization and the
Library Binding Institute

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Foreword

(This foreword is not part of the American National Standard for Library Binding, ANSI/NISO/LBI Z39.78-2000. It is included for information only.)

This standard is the result of a collaboration between the National Information Standards Organization (NISO) and the Library Binding Institute (LBI), the principal trade association representing the library binding industry. ANSI/NISO/LBI Z39.78-2000 is the first American National Standard for library binding. The committee charged with writing this standard included library binders, librarians, and suppliers of bookbinding materials.

The principal mission of the library binding industry is to extend the useful life of library books and periodicals. For decades, commercial binding services have been the chief preservation option (and often the only preservation option) available to most libraries. Considering the importance of these services to the library community, it is not surprising that binders and librarians have traditionally worked together to develop and maintain rigorous technical standards. Initial efforts to codify industry practice emphasized careful performance of all procedures, the use of high quality materials, and the value of a sturdy, economical end product. While the demand for affordable binding has dictated the gradual streamlining of production techniques and the introduction of automated procedures, the need to accommodate the variable nature and condition of library materials has always been recognized.

In the years following the establishment of the Library Binding Institute in 1935, eight editions of the *Library Binding Institute Standard for Library Binding* have been issued, each emphasizing quality of workmanship and materials and a discriminating approach to decision making. In 1986 the LBI Standard was substantially revised to acknowledge changing practice within the industry. Where strength was once the only yardstick against which library binding was measured, openability became equally important, as did conservative treatment of volumes with fragile paper. To address redefined objectives, sewing through the fold, double-fan adhesive binding, and recasing—once reserved for exceptional volumes—were incorporated into the *LBI Standard* as mainstream techniques. This broadening of the *Standard*, bolstered by improving technologies, maximized the binder's ability to take into account the structure, size, age, and condition of a volume when selecting a treatment method.

This standard builds upon previous LBI standards. Performance benchmarks are added to the Materials Specifications to encourage suppliers to develop superior materials and for binders to accept them. Concurrent with the development of this standard, several rounds of testing were conducted to support performance benchmarks and to provide a platform for additional improvement. A report on the testing project, *Performance Measures For Library Binding,* by Barclay W. Ogden and Robert J. Strauss (Minneapolis, MN: Library Binding Institute, 1995) is available from the LBI.

It is hoped that further advancements in technology, the availability of new products, and the increasing body of knowledge from which binders and librarians can draw, will stimulate further evolution of industry practice and the standard that defines it.

This standard was processed and approved for submittal to ANSI by the National Information Standards Organization. It was balloted by the NISO Voting Members December 15, 1998 - January 31, 1999. It will next be reviewed in 2005. Suggestions for improving this standard are welcome. They should be sent to the National Information Standards Organization, 4733 Bethesda Avenue, Suite 300, Bethesda, MD 20814. NISO approval of this standard does not imply that all Voting Members voted for its approval. At the time it approved this standard, NISO had the following Voting Members:

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Paul Parisi and Robert DeCandido served as technical editors in the preparation of this standard. NISO and LBI gratefully acknowledge their special contributions.

Library Binding

INTRODUCTION

1. Purpose and Scope

This standard applies to the binding of books and periodicals using methods and materials that result in volumes that are sturdy, durable, and flexible enough to withstand the rigors of library use.

1.1 Books

Specifications on the binding of books are set forth as follows:

- First-time hardcover binding of paperbound books for library use.
- Rebinding of hardcover books for library use.

1.2 Periodicals

Specifications on the binding of periodicals are set forth as follows:

- First-time hardcover binding of paper-covered serial issues for library use.
- Rebinding of hardcover serial volumes for library use.

1.3 Exceptions

No specifications are set forth for the binding of volumes identified by a customer as having high artifactual value; or for any volumes that, because of their physical characteristics, cannot or should not be library bound. Arrangements for special treatments shall be made on an item-by-item basis by the customer in consultation with the binder.

2. Title and Citation

This standard shall be cited as *ANSI/NISO/LBI Z39.78-2000 Standard for Library Binding* and hereinafter referred to as the *Standard.*

3. Representation and Warranty

Only binding that adheres to this standard may be represented as conforming to the ANSI/NISO/LBI Standard for Library Binding. With respect to such binding, the binder shall warrant to the customer as follows:

"Warranty: We warrant that the binding represented by us as conforming to the *ANSI/NISO/LBI Standard for Library Binding* complies with all requirements of the edition of the Standard that is current at the time of the binding. This statement is made pursuant to the Technical Specifications and Materials Specifications of the *ANSI/NISO/LBI Standard for Library Binding* and applicable federal and state laws relative to representations by a seller to a purchaser regarding the quality of a product and its adherence to a standard."

4. Compliance

To comply with this standard, a binder shall bind volumes in accordance with the Technical and Materials Specifications herein OR, in using alternatives to any of the materials specified, must

- commission an independent agency to test and evaluate samples of materials, using all relevant tests described in Materials Specifications (Sections 15 through 23 herein); and

- present specifications for the alternate material, along with test data, to the Library Binding Institute for review and approval. The performance and longevity of the new material shall be at least as great as that of the material it replaces.

5. Classification of Volumes

For the purpose of this standard, volumes shall be classified as cited in Sections 5.1 and 5.2 herein.

5.1 Book (Monograph)

A book is a single text block that can be bound without requiring the binder to match the spine lettering and/or color of cover to that of another volume.

5.2 Periodical (Serial)

A periodical is one or more serial issues that must be bound as a single unit. It requires the binder to match the spine-lettering pattern, color of cover, and color of stamping foil to other volumes having the same title. For the purposes of this standard, multivolume monographs are considered to be periodicals.

TECHNICAL SPECIFICATIONS

6. Examination, Collation, and Preparation

All volumes shall be carefully inspected to select an appropriate method for first-time hard cover binding or for rebinding. Inspection shall include an examination of the condition of the paper, the nature and condition of the original leaf attachment, and the width of the binding margin. Based on this inspection a suitable method of leaf attachment shall be selected and the need for paper mending and other special treatment identified. The head, fore edge, and tail margins shall be examined to identify those volumes that cannot be trimmed without cutting into text or illustrations.

6.1 Books

Books shall be inspected for completeness and defects. Incomplete or defective volumes shall be returned to the customer or bound as is, in compliance with instructions from the customer.

6.2 Custom Periodicals

Custom periodicals shall be collated in compliance with instructions from the customer. Services can include custom placement of title page, table of contents, index, supplements, and other loose pages; removal of covers and unpaginated advertisements at the front and back of each issue; inspection to ensure correct order of issues; and examination for completeness and defects. Incomplete or defective volumes shall be returned to the customer or bound as is, in compliance with instructions from the customer.

6.3 Standard Periodicals

Standard periodicals shall be inspected for completeness and correct order of issues. Title page, table of contents, index, supplements, and other loose pages shall be bound in the order in which they are received by the binder from the customer. Advertisements shall be left in place. Incomplete or defective volumes shall be returned to the customer or bound as is, in compliance with instructions from the customer.

6.4 Repair

All paper tears shall be repaired with transparent pressure-sensitive alkaline paper mending tape unless the customer and the binder make special arrangements for use of alternative mending materials or no repair.

6.5 Maps, Illustrations, and Folded Leaves

Steps shall be taken to preserve maps, illustrations, and folded leaves that are likely to be damaged when the spine of the text block is milled, the leaves sewn or glued, or the text block trimmed. Options include selecting a method of leaf attachment that requires as little of the binding margin as possible; setting the map or illustration out on a strip of reinforcing cloth or alkaline paper that is compatible with the weight of the map or illustration; constructing a cloth or alkaline paper pocket for the map or illustration; and/or leaving the text block untrimmed. Refolding of maps, inserts, or folded leaves to accommodate trimming or oversewing shall be avoided whenever possible. When a pocket is constructed for an insert that is thicker than 3/16 inch (4.76 mm), stubbing shall be added to the text block to compensate for the thickness of the pocket and its contents.

7. Attaching the Leaves

Specifications are set forth for the following methods for attaching the leaves of a volume:

- Recasing
- Sewing Through the Fold
- Double-Fan Adhesive Binding
- Oversewing
- Side Sewing

The customer may select a method of leaf attachment by preparing instructions for each volume or by providing the binder, in writing, guidelines that can be used by the binder to make decisions.

Where the customer has provided neither item-by-item instructions nor general guidelines for decision making, the binder shall use his or her best judgment in selecting an appropriate method of leaf attachment for each volume. The binder shall provide the customer, in writing, the decision-making guidelines that will be used in the absence of instructions from the customer.

7.1 Recasing

When text blocks are sewn through the fold, oversewn, or side sewn, and are intact (that is, when the original sewing thread is unbroken and the number of stitches is adequate for the size and weight of the text block) the sewing can be retained and the text block fitted with a new case.

7.1.1 Preparation

Old covers, adhesive, and spine lining shall be carefully and completely removed from the text block without damaging the sewing thread. The text block shall be inspected

after the spine is cleaned. If the original sewing is not sound, minor repairs shall be made, a different method of leaf attachment shall be selected, or the volume shall be returned to the customer, in compliance with instructions from the customer.

7.1.2 Attaching Endpapers

New endpapers shall be sewn to the text block using a method that is compatible with the original sewing structure; or, with permission from the customer, hinged on. For text blocks made up of signatures that are sewn through the fold, endpapers shall be attached by sewing through the folds of one or two outermost signatures of the text block, and then through the folds of the endpapers. For volumes that are oversewn or side sewn, the endpapers shall be whipstitched on with sewing stitches approximately 1 inch (25 mm) apart.

7.1.2.1 Endpaper Construction

Endpapers shall be constructed in one of the following ways:

- A single folded sheet with a hinge of reinforcing material that is adhered along the binding edge of the endpaper and extends beyond the fold.
- A single leaf hinged with reinforcing material to a single folded sheet.

7.2 Sewing Through the Fold

Sewing through the fold is a method of attaching separate signatures, one to another in succession, to create a text block. Signatures may be sewn through the fold by hand, using one needle and one thread; or by machine, using multiple needles and threads. A volume consisting of a single signature may also be sewn through the fold to secure the leaves and to attach them to endpapers.

7.2.1 Preparation

All staples shall be removed prior to sewing. All weak and damaged folds shall be reinforced or repaired with pressure-sensitive alkaline paper mending tape, unless the customer and the binder make special arrangements for use of alternative mending materials. Loose leaves or stiff inserts shall be hinged or tipped in. Sewing holes may be pre-punched or may be cut with a saw, provided that the saw cuts do not penetrate the margin on either side of the fold of the innermost folded sheet more than 1/8 inch (3 mm). When a volume is being resewn and original sewing holes exist, these should be used whenever possible.

7.2.1.1 Sewing Through the Fold by Hand

For an optimum combination of openability and durability, sewing tapes shall be used on all volumes sewn through the fold by hand. As a general rule, text blocks less than 8 inches (203 mm) in height shall be sewn on two tapes, those between 8 inches (203 mm) and 12 inches (305 mm) in height on three tapes, and those over 12 inches (305 mm) in height on four or more tapes. All sewing tapes shall extend at least one inch (25 mm) onto the endpapers. The kettle stitches shall be no closer than 1/4 inch (6 mm) and no farther than 1 inch (25 mm) from the head and tail of the text block after trimming. Sewing shall be all along except on volumes with many thin signatures, in which case sewing may be two-on for all but the first six and the last six signatures. When a text block consists of a single signature, it shall be sewn through the fold by hand using a sewing pattern based on the figure eight, with stitches no longer than 2 inches (50.8 mm).

7.2.1.2 Sewing Through the Fold by Machine

As many needles as possible shall be used. Stitches shall be no closer than 1/4 inch (6 mm), and no farther than 1-1/2 inch (38 mm) from the head and tail of the text block after trimming. When a text block consists of a single signature, it shall be sewn through the fold by machine using a lock stitch, with stitches approximately 1/2 inch (13 mm) long.

7.2.2 Attaching Endpapers

Endpapers shall be sewn onto text blocks as if the endpapers were the outermost signatures of the text block, front and back.

7.2.2.1 Endpaper Construction for Text Blocks Comprising Multiple Signatures

Endpapers shall be constructed in one of the following ways:

- A single folded sheet with a hinge of reinforcing material that is adhered along the binding edge of the endpaper and extends beyond the fold.
- A single leaf hinged with reinforcing material to a single folded sheet.
- Two folded sheets, nested. The fold of the sheet shall be reinforced with a 3/4 inch (19 mm) wide strip of reinforcing material.

7.2.2.2 Endpaper Construction for Text Blocks Comprising a Single Signature

Endpapers shall consist of two folded sheets. The fold of the outer sheet shall be reinforced with a 1-1/4 inch-wide (32 mm) strip of reinforcing material. The signature and the endpapers shall be sewn through the fold as a single unit.

7.3 Double-Fan Adhesive Binding

Double-fan adhesive binding is a method of adhering loose leaves together at the binding edge to create a text block. An emulsion copolymer of internally plasticized polyvinyl acetate adhesive (PVA) shall be used. The flexibility and surface finish of the paper as well as the thickness and weight of the text block must be taken into account when deciding whether to double-fan adhesive bind a volume. No text block more than 2 inches (50.8 mm) thick shall be double-fan adhesive bound.

7.3.1 Preparation

The spine of the text block shall be milled or trimmed, if necessary, to remove existing thread and/or adhesive and to free all leaves for fanning and gluing. To maximize the contact of paper to adhesive, as many paper fibers as possible shall be exposed. This is best achieved by notching the spine, which increases the surface area of the spine and thus its exposure to adhesive. While spine notching restricts openability, it enhances the strength of the binding. Notches shall be no deeper than 3/32 inch (2.38 mm), and in no case shall they cut into the text.

7.3.2 Attaching Endpapers

Endpapers shall be attached at the same time as the leaves, as if they were the outer-most leaves of the text block, front and back.

7.3.2.1 Endpaper Construction

Endpapers shall be constructed in one of the following ways:

- A single folded sheet.
- Two or three leaves. One leaf has a 1-1/4 inch (32 mm) wide extension of reinforcing material; a second leaf is tipped to the extension along the binding edge; a third leaf may be tipped to the second leaf.

7.3.3 Fanning and Gluing

The text block shall be securely clamped. The binding edge shall be fanned first in one direction, as adhesive is applied; and then in the opposite direction, as adhesive is applied. The penetration of adhesive between leaves shall be approximately 1/32 inch (.8 mm), so that each leaf is tipped to the next. No adhesive shall run between pages further than 1/8 inch (3 mm), and in no case shall it run into the text. If the spine is notched, all notches shall be completely filled with adhesive. The fanning of very stiff paper stock (e.g., the paper covers of some periodical issues) can cause an excessive amount of adhesive to run into the text.

7.3.4 Lining

A spine lining shall be applied squarely and adhered snugly to the spine of the text block. The lining shall extend to within 1/4 inch (6 mm) of the head and tail of the spine (after trimming), and extend squarely onto each endpaper at least 1 inch (25 mm). The text block shall be positioned squarely and allowed to dry without the use of a heater or other drying device.

7.4 Oversewing

Oversewing is a method of sewing thin sections (i.e., piles) of loose leaves, one to another in succession, to create a text block. This process can be done by hand or by machine. When done by machine, multiple needles and threads pass obliquely through the binding margin of each section, forming stitches that attach it to previously attached sections. When done by hand, the sections are whipstitched, one to another, using one needle and one thread. Medium- and large-size text blocks that are oversewn by hand shall be sewn onto tapes. For all oversewn volumes, a minimum binding margin of 5/8 inch (15.87 mm) after milling is desirable. When volumes have narrower margins, another method of leaf attachment shall be used if possible. If no other method is appropriate, volumes that have narrow margins may be oversewn on a machine that has been modified by adding a narrow sewing plate. Because this technique is less strong than regular oversewing, it shall be used only as a last option.

7.4.1 Preparation

The spine of the volume shall be milled or trimmed if necessary to free the leaves for sewing. No more than 1/8 inch (3 mm) of the binding margin shall be removed.

7.4.2 Attaching Endpapers

Endpapers shall be sewn onto the text block together with the outermost sections of the text block, front and back.

7.4.2.1 Endpaper Construction

Endpapers shall be constructed in one of the following ways:

- A single folded sheet tipped 1/4 inch (6 mm) from the edge of a single leaf to make three leaves. A 1-1/4 inch (32 mm) strip of reinforcing material shall be adhered along the binding edge of the folded sheet and the exposed 1/4 inch (6 mm) margin of the single leaf. After sewing, the outermost leaf shall be folded and tipped back flush and parallel to (but not extending beyond) the binding edge of the text block, to cover the sewing thread and to allow the endpaper to hinge from the binding edge.

- Two or three leaves. One leaf has a 1-1/4 inch (32 mm) wide extension of reinforcing material; the second leaf is tipped to the extension along the binding edge; a third leaf may be tipped to the second leaf. When this type of endpaper is used, boards shall be cut according to Section 12.3.2 of this standard.

7.4.3 Sewing

All volumes shall be divided into uniform sections approximately 1/16 inch (1.58 mm) thick, the thickness varying depending on the nature and condition of the paper. Sewing shall be no closer than 1/4 inch (6 mm), and no farther than 1 inch (25 mm) from the head and tail of the text block after trimming. The shuttle thread shall be coated with adhesive during sewing; or a thin line of paste shall be applied along the binding margin of the top sheet of each section prior to sewing. In no case shall the sewing stitches be closer to the text than 1/8 inch (3 mm).

7.5 Side Sewing

Side sewing is a method of attaching signatures or loose leaves together by sewing the entire text block, through the side along the binding margin, in a single pass. Sewing is done by machine. No text block more than 1/2 inch (13 mm) thick, or with a binding margin less than 3/4 inch (19 mm) wide, shall be side sewn.

7.5.1 Preparation

All staples shall be removed prior to side sewing.

7.5.2 Attaching the Endpapers

Endpapers shall be attached at the same time as the leaves, as if they were the outermost leaves of the text block, front and back.

7.5.2.1 Endpaper Construction

Endpapers shall be constructed as specified in Section 7.4.2 herein.

7.5.3 Sewing

A lock stitch shall be used. Stitches shall be approximately 1/2 inch (13 mm) long. The sewing shall be no farther from the head and tail of the text block than 1/2 inch (13 mm) after trimming, and shall be no farther in from the binding edge than 3/16 inch (4.76 mm).

8. Trimming the Text Block

Text blocks shall be trimmed squarely and as slightly as possible. (The spines of text blocks that are sewn through the fold shall be glued prior to trimming, as specified in Section 9 herein.) The trimmed edges shall be smooth and without rough knife marks. Excessive trimming of irregularly-sized issues for the purpose of making them uniform shall be avoided. The binder shall leave text blocks untrimmed when necessary to preserve text, marginal notes, illustrations, and the folds of maps and other inserts. Volumes that will be recased and that are already rounded and backed shall be left untrimmed. The customer may specify that certain other types of volumes, or all volumes, shall be left untrimmed to preserve their original size and appearance and to ensure that no information is inadvertently cut away by trimming. Note that when an irregularly shaped text block is left untrimmed, the case may have uneven squares. Also note that double-fan adhesive bound text blocks often have a squeeze-out of excess adhesive along the spine at the head and tail of the text block. If they are left untrimmed this adhesive will remain.

9. Gluing the Spine

Polyvinyl acetate adhesive shall be applied to the spines of all sewn text blocks (except for side sewn text blocks) prior to rounding and backing. The adhesive shall thoroughly coat the spine. After gluing, text blocks shall be stacked squarely and allowed to dry without the use of a heater or other drying device.

10. Spine Treatment

The spine of a volume may be rounded and backed or this step may be eliminated and the volume left flat-backed.

The binder shall provide the customer with written guidelines specifying when spines will be rounded and backed and when they will be left flat-backed, or the binder shall follow guidelines provided by the customer. In the absence of alternate written guidelines, the binder shall round and back all volumes except as follows:

- Text blocks sewn through the fold, with signatures thicker than 1/4 inch (6 mm) shall be rounded but not backed.
- Text blocks thinner than 1/2 inch (13 mm) that have very fragile paper, or that are being recased and have fragile sewing thread, shall not be rounded and backed.
- Where a text block has already been rounded and backed (a candidate for recasing for example) the rounding and backing shall be touched up by hand when possible.
- Text blocks that fall into a “flat-back” binding category (e.g., paperbacks), shall be handled according to guidelines that have been defined and agreed upon by the binder and the customer.

10.1 Rounding and Backing

Rounding and backing enhances the durability of bound volumes, especially those that are large or heavy (see Section 19.5.4). It also prevents the spines of some volumes from becoming concave.

10.1.1 Process

Text blocks shall be evenly rounded to form a smooth, convex spine and a concave fore edge; and shall be backed to form shoulders that are symmetrical, uniform from head to tail, and nearly equal in size to the anticipated board thickness. Rounding and backing may be done using a semiautomatic hydraulic machine, a roller backer, or by hand. Good results often require a combination of hand and machine processes.

10.2 Flat-Backed Text Blocks

Flat-backed text blocks are those for which the process of rounding and backing is omitted. Since rounding and backing is an involved step in the manufacture of a library binding, the elimination of this process may result in a lower-priced product.

11. Lining the Spine

The spines of all text blocks shall be lined with a spine lining material that meets specifications cited in Section 17.2 herein. The lining shall extend to within 1/2 inch (13 mm) of the head and the tail of the text block, and extend squarely onto each endpaper at least 1 inch (25 mm). The spines of all volumes over 1-1/2 inches (38 mm) thick that have been sewn through the fold or recased, and all other volumes over 2-1/2 inches (64 mm) thick, shall be reinforced with an additional layer of material. This reinforcement can be alkaline paper, no lighter than 60-pound (27.2 kg) text weight, cut to the height and width of the spine, or a second layer of spine lining cloth.

12. Making the Case

12.1 Cutting the Covering Material

Covering material shall be cut squarely, approximately 1-1/2 inches (38 mm) taller and wider than the anticipated size of the finished case. This allows for a 3/4 inch (19 mm) overhang on all four sides of the unfinished case and results in a turn-in of approximately 5/8 inch (15 mm), although turn-ins may be wider.

12.2 Lettering the Covering Material

Lettering shall be permanent, sharp, clean, legible, and stamped with adequate pressure, temperature, and dwell to ensure adhesion of the foil to the covering material.

Binders shall keep records of lettering patterns and color of stamping foil for serial titles so that uniformity of sets is maintained. Precise matching of lettering may not always be possible, since different binders use different equipment and different type faces.

12.3 Selecting and Cutting Boards

12.3.1 Narrow-Hinge Cases

Boards shall be cut squarely and smoothly, with the grain running parallel to the binding edge. The height of the boards shall be approximately 1/4 inch (6 mm) taller than the text block, unless the text block is to be bound flush with the bottom of the case, in which case the height of the boards shall be approximately 1/8 inch (3 mm) taller than the text block. The width of the boards for rounded and backed volumes shall be equal to the width of the text block from shoulder to fore edge. The thickness of the boards shall be between 0.06 inch (1.5 mm) and 0.125 inch (3 mm), and appropriate for the size and weight of the text block. For exceptionally large text blocks (e.g., newspapers) boards shall be no less than 0.125 inch (3 mm) thick. For heavy or large text blocks the boards shall be no less than 0.095 inch (2.4 mm) thick. For small or light text blocks the boards shall be no more than 0.08 inch (2 mm) thick.

12.3.2 Wide-Hinge Cases

The width of the boards for rounded and backed volumes shall be approximately 1/4 inch (6 mm) narrower than the width of the text block from shoulder to fore edge. The width of the boards for flat-backed volumes shall be approximately 3/8 inch (9 mm) narrower than the width of the text block. In all other respects selecting and cutting the boards shall meet the specifications cited in Section 12.3.1 herein.

12.4 Selecting and Cutting the Inlay

An inlay shall be used to reinforce the spine of the case. The inlay shall be cut squarely, and shall be the same width as the spine of the text block from shoulder to shoulder and the same height as the boards.

12.5 Assembling the Case

The boards and the inlay shall be squarely and securely adhered to the covering material. The spaces between the inlay and the boards shall be uniform and approximately 1/4 inch (6 mm) for narrow-hinge cases or 1/2 inch (13 mm) wide for wide-hinge cases. The inlay may be left plain; or a piece of cord approximately 1/8 inch (3 mm) in diameter or a piece of braid may be placed at the head and tail of the inlay. The corners of the cloth shall be left uncut so that library corners can be made; or corners shall be straight-cut or cut concave at a 45-degree angle so that traditional corners can be made. The covering material shall be turned in snugly and uniformly, approximately 5/8 inch (15 mm) on all sides, and shall adhere neatly and tightly to the edges of the boards.

12.6 Corners

12.6.1 Library Corners

Each of four uncut corners of the overhanging cover material shall be folded at a 45-degree angle and adhered onto the inside surface of the cover boards. The already glued-off overhang shall be turned in at the head and tail, fore edge, and back edge of the case.

12.6.2 Traditional Corners

The overhang of the cover material shall be cut away at a 45-degree angle at each corner of the case, approximately 1/8 inch (3 mm) beyond the corner of the cover boards. The already glued-off overhang shall be turned in at the head and tail of the case. Then, the small protruding tip or tit at each corner shall be nicked or tucked in prior to the turning in of the overhangs at the fore edge and back edge of the case.

13. Casing In

Text blocks shall be cased in squarely and tightly. All squares shall be uniform around the perimeter of the text block; and shall be between 1/16 inch (1.59 mm) and 3/16 inch (4.76 mm) wide. Very heavy or thick text blocks may be bound flush with the bottom of the case (that is, the case will have no square at the tail) in compliance with instructions from the customer. When text blocks are bound flush with the bottom of the case, the optional cord at the tail of the inlay shall be omitted.

Cased-in volumes shall either be pressed between metal-edged boards until thoroughly dry; or pressed in a building-in machine using sufficient pressure, dwell, and heat to ensure good adhesion of the endpapers to the boards and turn-ins, and good adhesion of the covering material to the spine lining and endpapers in the joint area of the text block. The amount of adhesive applied to the joints and the method used for building in shall be sufficient to ensure that joints are tight and secure and cannot be separated without damaging the bonded surfaces. Endpapers shall adhere to all surfaces smoothly and shall be free of wrinkles and bubbles.

14. Inspection

Each volume shall be inspected to ensure that the case and the edges of the text block are free from adhesives, workmanship is neat, instructions from the customer have been followed, and that there has been strict adherence to this standard.

Materials Specifications

15. Paper

15.1 Endpapers

15.1.1 Paper Composition

All endpapers shall be constructed of paper that meets *American National Standard for Information Sciences — Permanence of Paper for Printed Library Materials, ANSI/NISO Z39.48-1992,* or the latest edition of that standard.

15.1.2 Basis Weight

Five hundred (500) 25-inch x 38-inch (635 mm x 965 mm) sheets of the paper used to construct endpapers shall weigh 80 pounds (36 kg).

15.1.3 Mechanical Characteristics

The paper used to construct all endpapers shall meet or exceed the following specifications:

Test	Performance	Test #
Bursting Strength (Mullen)	60 lbs/ in^2 (27.21 kg/cm^2)	TAPPI T-403
Folding Endurance (MIT), with grain	400 double folds	TAPPI T-511
Folding Endurance (MIT), across grain	210 double folds	TAPPI T-511
Tensile Strength, with grain	40 lbs/ in^2 (18.14 kg/cm^2)	TAPPI T-404
Tensile Strength, across grain	25 lbs/ in^2 (11.34 kg/cm^2)	TAPPI T-404
Tear Resistance (Elmendorf), with grain	4.4 oz (125 grams)	TAPPI T-414
Tear Resistance (Elmendorf), across grain	5.1 oz (145 grams)	TAPPI T-414

15.2 Papers for Stubbing, Pockets, Additional Spine Lining Reinforcement, and Setting Out Inserts

Papers used for stubbing, pockets, additional spine lining reinforcement, and setting out inserts shall meet the specifications cited in Section 15.1.1. Papers shall be of a weight appropriate for the purposes they are meant to serve.

15.3 Inlays

Inlays shall be made from flexible, durable paper with the grain running parallel to the spine of the case. The paper shall be between .012 inch (.3 mm) and .030 inch (.76 mm) thick, and shall have a minimum pH of 6.5.

16. Cover Board

16.1 General Requirements

16.1.1 Surface
Cover board shall be free from surface lumps and reasonably smooth and flat; the usable portion of the sheet shall be reasonably free from all clip indentations and other mechanical imperfections.

16.1.2 Direction of Grain
Unless the direction of grain is otherwise specified by the customer, the grain shall run parallel with the binding edge.

16.1.3 Density
Individual sheets shall not weigh less than 0.02 ounce (0.51 gram) nor more than 0.035 ounce (1 gram) per cubic inch (per cubic centimeter).

16.1.4 Internal Bond
All board shall have adequate internal bond in order to resist delamination.

16.1.5 Moisture Content
Moisture content at time of shipment shall be not less than 4% nor more than 8% as tested according to test procedure SIB TAPPI T-412

16.2 Thickness, Bursting Strength, and Flexural Properties

The thickness, bursting strength, and flexural properties of cover board shall conform to the following requirements:

Table 1: Thickness, bursting strength, and flexural properties

Bursting			**Flexural Properties**			
Thickness, Nominal		Strength, Minimum	Breaking Load, Minimum		Deflection at Rupture, Minimum	
Inch (mm)	Points	lbs/sq inch (kg /cm ^{2})	Lengthwise pounds (kg)	Crosswise pounds (kg)	Lengthwise inch (mm)	Crosswise inch (mm)
0.058 (1.47)	58	235 (16.5)	2.1 (0.95)	1.6 (0.72)	0.22 (5.58)	0.34 (8.6)
0.065 (1.65)	65	255 (17.9)	2.5 (1.13)	1.9 (0.86)	0.22 (5.58)	0.34 (8.6)
0.070 (1.78)	70	275 (19.3)	2.8 (1.27)	2.1 (0.95)	0.22 (5.58)	0.34 (8.6)
0.075 (1.91)	75	295 (20.7)	3.3 (1.49)	2.4 (1.08)	0.22 (5.58)	0.34 (8.6)
0.080 (2.03)	80	315 (22.1)	3.8 (1.72)	2.8 (1.27)	0.22 (5.58)	0.34 (8.6)
0.088 (2.24)	88	350 (24.6)	4.4 (1.99)	3.3 (1.49)	0.22 (5.58)	0.34 (8.6)
0.098 (2.49)	98	385 (27.1)	5.1 (2.30)	3.8 (1.72)	0.22 (5.58)	0.34 (8.6)
0.110 (2.79)	110	425 (29.9)	5.6 (2.52)	4.3 (1.95)	0.22 (5.58)	0.34 (8.6)
0.120 (3.05)	120	450 (31.6)	6.0 (2.72)	4.7 (2.13)	0.22 (5.58)	0.34 (8.6)

16.2.1 Thickness Tolerance

The thickness tolerance of uncut sheets of board from the mill shall be plus or minus .03 inch (.76 mm) on boards up to and including 32 inches (813 mm) in the shorter dimension. A variation of 5 percent above or below the specified thickness is permitted on boards over 1/8 inch (3 mm) in thickness. On boards over 32 inches (813 mm) in the shorter dimension, an additional tolerance of 50 percent of the above amounts is allowed.

NOTE: See Appendix A for methods of sampling and testing cover board.

17. Reinforcing Material

17.1 Reinforcing Material for Endpapers

17.1.1 Reinforcing Material for Folded Endpapers

The performance of reinforcing material (commonly known as cambric) for folded endpapers shall meet or exceed the following specifications:

Test	Warp	Fill
Tensile Strength, lbs/inch (kg/cm)	58 (10.36)	45 (8.04)
Tear Resistance, oz (grams)	16.93 (480)	16.36 (464)

17.1.2 Reinforcing Material for Endpapers for Side Sewn Books

The performance of reinforcing material (commonly known as drill) for endpapers for side sewn books shall meet or exceed the following specifications:

Test	Warp	Fill
Tensile Strength, lbs/inch (kg/cm)	92 (16.43)	55 (9.82)
Tear Resistance, oz (grams)	23.98 (680)	27.51 (780)

17.2 Material for Lining the Spines of All Text Blocks

The performance of stretchable material for lining the spine shall meet or exceed the following specifications:

Test	Warp	Fill
Tensile Strength, lbs/inch (kg/cm)	75 (13.4)	27 (4.82)
Tear Resistance, oz (grams)	15.80 (448)	23.13 (656)

18. Covering Materials

18.1 Covering Materials

Covering materials shall be impregnated or coated with a nonmigratory resinous material and shall meet or exceed the following tests for Group F buckram as specified in ANSI Standard L29.1-1977, *Fabrics for Book Covers:*

Test	Performance	Test #
Abrasion Resistance	215 cycles	Test 5302
Breaking Strength	Warp: 120 lbs. (54.431 kg)	Test 5102
	Filling: 80 lbs. (36.287 kg)	
	Sum: 200 lbs. (90.719 kg)	
Colorfastness	Fair after 40 hours	Test 5660
Grease Resistance	No penetration in 5 minutes	
Tear Strength	Warp: 42.32 oz. (1200 grams)	Test 5132
	Filling: 42.32 oz. (1200 grams)	
Water Resistance	No penetration in 10 minutes	
Odor	Free of marked odor	

Endcap strength of covering materials as measured by the RIT Spine Pull Test must endure a minimum of 240 pounds of force without damage.

18.1.1 Exceptions

In compliance with instructions from the customer, text blocks weighing less than 2 pounds may be covered with material that is impregnated or coated with a nonmigratory resinous material; and that meets or exceeds the following tests for C-1 Grade book cloth, as described in ANSI Standard L29.1-1977, *Fabrics for Book Covers:*

Test	Performance	Test #
Abrasion Resistance	100 cycles	Test 5302
Breaking Strength	Warp: 64 lbs. (29.03 kg)	Test 5102
	Filling: 48 lbs. (21.77 kg)	
	Sum: 112 lbs. (50.8 kg)	
Colorfastness	Fair after 40 hours	Test 5660
Grease Resistance	No penetration in 5 minutes	
Tear Strength	Warp: 18.05 oz. (512 grams)	Test 5132
	Filling: 15.80 oz. (448 grams)	
Water Resistance	No penetration in 10 minutes	
Odor	Free of marked odor	

19. Adhesives

19.1 Adhesives for All Processes

Adhesives used for all processes shall be capable of forming a permanent bond between the surfaces to be joined. The adhesive force shall be such that the bonded materials cannot be separated without damaging them.

19.2 Adhesive for Double-Fan Adhesive Binding, Gluing the Spine, and Lining the Spine

Adhesive used for double-fan adhesive binding, gluing the spine, and lining the spine shall be an emulsion copolymer of internally plasticized polyvinyl acetate adhesive (PVA) that is flexible and that will not crosslink after long-term aging at normal room temperature, 68-77° F (20-25° C).

19.3 Adhesive for Making the Case

The adhesive used for making the case shall be a polyvinyl acetate emulsion adhesive (PVA) with good long-term aging characteristics.

19.4 Adhesive for Casing In

Text blocks shall be cased in using a polyvinyl acetate emulsion adhesive with good long-term aging characteristics. The adhesive shall be compatible with the adhesive used to make the case, to help ensure that the case adheres tightly and securely to the text block. Adhesion of the covering material to the spine lining and endpapers in the joint is critical.

19.5 Additional Requirements for Alternate Adhesives

For additional requirements for alternate adhesives to the PVAs specified for double-fan adhesive binding, gluing the spine, and lining the spine in Section 19.2, making the case in Section 19.3, and casing in in Section 19.4, see *Performance Measures for Library Binding,* Appendix A: Specifications for Test Volumes, for manufacturing specifications applicable to tests in 19.5.1 to 19.5.4.

19.5.1 Strength of Leaf Attachment

Volumes bound with adhesives other than the PVAs specified for double-fan adhesive binding in Section 19.2 must meet or exceed the following Page Pull performance specification:

Test	Book Specification	Performance
Page Pull Test after flexing	8-1/2" x 11" x 2" Volumes 60# coated paper	70 lbs (31.75 kg)

19.5.2 Openability

Volumes bound with adhesives other than the PVA's specified in Sections 19.2-19.4 must meet or exceed the following Openability performance specification:

Test	Book Specification	Performance
LTP Openability Test	8-1/2" x 11" x 2" Volumes 60# coated paper	7.9 inches (200.7 mm)

19.5.3 Joint Strength

Volumes bound with adhesives other than the PVAs specified in Sections 19.2-19.4 must meet or exceed the following Joint Strength performance specification:

Test	Book Specification	Performance
Joint Strength Test	8-1/2" x 11" x 2" Volumes 60# coated paper	50 lbs (22.5 kg)

19.5.4 Durability

Volumes bound with adhesives other than the PVAs specified in Sections 19.2-19.4 must meet or exceed the following Durability performance specification by withstanding the stated number of tumbles with no visible damage to the binding (i.e., condition 0).

Test	Book Specification	Performance
Tumble Test	Rounded and Backed 8-1/2" x 11" x 2" Volumes 60# coated paper	600 tumbles
Tumble Test	Flat-Backed 8-1/2" x 11" x 2" Volumes 60# coated paper	300 tumbles

20. Thread

20.1 Thread for Oversewing

Thread for oversewing shall be cotton, nylon, or cotton-covered polyester. Cotton thread shall meet or exceed Federal Specifications U-T 276H (October 1976); nylon thread shall meet or exceed Federal Specifications U-7 295D (February 3, 1977).

20.2 Thread for Sewing Through the Fold

Thread for sewing through the fold by machine shall be cotton, nylon, or cotton-covered polyester, and shall be of appropriate diameter to control swell. Breaking strength shall be no less than 3.4 pounds (1.542 kg). Threads of the same quality shall be used for sewing through the fold by hand, except that linen thread may also be used.

20.3 Thread for Side Sewing

Thread for side sewing shall be at least equal to cotton thread No. 14-4 cord. Breaking strength shall be no less than 3.4 pounds (1.542 kg).

21. Sewing Tapes

Sewing tapes shall be cotton or linen. They shall be no less than 1/2 inch (13 mm) wide and shall have no less than 104 warp threads per inch (41 warp threads per cm) and 32 filling threads per inch (12.6 filling threads per cm). The tensile strength of the warp threads shall be no less than 65 pounds (29.48 kg) as measured by the strip method; and of the filling threads, no less than 24 pounds (10.886 kg).

22. Lettering Foil

Lettering foil shall be legible during the life of the binding and shall perform as follows, when tested in environmental conditions as specified in Federal Test Method AA T CC 23-72:

Type of Exposure	Time	Minimum Requirement
158° F (70° C), Dry Heat	10 days	No change
158° F (70° C), Moist Heat	10 days	Moderate change
Oxygen	4 days	Very slight change
Ozone, 50 PPHM, 100° F (38° C)	4 days	No change
Hydrogen Sulfide Gas	2 hours	No change
Fade-Ometer	40 hours	Satisfactory
Oxides of Nitrogen	3 cycles	3.0

23. Exceptions

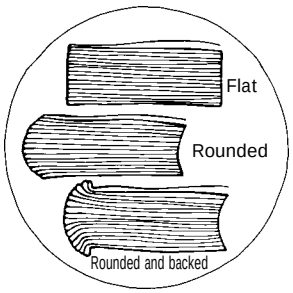
Should a new material be developed that meets or exceeds the performance specifications cited in the Materials Specifications Sections 15–22 herein, that new material may be substituted if the procedures cited in Section 4 herein are followed.

Glossary

Alkaline buffered paper
Paper containing an alkaline compound (calcium carbonate, for example) at a level sufficient to neutralize acid that might, in the future, be generated through aging of the paper or from atmospheric pollution.

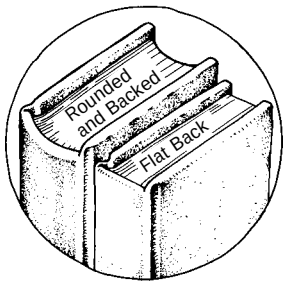
All along
Refers to a method of sewing signatures through the fold by hand. Sewing thread travels in and out of the fold of one signature, from kettle stitch to kettle stitch, then passes to the next signature and travels in and out of the fold from kettle stitch to kettle stitch; so that each pass of thread along the length of the spine attaches one signature to the text block. When sewing "two-on," the thread travels in and out of the fold of one signature, then in and out of the fold of another, alternating from one signature to the other as it passes from kettle stitch to kettle stitch, so that each pass of thread along the length of the spine attaches two signatures to the text block. Sewing all along is the stronger method and should be used unless the text block has many thin signatures, in which case sewing all along would result in an excessive buildup of thread in the spine. Library binders must sew two-on only in rare cases.

Artifactual value
Importance or worth as a physical object. Often artifactual value is obvious (the manuscripts of a well-known poet are artifacts), but sometimes it is less so. A plain volume may be among the first manufactured by machine in the 1820s in England, for example; may have a signed, early machine-stamped binding, important hand binding, or hand-colored illustrations; or may be a first edition or special edition of an important work. Anything that is done to change such artifacts reduces their value.



Back/Backing

Back/Backing
The process of dispersing the swelling of the spine of a rounded text block and shaping it into a shoulder on each side of the spine of a text block. Backing accommodates the thickness of the boards, and provides a hinge along which they can swing freely. Backing also helps to prevent the spine of the text block from collapsing into a concave shape over time. (See also Flat back, and Round/Rounding.)



Flat back

Binding edge
The edge of a text block along which the leaves of a text block are attached by sewing, adhesive binding, or another method.

Binding margin (inner margin, gutter margin, back margin)
The distance between the binding edge of a printed page and the printed area.

Book block
The text block plus the endpapers and other materials added by the binder before casing in to a hard cover.

Building-in machine
A hydraulic or pneumatic machine used to duplicate the action of a hand book press. The cased-in text block is placed between the platens of the machine which then close and exert great pressure. Heated jaws compress the case along its hinges to form tight front and back joints.

Case
A book cover consisting of two boards and an inlay covered with paper, cloth, or some other covering material. The case is made separately from the text block and is later attached to it in a step called casing in. A cased-in book is often referred to as a hard cover book. (See Appendix B.)

Casing in
The process of applying adhesive to the outside endpapers of a text block and fitting the text block into its case.

Cloth/Clothbound
The fabric used for book covers; a term used indiscriminately for any clothbound volume.

Collation
In library binding, the process of checking books and periodicals for completeness, physical characteristics, margin width, condition of paper, and overall suitability for binding. Also, preparation and arrangement of material in proper sequence for binding.

Flat back (square back)
A text block that has not been rounded and backed. (See illustration for Back/Backing.)

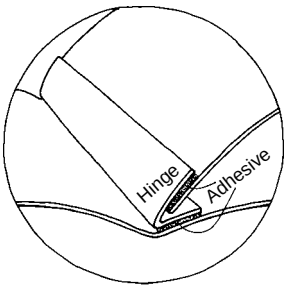
Fore edge
The edge of a leaf or a board opposite from, and parallel to, its binding edge (i.e., opposite from its spine edge). Fore edge is also used in a more general way to refer to any part of a volume opposite from, and parallel to, its spine. (See Appendix B.)

Grain direction
The direction in which the majority of the fibers in a piece of paper or board are aligned; and the direction in which the warp threads run in cloth. Grain direction in all man-made materials used in bookbinding should run parallel to the spine of a volume.

Guard
A thin strip of cloth or paper used as a hinge for a map, illustration, or a single sheet.

Hard cover
The cover of a book produced from a flexible material, usually cloth or paper supported by rigid boards.

Head
The top edge of a leaf, board, or bound volume, opposite from the surface on which the volume rests when it is shelved upright. (See Appendix B.)

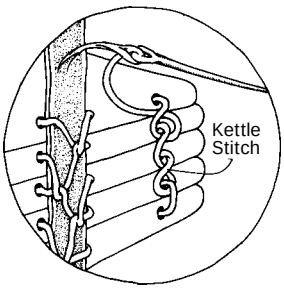


Hinge in

Hinge in
Adhering a paper or cloth strip along the binding edge of a leaf or group of leaves that are attached to one another so that the strip extends beyond the binding edge. This assembly can be "hinged" into a text block by pasting up the part of the paper or cloth strip that extends beyond the leaf (or leaves), and adhering the strip to the binding edge of a leaf in the text block.

Inlay (back strip)
A heavy weight but flexible paper strip used to stiffen the spine of a case, centrally placed between two cover boards.

Joint
The grooves that run head to tail on the outside of the case, front and back, along which the boards hinge when they open. (See Appendix B.)



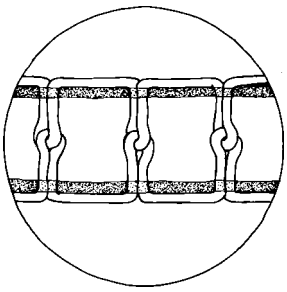
Kettle stitch

Kettle stitch
A stitch closest to the head and tail of each signature of a text block that has been sewn through the fold by hand. Kettle stitches lock the sewing thread after each complete pass of the thread along the spine of the text block, and link each signature to the one sewn on previously.

Leaf
A single sheet of paper, or one half of a folded sheet of paper. Each side of the leaf is a page. Leaves can be printed or blank.

Leaf attachment
The means by which the leaves of a text block are attached, one to another. Leaves are most often attached along their binding edges by means of thread, adhesive, or staples. The latter method of leaf attachment does not comply with the ANSI/NISO/LBI Standard for Library Binding.

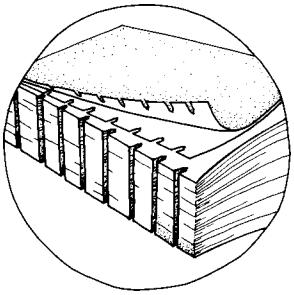
Lining (super, mull, crash, and gauze)
Cotton, muslin, gauze, crash, paper and other materials used to reinforce spines of library bound books. Lining provides the means for a firm connection between text block and cover and gives shape and firmness to the binding.



Lock stitch

Lock stitch
A stitch formed by a primary thread that runs along the top surface of the text block being sewn; and a bobbin thread that runs along the bottom surface, and locks with the top thread at regular intervals. Lock stitches are the type made by household sewing machines, although the machines used by library binders are often larger.

Mill
To cut away on a milling machine to prepare spines of books for double-fan adhesive binding or oversewing. The machine clamps the text block, spine down, and moves it over a series of rotating blades that cut away approximately 1/8 inch (3 mm) of the binding margin, thus removing old adhesive, thread, staples, and/or folds of signatures. After milling, a text block consists of loose leaves.



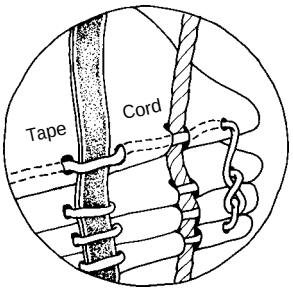
Notch/Notching

Notch/Notching
Parallel grooves cut into the spine perpendicular to the binding edge. Notching increases the amount of surface area on the spine that comes in contact with the adhesive and increases the strength of double-fan adhesive bindings. Spines of text blocks can be notched by machine prior to double-fan adhesive binding.

Overhang
Covering material that extends beyond the edges of the boards and inlay before turning in. The overhang becomes the turn-in.

Round/Rounding
The mechanical or manual manipulation of the spine of a text block into a convex shape (and the consequent manipulation of the fore edge into a concave shape). Rounding usually precedes backing. Rounding and backing help distribute the swell that naturally occurs with sewing and adhesive binding. (See illustration and definition for Back/Backing.)

Sewing on sawn-in cords
Hand-sewing of signatures through the fold onto sawn-in cords. Saw cuts are first made across the spine of the text block, perpendicular to the binding edge. These saw cuts then become the sewing holes through which the threaded needle passes on its way in and out of the fold of each signature. Cords are set into the saw cuts perpendicular to the spine, so that the sewing thread passes over the cords as it runs from kettle stitch to kettle stitch. The cords link the signature, one to another, across the spine.



Sewing on sawn-in cords and Sewing on tapes

Sewing on tapes
Hand-sewing of signatures through the fold onto cloth tapes. Holes can be punched through the folds of each signature; or saw cuts can be made across the spine of the text block, perpendicular to the binding edge, to create holes through which the sewing needle can pass. Signatures are sewn onto tapes by passing the sewing needle into the signature, through the fold, at the kettle stitch; out and around a tape; and back into the signature, through the fold. This process is repeated along the length of the signature—the number of times depending on the number of tapes used. The tapes link the signatures, one to another, across the spine.

Shoulder (joint, ridge, flange)
The shoulder is formed when a text block is backed. During this process the outermost leaves on each side of the text block are bent outward at a 45-degree angle along the binding edge to accommodate the boards and to allow them to hinge freely. The ridge that is thus formed on either side of the spine is the shoulder. (See Appendix B.)

Signature (section or gathering)
A signature consists of a sheet of paper folded one, two, three, or four (and rarely five) times to make a section. Signatures are commonly eight, sixteen, or thirty-two pages.

Spine (backbone)
The surface of a volume that usually faces outward when a book sits on a shelf; that is, the surface opposite the fore edge. It is the part of a bound text block between the two cover boards on which the lettering appears. (See Appendix B.)

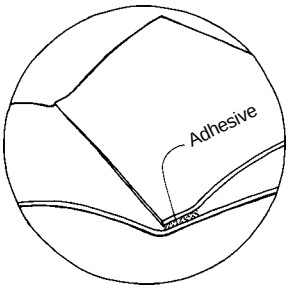
Spine lettering pattern
The arrangement of letters, numbers, and punctuation on the spine of a case. The color of stamping foil is also part of the lettering pattern.

Squares
The edges of the case that extend beyond the text block at the head, tail, and fore edge, and protect it. (See Appendix B.)

Surface finish
The quality of the surface of a sheet of paper. Paper can be rough or smooth, absorbent or repellent, shiny or dull.

Tail
The bottom edge of a leaf, board, or bound volume; that is, the surface on which a volume rests when shelved upright. (See Appendix B.)

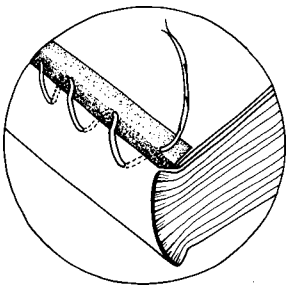
Text block
A gathering of printed or written leaves that may be or have been bound, excluding all paper to be added by the bookbinder such as the endpapers. (See Appendix B.)



Tip in

Tip in
A thin line of adhesive applied along the edge of a leaf (usually along the binding edge), with the leaf tipped onto another leaf (usually at the binding edge). The openability of a tipped-in leaf is somewhat restricted.

Turn in
That part of the covering material that is turned over the outer edges of the boards and inlay, and onto their inner surfaces, in the process of making a case. The turn-in protects the boards and inlay from delamination and wear. Most of the turn-in will be covered by the paste-down after casing-in. (See Appendix B.)



Whipstitch

Whipstitch (overcasting)
Stitching through holes usually punched along the binding edge of a text block. Sewing thread passes into the top and out the bottom of each hole in succession to attach the leaves. Library binders whipstitch new endpapers to oversewn and side sewn text blocks in preparation for recasing.

APPENDIX A

Methods of Sampling and Testing Cover Board

(This appendix is not part of the American National Standard for Library Binding, ANSI/NISO/LBI Z39.78-2000. It is included for information only.)

1.1 Sampling for Tests

The test sample used for making thickness, density, and bursting strength determinations shall consist of ten specimens cut 10 inches x 10 inches (254 mm x 254 mm), each specimen being cut from a different board. Where a delivery consists of less than 30 bundles, not less than three bundles shall be sampled. On all deliveries of 30 bundles or more, at least 10% of the bundles shall be sampled, except where a delivery consists of more than 100 bundles, in which event 10 bundles shall be sampled.

1.2 Control Testing

For ordinary control testing, the prevailing temperature and humidity conditions are satisfactory. In controversial cases, the specimens shall be tested at 70° F (21° C) and at 50% to 65% relative humidity after being exposed to this condition for 72 hours. Such tests may be made in any accredited commercial testing laboratory satisfactory to both buyer and seller.

1.3 Thickness

Twenty readings shall be made, two on each of the ten test specimens cut 10 inches x 10 inches (254 mm x 254 mm). Each of the twenty individual readings shall not vary over 0.03 inch (0.76 mm) above or below the designated nominal thickness. In test reports, thickness shall be expressed in decimal parts of an inch.

1.4 Density

The density is computed from the thickness and the weight per unit area. The latter is determined by measuring the dimensions of each of the ten specimens used for the thickness determination to an accuracy of 0.1 inch (2.5 mm), and weighing each specimen separately in grams. The density is computed according to the following formula:

$$\text{Density (Grams per cubic centimeter)} = \frac{\text{Weight of one test specimen in grams}}{\text{Area of test specimen in square inches} \times \text{Thickness of test specimen in decimal parts of an inch} \times 16.39}$$

The density of each of the individual test specimens shall fall between the limits prescribed for minimum-maximum density cited in Section 16.1.3.

1.5 Bursting Strength

In determining the bursting strength, twenty bursts shall be made, one on each side of the ten test specimens. The average of the twenty bursts shall be reported as the average bursting strength. The average bursting strength shall not be lower than the figures given under specific requirements for the designated nominal thickness. See Table 1, in Section 16.2.

1.6 Flexural Properties

The flexural properties shall be determined with a tensile testing machine, using an attachment by means of which a load is applied with the loading clamp to the specimen at midspan between two parallel supports 3 inches (76 mm) apart suspended from the upper clamp of the tester. The ends of the test specimen shall be equidistant from the supports. The load is applied to the board at the rate of 12 inches (305 mm) per minute. The load in pounds required to break the specimen is recorded as breaking load and the deflection in inches at rupture is recorded as deflection rupture (a recording device should be provided for convenience in measuring deflection).

Ten test specimens, 1 inch x 5 inches (25 mm x 127 mm), shall be cut in each direction of the board and tested for flexural properties. Two results shall be reported for breaking load: the average of the 10 tests on samples cut lengthwise, and the average of 10 tests of samples cut crosswise. These averages shall not fall below the corresponding figures for breaking load given in Table 1 for the designated nominal thickness. Two results shall be reported for deflection at rupture: the average of the 10 tests on samples cut lengthwise, and the average of the 10 tests of samples cut crosswise. These averages shall not fall below the corresponding figures for deflection at rupture given in Table 1 for the designated nominal thickness.

APPENDIX B

Parts of a Bound Volume

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