



READ@HOME

GUIDANCE NOTE Technical Specifications for the Production of Reading Books

Christophe Barth

© 2021 International Bank for Reconstruction and Development / The World Bank
1818 H Street NW, Washington, DC 20433
Telephone: 202-473-1000; Internet: www.worldbank.org
Some rights reserved.

This work is a product of the staff of The World Bank with external contributions. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of The World Bank, its Board of Executive Directors, or the governments they represent. The World Bank does not guarantee the accuracy of the information included in this work.

Nothing herein shall constitute or be considered to be a limitation upon or waiver of the privileges and immunities of The World Bank, all of which are specifically reserved.

Rights and Permissions



This work is available under the Creative Commons Attribution 4.0 IGO license (CC BY 4.0 IGO) <https://creativecommons.org/licenses/by/4.0/>, with the following mandatory and binding addition:

Any and all disputes arising under this License that cannot be settled amicably shall be submitted to mediation in accordance with the WIPO Mediation Rules in effect at the time the work was published. If the request for mediation is not resolved within forty-five (45) days of the request, either You or the Licensor may, pursuant to a notice of arbitration communicated by reasonable means to the other party refer the dispute to final and binding arbitration to be conducted in accordance with UNCITRAL Arbitration Rules as then in force. The arbitral tribunal shall consist of a sole arbitrator and the language of the proceedings shall be English unless otherwise agreed. The place of arbitration shall be where the Licensor has its headquarters. The arbitral proceedings shall be conducted remotely (e.g., via telephone conference or written submissions) whenever practicable, or held at the World Bank headquarters in Washington, DC.

Attribution – Please cite the work as follows: World Bank (2021). Read@Home: Guidance Note. Technical Specifications for the Production of Reading Books. Washington, DC: The World Bank.

Translations – If you create a translation of this work, please add the following disclaimer along with the attribution: This translation was not created by The World Bank and should not be considered an official World Bank translation. The World Bank shall not be liable for any content or error in this translation.

Adaptations – If you create an adaptation of this work, please add the following disclaimer along with the attribution: This is an adaptation of an original work by The World Bank. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by The World Bank.

Third-party content – The World Bank does not necessarily own each component of the content contained within the work. The World Bank therefore does not warrant that the use of any third party-owned individual component or part contained in the work will not infringe on the rights of those third parties. The risk of claims resulting from such infringement rests solely with you. If you wish to reuse a component of the work, it is your responsibility to determine whether permission is needed for that reuse and to obtain permission from the copyright owner. Examples of components can include, but are not limited to, tables, figures, or images.

All queries on rights and licenses should be addressed to Marcela Gutierrez, The World Bank Group, 1818 H Street NW, Washington, DC 20433, USA; e-mail: mgutierrezb@worldbankgroup.org



Supported with funding from the Global Partnership for Education

This note is part of a series being prepared by the Read@Home team to support World Bank teams as they procure teaching and learning materials (textbooks, teacher's guides, and supplementary reading materials). For more information, contact co-TTLs Amanda Devercelli (adevercelli@worldbank.org) and Peter Holland (pholland@worldbank.org).

To access additional resources, follow this link: <https://www.worldbank.org/en/topic/education/brief/read-at-home>



CONTENTS

Acronyms and Abbreviations	4
Background	5
Technical Specifications	6
Paper Specifications	7
Printing Specifications	12
Binding Specifications	17
Packaging	21
Standards and Certifications	22
Conclusion	24
Annexes	25
Image References	44



ACRONYMS AND ABBREVIATIONS

C1S	Coated on One Side
C2S	Coated on Two Sides
CIE	International Commission on Illumination
EMAS	Eco Management and Audit Scheme
FSC	Forest Stewardship Council
GSM	Grams per Square Meter
ISO	International Organization for Standardization
PEFC	Programme for the Endorsement of Forest Certification
TAPPI	Technical Association of Pulp and Paper Industry
UV	Ultraviolet
CMYK	Cyan, Magenta, Yellow, Black
RGB	Red, Green, Blue
PUR	PolyUrethane Reactive
VOC	Volatile Organic Compounds
ECF	Elemental Chlorine Free
TCF	Totally Chlorine Free





1. BACKGROUND

Education projects funded by The World Bank procure textbooks and other teaching and learning materials through national and international tenders (bids). Documents for the tenders describe the purposes of the procurement, the qualification requirements for potential bidders, and the technical specifications of the education materials to be procured.

The technical specifications provided in a tender significantly impact the cost and quality of the books to be procured and the success of the procurement overall. Precise, complete, and detailed technical specifications must be determined in advance to avoid delays and increase transparency.

This guide explains standard technical specifications for the most common types of textbooks and teaching and learning materials. Use of these standard specifications will increase cost-effectiveness, efficiency, transparency, and comparability of prices. The guide is meant to be used in conjunction with the Read@Home guides to using the World Bank Bidding Document for Books and the Production of Reading Books, both of which can be accessed at:

<https://www.worldbank.org/en/topic/education/brief/read-at-home>

The recommended technical specifications for thirteen kinds of books that are commonly purchased in World Bank projects can be found in Annexes 1 to 13.



2. TECHNICAL SPECIFICATIONS

For optimal book procurement, tender documents must include correct and detailed technical specifications, which depend on the planned use of each type of book and the desired durability of each type of book, as well as the location and circumstances where each type of book will be used.

The location and circumstances where books are to be used and stored determine their lifespan. For example, in lower income countries, books tend to have a shorter lifespan, due for example to high humidity during the rainy season and/or a lack of well-equipped storage facilities. On top of this, not every child owns a backpack or other school bag to bring their books to and from school in all kinds of weather, and therefore they cannot protect their books from the rain, the sun, and the dust.

Technical specifications such as paper type and binding methods also affect book durability. Some binding methods are stronger than others but can be more expensive. It is therefore important that the technical specifications are selected to match the desired the life expectancy and planned usage of the book.

Technical specifications **must** include:

- Paper specifications (paper type, coating, paper brightness, whiteness, opacity and weight)
- Printing specifications (book size, page count, colour, cover protection)
- Binding specifications (types of binding)
- Packaging description
- Standards and certifications: CIE (International Commission of Illumination), ISO (International Organisation for Standardisation) brightness, ISO opacity, PEFC (Program of Endorsement of Forest Certification), FSC(Forest Stewardship Council).

3. PAPER SPECIFICATIONS

Paper is of great importance in book production. It accounts for 50% to 70% of book costs and the type of paper selected directly impacts book durability. Paper is classified based on the type of pulp used to make it; the brightness, opacity, whiteness, and weight of the paper; and the type of coating (for coated papers). These parameters are described in detail below.

A. TYPES OF PAPER

Paper is made from pulp, which is derived from wood and other plant materials through a process called pulping. The main types of paper are wood/mechanical, chemical/wood free, and recycled.

- **Wood or mechanical paper** is produced by grinding wood between metal plates, separating the wood into individual fibres and keeping the lignin in the pulp. Lignin is a structural element in wood which makes paper turn yellow when exposed to sunlight.
 - **Recommendation:** Mechanical/wood paper should be used for books/materials that will be used for less than a year, such as newsprint, paperboard, workbooks, and notebooks.
- **Chemical or Woodfree paper** is not wood free. It is produced by dissolving the lignin in the wood pulp using chemicals. In this process, cellulose remains in the pulp, but the lignin is removed to avoid paper yellowing. The process of making chemical or woodfree paper is more expensive, but results in paper that does not yellow over time.
 - **Recommendation:** Woodfree paper should be used to make books that need to be more durable, such as textbooks, reading books, read aloud books, big books, library books, and teacher guides.
- **Recycled paper** is produced from used scrap paper which is then processed with chemicals to remove ink and other unwanted elements. The pulp is then whitened using a bleaching chemical. During the recycling process, fibres are weakened and shortened, thus decreasing the durability of recycled paper. Production of this paper is environmentally friendly as it reduces the pressure on forests and requires less water.
 - **Recommendation:** Recycled paper is recommended for workbooks, textbooks, and household products such as tissues and paper towels.
- **Bulky paper** is a recent innovation by paper manufacturers. It has been developed over the last five years as an alternative to the Uncoated Woodfree offset paper that is frequently used for book printing. Bulky paper is a mechanically smoothed paper with a high wood fibers content (mechanical pulp). It is light and thick. It is mainly used to print trade books and textbooks.

The most notable characteristic of bulky paper is the ratio between the weight and the thickness of the paper. This is called bulk¹ or volume. On average, the thickness of a sheet of bulky paper is 1.5 times higher than Uncoated Woodfree paper of the same weight. This unique feature reduces paper costs and transport costs, which are the main cost drivers of books.

Another important characteristic of bulky paper is its rough surface. It is therefore particularly suitable for printing text and images in colour and for workbooks.

As an example, a textbook printed with 80g Woodfree paper will have the same thickness as a book printed with 55g bulky paper but book costs will be up to 25% lower and delivery costs will be reduced by as much as 30%.²

In countries where the expected durability of textbooks is less than 18 months due to inappropriate storage, Woodfree Uncoated paper should be replaced by mechanical, recycled or bulky paper to reduce book costs and allow for regular replacement.

B. COATING

Paper can be coated by covering it with a substance to impart the desired finish and/or texture. Coating improves papers' printability, and enhances its whiteness, opacity, and glossiness. In addition, it ensures a smoother feel while improving the sharpness of illustrated images.

- **Coated Paper:** Images have a better printing result on coated paper, as the ink is not absorbed into the paper. Paper can be coated using matte, silk or gloss finishes. Matte coated paper does not shine, as no light reflects off the paper, so this paper is best for books that have a lot of text. Silk finish has a bit more shine than matte. It provides a polished look without the mirror effect that gloss coating can have. Gloss coating has a lot of shine and will make images stand out; therefore it is mostly used for books that contain a lot of pictures.
- **Uncoated paper** has a rougher feel and is typically used when content consists mainly of text or large illustrations, as the quality of detailed images on uncoated paper tends to be lower.

Coated paper has a lower volume per unit weight (bulk) than uncoated paper, because the paper is compressed when applying the coating. Lowering paper volume makes it less expensive to ship, as it takes up less space. The average coated paper's volume per unit weight is 0.8 cm³/g to 1 cm³/g, while that of uncoated paper is 1.2 cm³/g to 1.4 cm³/g. A 40 foot container can carry on average 70,000 books printed on uncoated paper and 100,000 books printed on coated paper.

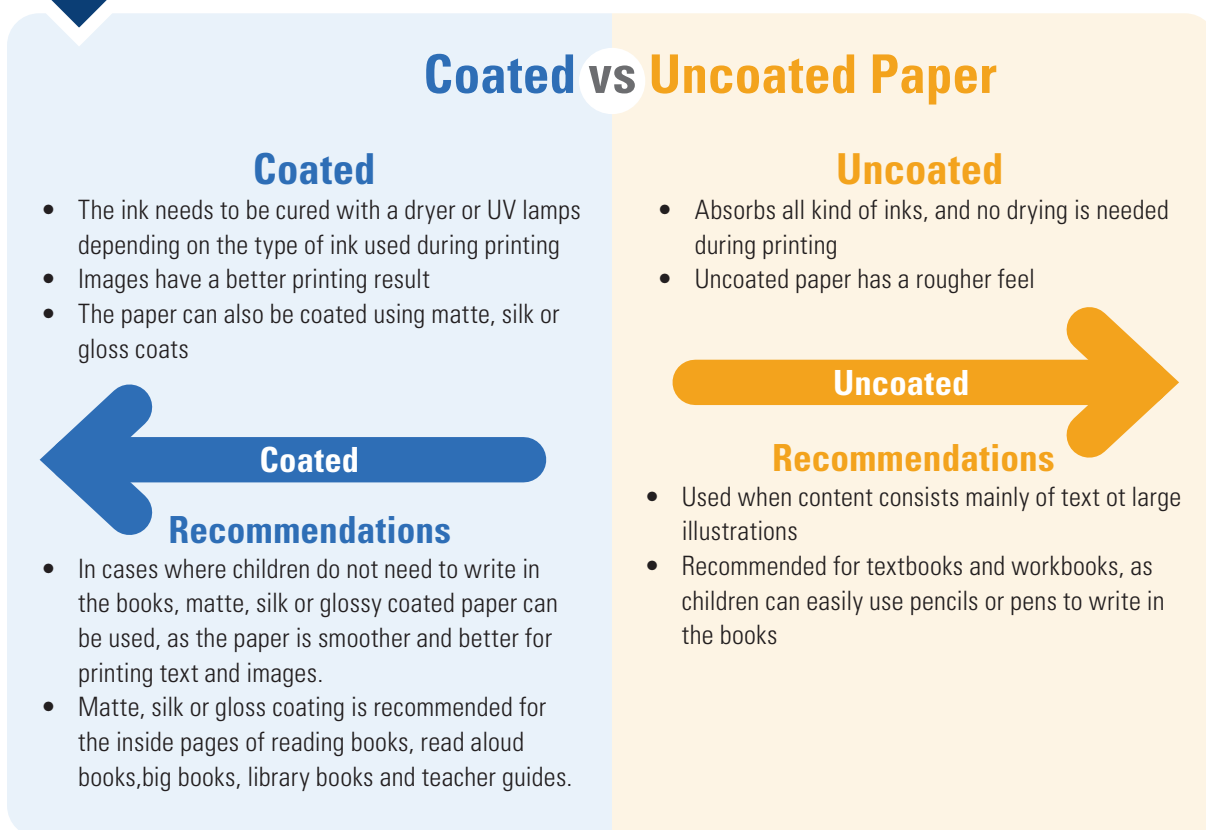
1 Bulk is the ratio of paper thickness to its weight in cubic centimetres per gram.

2 <https://bluetree-group.com/can-bulky-paper-reduce-the-costs-of-reading-materials/>

- **Recommendations:** Uncoated paper is recommended for workbooks, as children can easily use pencils or pens to write in the books. In cases where children do not need to write in the books, matte, silk or glossy coated paper can be used, as the paper is smoother and better for printing text and images. Matte, gloss or silk coating is recommended for the interior pages of reading books, read aloud books, big books, library books and teacher guides.

Figure 1

RECOMMENDATIONS FOR COATED VS. UNCOATED PAPER



C. PAPER OPACITY, BRIGHTNESS, AND WHITENESS

The value of paper is based upon its performance as well as its visual appeal, which is affected by opacity, brightness, and whiteness. Increasing the opacity, brightness, and whiteness of paper increases its production costs, as extra steps need to be taken during the production process.

- **Opacity (Transparency):** Paper that has a high degree of opacity does not let much light pass through it, while paper that has a low degree of opacity is more translucent.³ A paper's opacity determines the extent to which printing on one side of the paper will be visible from the reverse side. The International Organization for Standardization (ISO) define industry standards for measuring opacity through ISO standard 2471.

³ <https://www.spatechnicaladviser.com/e-books-pdf/5-INRODUCTION-TO-PRINTING.pdf>

- **Recommendation:** Use paper with a minimum of 90% opacity for book covers. For inside pages, recommended opacity varies from 90% to 95%, depending on the weight of the paper and the desired durability of the book.
- **Brightness:** Brightness is the amount of light reflected from the surface of paper. The Technical Association of Pulp and Paper industry (TAPPI) and the International Organization for Standardization (ISO) define industry standards for measuring brightness through TAPPI standard T452 and ISO standard 2470-1 and 2470-2.
 - **Recommendation:** For cover paper, overall brightness can be lower than for interior pages. Extensive color is usually used on book covers to make them more attractive to children and so brightness does not need to be higher than 90%. Brightness is more important for inside pages, where it will increase the readability of graphics and text. Books that should have a longer durability like reading books and read-aloud books should use especially bright paper, as this increases their readability. For inside paper the recommended brightness is minimum 80%.
- **Whiteness:** The International Commission on Illumination (CIE) measures whiteness.
 - **Recommendation:** The whiteness of paper is more important for books that include images and are expected to have a long lifespan. So, the recommended whiteness for read aloud books and reading books should be above 115% and higher than 90% for workbooks, teacher guides and student textbooks.

D. PAPER WEIGHT

Paper weight is measured in grams per square metres (gsm) of a sheet of paper. Cover paper needs to have a higher gsm, as its function is to protect interior pages.

- **Recommendation:** Cover paper gsm can vary from 300 gsm for read-aloud books to 160 gsm for workbooks and reading books. Higher gsm results in a higher expected lifespan for the book. Inside paper can be a lower gsm, as the interior pages will be protected by the book's cover. 70 gsm is recommended for workbooks, 80 gsm paper for textbooks, reading books, and teacher guides and 170 gsm for read aloud books. The inside paper weight can be further reduced to 50 gsm by using bulky paper (see p. 8) with a minimum bulk of 2.0.
 - Example of a paper technical specification table (additional paper specification examples are available in Annex 14):

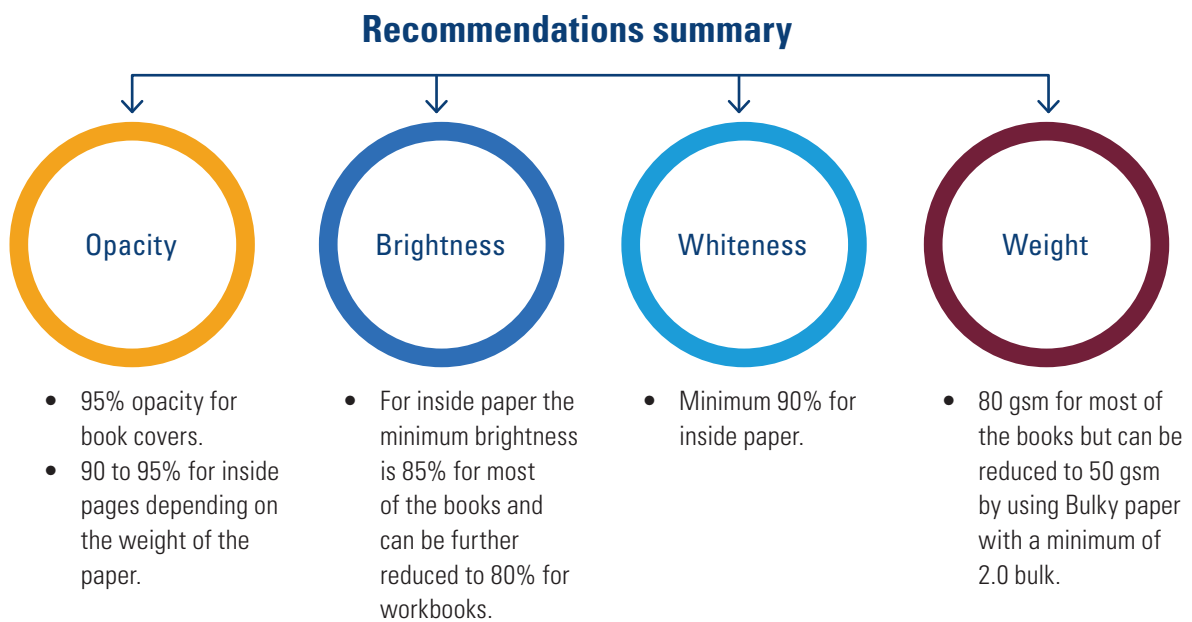
Table 1

TECHNICAL TARGET VALUE UPM FINE⁴

Basis Weight (ISO 536) (g/m ²)	60.0	70.0	80.0	90.0	100.0
Thickness (ISO 534) (µm)	75.0	88.0	100.0	113.0	125.0
Bulk (ISO 534) (cm ³ /g)	1.25	1.25	1.25	1.25	1.25
Brightness D65 (ISO 2470-2) (%)	105.0	105.0	105.0	105.0	105.0
CIE Whiteness (ISO 11475:2017) (%)	150.0	150.0	150.0	150.0	150.0
L-value D65 (D65/10°) (ISO 5631-2)	93.9	93.9	93.9	93.9	93.9
a-value D65 (D65/10°) (ISO 5631-2)	3.9	3.9	3.9	3.9	3.9
b-value D65 (D65/10°) (ISO 5631-2)	-14.0	-14.0	-14.0	-14.0	-14.0
Opacity ISO (2471) (%)	87.0	90.0	92.5	94.5	95.5
Roughness Bendtsen (ISO 8791-2) (ml/min)	200.0	250.0	250.0	250.0	250.0

Figure 2

RECOMMENDATION SUMMARY



4 <https://www.upmpaper.com/products/paper-catalogue/?Region=235633&Category=230578>

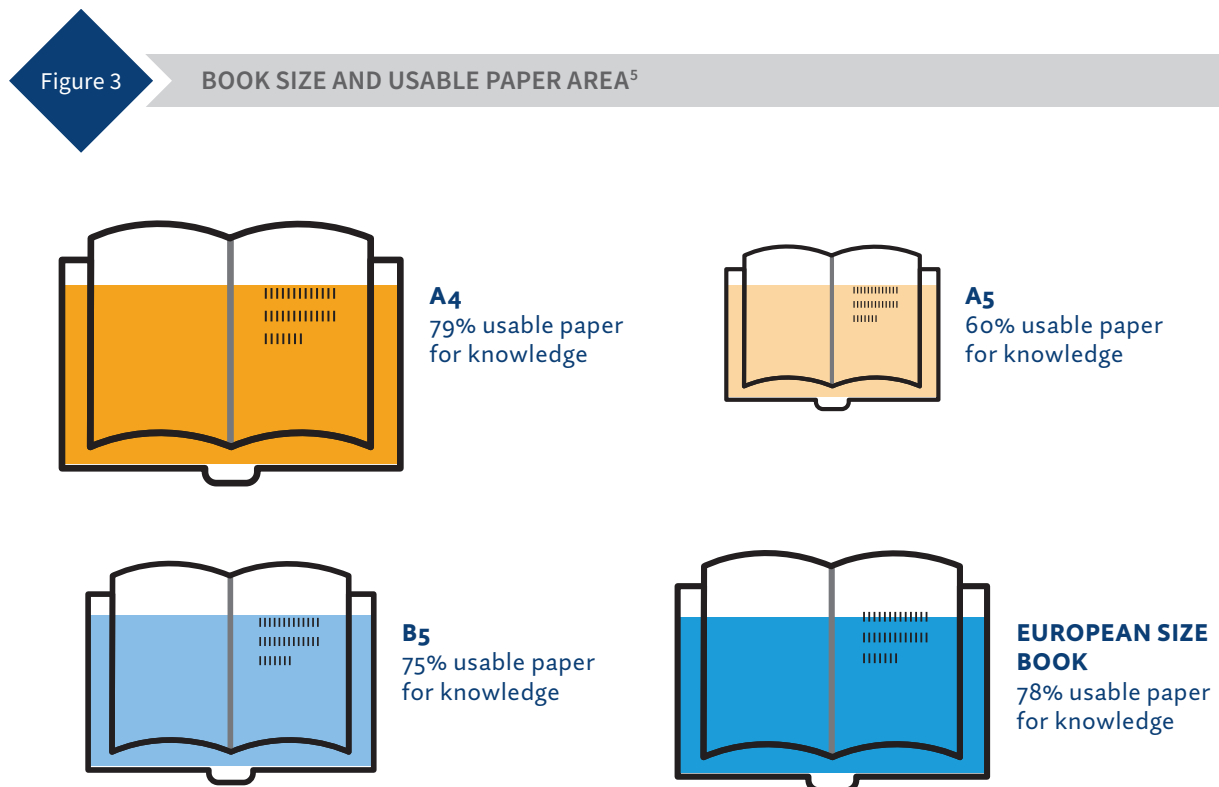
4. PRINTING SPECIFICATIONS

A. BOOK SIZES AND PAGE COUNT

The book size is also called the trim size, which refers to the size of the book after trimming. Usually, trimming happens after the binding process, once the cover is attached. However, this is not the case when using case binding or flexi-bound. More information on these binding methods is below.

When determining book size and page count, one needs to consider the planned use of the books: will the books have diagrams or only plain text, are the books for children in early grades, students in high school or for the teachers, and so forth.

To calculate the usable paper space for text and pictures in a book, one needs to consider the paper size minus the margins. For example, when using an A4 paper size, it is possible to use 79% of the total surface area of the paper. With B5, you can use 75%, and with A5 you can only use 60% of the paper's surface. For standard book size the figure below give the ratio of the usable paper area:



⁵ <https://bluetree-group.com/book-sizes-in-publishing/>

Book sizes **must** be indicated in **millimetres (mm)**, indicating the width x height; and not in A4, B5 or A5, as paper sizes may differ in millimetres by country or region. Additionally, imperial system measurements can be indicated in countries where the imperial system is used.

It is important to note that the number of pages **should always be divisible by four**, as printing machinery folds paper into fourths.

B. COLOR (COVER AND INTERIOR)

Books are generally referred to as black and white or color books. The colors used in book printing are Cyan, Magenta, Yellow, and Black (CMYK) which must not be confused with Red Green Blue (RGB), which is used for digital media such as television and websites. The CMYK model is a subtractive color which begins with white, and colors are created by completely or partially absorbing some light wavelengths and reflecting others. In printing, the color ink is named as below in the table Ink Color Definition:

Table 2

INK COLOR DEFINITION IN PRINTING

Ink color definition	Front side	Reverse Side
1/0	Black	Unprinted
1/1	Black	Black
4/0	Four colors (CMYK)	Unprinted
4/1	Four colors (CMYK)	Black
4/4	Four colors (CMYK)	Four colors (CMYK)
2/0	Two specified colors	Unprinted
2/1	Two specified colors	Black
2/2	Two specified colors	Two specified colors

→ **Recommendation:** Generally, covers are printed either in 4/0 or 4/4. The interior pages of workbooks are printed in 1/1, reading books and read aloud books are printed in 4/4, textbooks in 4/4, teacher guides in 1/1, and softcover library books in 4/4.

C. PRINTING SPECIFICATIONS

Printing specifications are influenced by the quantity of books to be printed and the printing machinery available in the location.

The printing specifications and the quantity of books to be printed influence the location or region where the books can be printed. For example, if the tender requires a large quantity of books printed on coated paper, heatset web offset machines are necessary to fulfil the order. Heatset web offset machines are extremely rare in Africa, and therefore this tender cannot be printed there. Therefore, most textbooks in Africa are printed on uncoated paper, as that type of printing requires coldset web offset machines that are more available in Africa.

Offset printing/ litho printing: is the most common form of printing for books and other bound materials. With offset or “litho” printing, the images and text are transferred to metal plates and then from the plates to a rubber blanket. Then the inked blankets transfer the image onto paper. The process is called offset because the ink is first transferred from plate to blanket rather than going directly onto the paper.⁶ The two types of offset printing are:

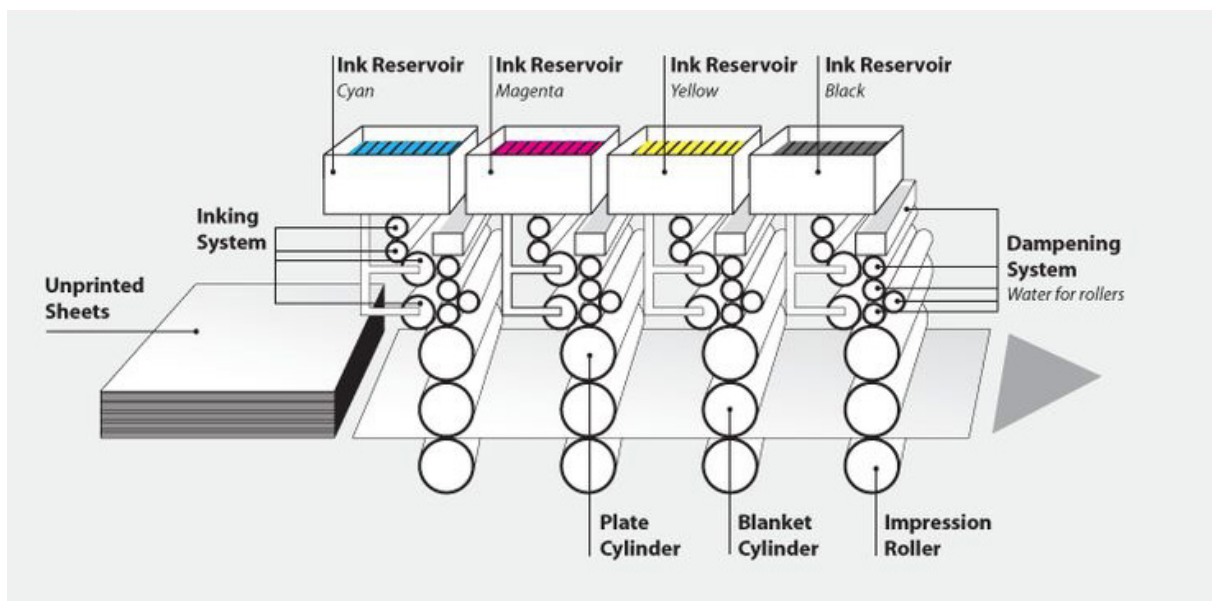
- **Web offset printing:** this process printing involves continuously feeding a roll of paper through a printing press. As the paper unwinds from the roll, it forms a continuous “web” through the press. The paper on a web press is cut into smaller parts after receiving the inked images. There are two printing types of web offset; **coldset printing** and **heatset printing**.
 - **Coldset printing:** is a printing process where the ink is left to dry gradually through evaporation and absorption into the paper. Since the ink does not set immediately, there is always a bit of residue that remains on the paper. Being one of the more economical and fastest forms of printing, it allows printers to use cheaper uncoated paper and consumes less energy. Coated paper cannot be used in coldset printing, as the method does not work with the dryers or UV lamps that are required for coated paper.
 - **Recommendation:** Coldset printing is mostly recommended for lower quality print outputs like daily newspaper prints and workbooks. Print runs should be above 15,000 copies.
 - **Heatset printing:** is a printing process where the ink is dried by running the printed paper through a dryer immediately after the ink is applied by the printing units. There are four printing units, that normally apply Cyan, Magenta, Yellow, and Black (CMYK). As the paper passes through the dryer, the oil-based solvents in the ink reach a “flashpoint” or evaporation point. The waxes, resins, and pigment remain on the paper. The paper then passes through chilling rollers where the waxes and resins cool and set. This gives heatset printing its name. This process yields a cleaner, higher quality product than coldest printing.

6 https://graphicdesign.sfcc.spokane.edu/dzine/mujica/printproduction/calendarlinks/day2/IntroPrinting_L1a_wk2.pdf

- **Recommendation:** Heatset printing is recommended for coated paper for magazines, books, and catalogues. Print runs should be above 20,000 copies.
- **Sheet fed offset printing** is a method in which individual pre-cut sheets are fed into the printing press.
 - **Recommendation:** Sheet-fed offset is commonly used for printing short-run magazines, brochures, and letterhead stationary. The drying process in sheet-fed offset takes longer than in web-offset, therefore sheet-fed offset is better used for small print runs between 300 and 15,000 copies.

Figure 4

SHEETFED OFFSET PRINTING MACHINE



Sheetfed offset printing machine⁷

- **Digital printing:** Digital presses use inkjet or toner-based print technologies instead of traditional inks. In digital printing, artwork goes straight from a pdf to print.
 - **Recommendation:** Digital presses have very low set up costs (or origination costs) and high running costs, they are therefore more economical when the book quantities range from 1 to 500 copies.

NOTE: High volume refers to large print runs with quantities of tens or even hundreds of thousands. The price per copy printed goes down as the size of the print run goes up.



D. COVER PROTECTION

Book covers are always coated to increase durability and improve the look and feel of books. The cover protection can either be laminate, UV, or aqueous coating.

- **Lamination:** a thin layer of plastic is applied to the entire outer cover. This can be either gloss or matte lamination; gloss lamination makes the colour brighter; matte lamination makes the colour softer. Laminating is the most durable way to finish covers, but more expensive than other options. Lamination uses plastic and is therefore more harmful to the environment.
 - **Recommendation:** As lamination is relatively expensive, other cover protections such as UV coating and aqueous coating are recommended for teaching and learning materials, other than storycards for very young children, which should be laminated.
- **UV coating:** a flood of lacquer covers the book, which is then placed under an ultra-violet lamp to dry. This produces a glossy look and feel. After laminates, UV coating is the most durable type of coating. It is also water resistant.
 - **Recommendation:** UV coating should be used for covers of books that should have a relatively long lifespan, such as textbooks, reading books, big books/read aloud books, library books, and teacher guides.
- **Aqueous coating:** Aqueous coating is fast drying and therefore environmentally friendly. However, aqueous coating is not as strong as UV coating or lamination, because it is water based.
 - **Recommendation:** Aqueous coating is recommended for books that are not expected to last longer than a year, like workbooks for kindergarten or grade one.
- **Machine Varnish.** a liquid finish is applied via the printing press to protect the ink on the printed surface. Machine varnish is not as strong as the other types of coating.
 - **Recommendations:** Machine varnish is recommended for board books, as the board paper is durable enough for a lesser finish.

NOTE: Technical specifications that specify coated or uncoated paper types include C2S, implying coated on two sides, and C1S, implying coated on one side. C1S is recommended for textbooks covers as it is stiffer and more durable and C2S is recommended for the inside pages or covers where a high thickness is not mandatory, as C2S is less durable.

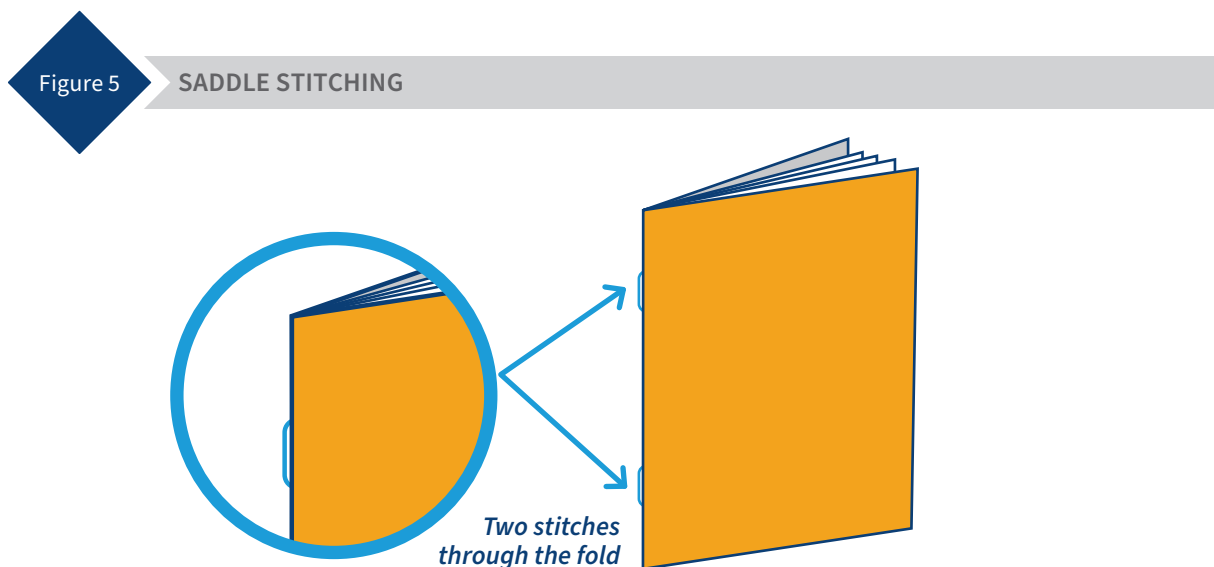
5. BINDING SPECIFICATIONS

A. BINDING TYPES

Binding has a significant impact on the durability of books, costs, and production timelines⁸. There are various types of binding, including saddle stitching, perfect binding, and section sewing.

- **Saddle stitching:** During this binding process, sheets of paper are stacked, folded in half, and then stapled through the fold line with wire staples. There can be two or four staples, depending on the number of pages and the strength required. Saddle stitching is the cheapest and fastest way to bind books, but it can only be used for books that have 96 or fewer interior pages. A saddle stitching machine can produce 5,000 to 15,000 copies per hour. Saddle stitched books generally do not last more than 6 to 12 months when frequently used.

→ **Recommendation:** Saddle stitching is recommended for workbooks with fewer than 96 pages and for short storybooks that are not expected to last more than a year.



- **Section sewing:** With this binding type, pages are collected into sections and sewn together, forming something called a book block. This block is then glued along the binding edge. This part of the process is called perfect binding (see below). For large print runs, multiple machines are required to complete section sewing in a timely manner.
- **Recommendation:** Section sewn binding is strong and can be used for paperback (softcover) and hardback (hardcover) books. However, this binding type is relatively expensive, and the process is very slow.

- **Perfect binding:** is used for high page count books. A perfect bound book is created by gluing the pages into the cover at the spine, after which the pages are trimmed.

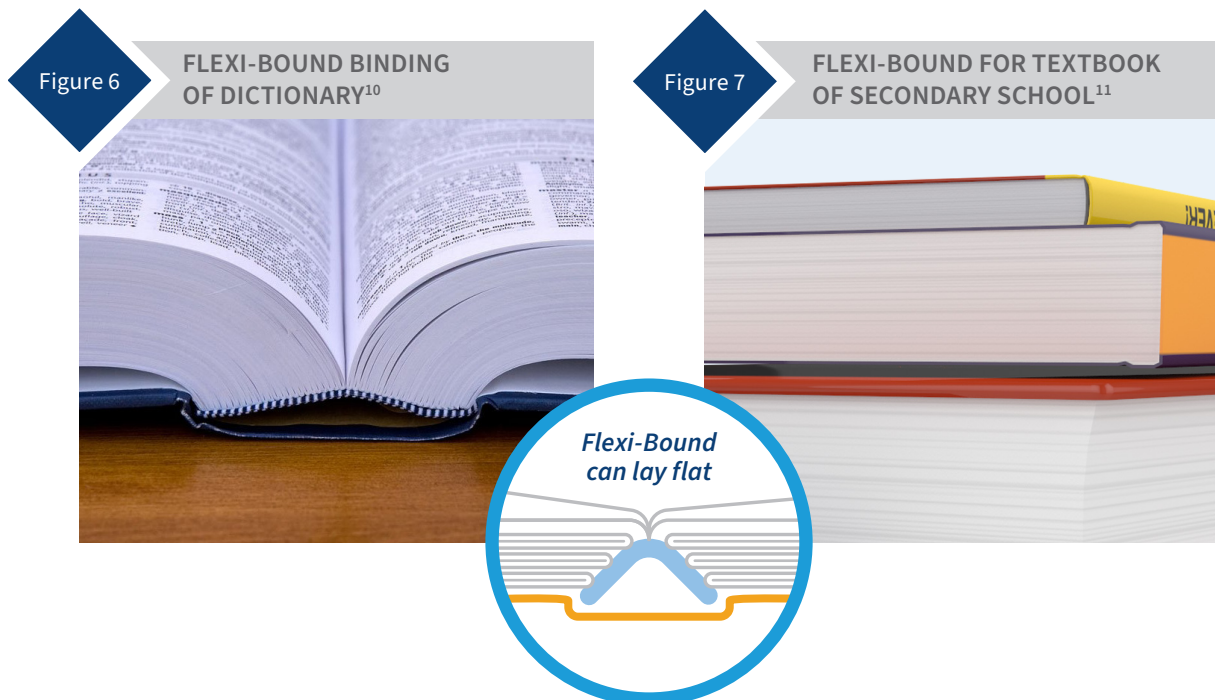
Two types of glue can be used, PUR (polyurethane) and hotmelt. A disadvantage of hotmelt glue is that the glue starts to melt at 70 degrees Fahrenheit. When a book is left in the sun or in a warm area such as a vehicle or warehouse, the glue melts and pages start falling out. With PUR glued books this does not happen, as PUR dries through a chemical process. On top of this, PUR is three to four times stronger than hotmelt glue.

The advantage of perfect binding is that it is an economical alternative to section sewing and case binding. The downside is that books do not lie flat on the table when opened.

→ **Recommendation:** Perfect binding (preferably with PUR) should be used for softcover textbooks and library books⁹

- **Flexi-bound binding:** Flexi-bound binding falls between perfect binding for softcover books and case binding for hardcover books. A flexi-bound book is less expensive to produce than a case bound book but more expensive than a perfect bound book. The interior pages are sewn together in a block and undergo the same binding process as case binding, but the cover is soft, as it does not use an inner board. Flexi-bound books are flexible but more durable than perfect bound books.

→ **Recommendation:** Flexi-bound binding is recommended for teacher guides that should lay flat



⁹ <https://www.qinprinting.com/perfect-binding/>

¹⁰ Figure 6 – Image by PublicDomainPictures from Pixabay

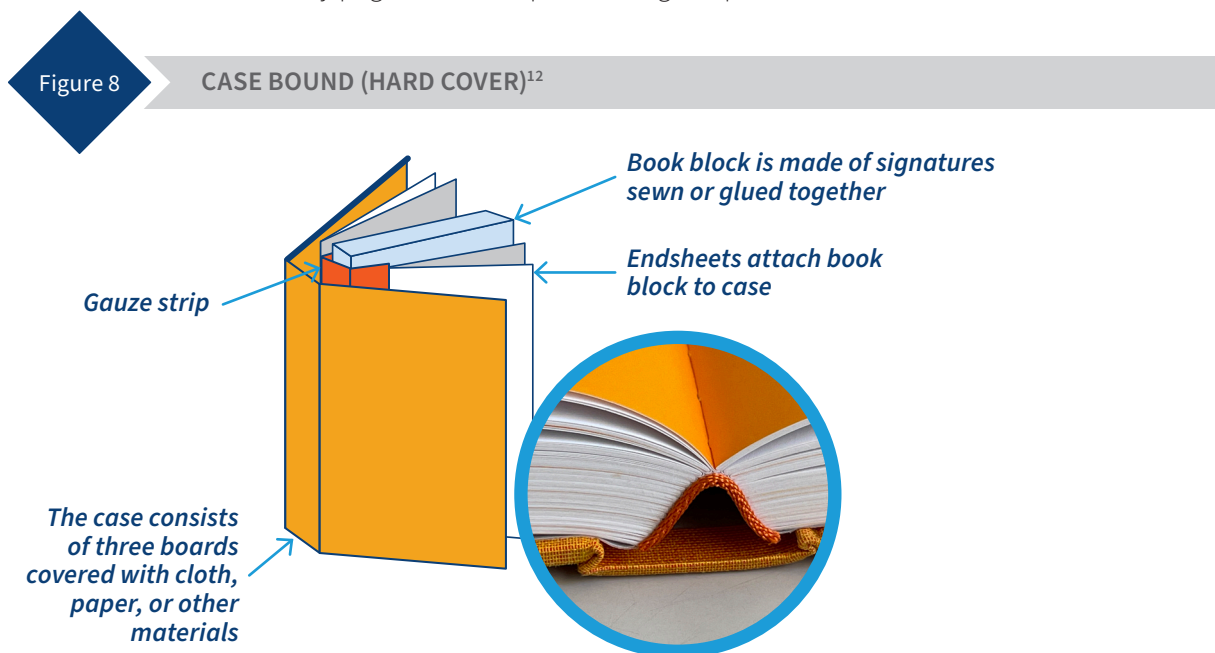
¹¹ Figure 7 – Image by BUMIPUTRA from Pixabay

- **Spiral or Wire-o binding:** This style of binding is used for books that need to lie flat or fold at the centre margin. The cover and interior pages are punched with holes and a coated metal wire is inserted. There are three different types of spiral binding; wire-o, which is fast and economical; coil binding, which is slow and expensive; and comb binding, which is very slow and expensive. After enough usage, the pages will come out of the binding, as paper is not strong enough to be turned against the wire an infinite number of times.
 - **Recommendation:** Wire-o or Spiral binding are not recommended as they are not durable enough for educational use.

- **Case binding:** With this binding type, inside pages are sewn together in sections. These sections together make a block. A gauze strip is attached to the block and then to the spine. This gauze holds the end sheet and the block and increases the strength of the spine of the sewn block. End paper is paper that is glued between the inside block and the cover case. The block is then glued to the endpapers, which are finally glued to the cover case. The cover case consists of three boards covered with cloth, paper, or other materials.

Books bound with case binding are highly durable. However, the net cost of case binding can be several times the cost of perfect binding. On top of this, case bound books are generally heavier than saddle stitched or perfect bound books, which may result in higher shipping costs. Head and tail bands can be applied on the top and bottom of the spine for ornamentation. Ribbon markers can be applied to help readers to keep their place as they go through the book. Head and tail bands and ribbon markers are used for books that are meant to have a long lifespan.

- **Recommendation:** Case binding is recommended mostly for library books or higher education textbooks with many pages and an expected long lifespan.



¹² <https://www.karensaundersassoc.com/options-for-book-binding/>

- **Board book binding:** Board books are books where all the pages are made of thick paperboard, rather than thin inside paper. For this method, each set of two pages is printed on one side of the paperboard, cut, and then glued to the next paperboard and so forth. Finally, the cover board is wrapped and glued around the inside pages.
 - **Recommended** for young children. The paperboard makes the book durable, and the thick pages are easy to turn. Most board books have rounded corners for safety and to increase durability.

B. PAPER GRAIN DIRECTION

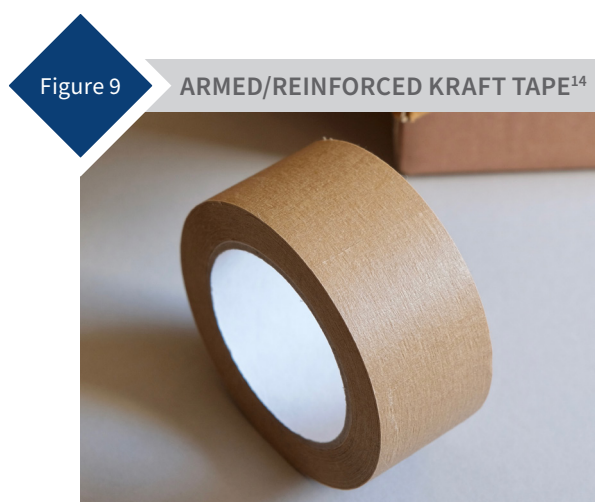
The direction of the paper grain is very important for book durability. The direction of the grain is the direction in which fibres align on a sheet of paper.¹³ When folding and binding paper, it is important to ensure that both are done in the direction of the grain. If not, the fibres could crack, leading to an uneven or rough fold. Folding paper parallel to the grain reduces cracks, leading to a smoother and flatter fold.

- **Recommendation:** Paper used for books that will be folded during the binding process, which includes every binding process other than wire-o or spiral binding, needs to be folded with the grain parallel to the spine of the book.

13 <https://www.spatechnicaladviser.com/e-books-pdf/5-INRODUCTION-TO-PRINTING.pdf>

6. PACKAGING

Correct packing is essential to avoid damage to books during delivery and distribution. Typically, books should be packed in 5 ply cardboard boxes. The books should lay flat in the boxes and completely fill the box. The box size is defined by the book format and quantity. The weight of a single box should not exceed 15kg, to make them easier to carry. The box should be sealed using reinforced kraft tape with a minimum of 70mm width.



Labelling: Labels need to be highly visible and large enough for the information to be seen quickly and clearly. Generally, an A5 label is recommended, printed in different colours to facilitate book sorting before distribution.

Loading: Book boxes must be loaded so that the books lay flat while being transported.

14 Figure 9 – Photo by Klára Vernarcová on Unsplash

15 Figure 10 – Image by digital designer from Pixabay



7. STANDARDS AND CERTIFICATIONS

The printing industry has a significant negative environmental impact. The main environmental issues are air pollution, from releasing Volatile Organic Compounds (VOCs) from solvents into the atmosphere; the handling of hazardous materials, such as solvent wastes and chemical wastes; deforestation by sourcing wood from irresponsibly managed forests; the usage of various oils for the production of ink; various harmful bleaching methods for bleaching paper, and high water consumption.

The most important material for paper production is water, with around 100 litres of water is needed to produce 1 kg of paper, so it is important to source paper from areas which have from significant water resources. Globally, freshwater wastage is an increasing concern. It is essential to source paper from paper mills that have measures in place to reduce their water consumption and/or recycle the water they use. There are several certifications and standards for both paper mills and paper that guarantee well-managed processes. Purchasing certified paper reduces the environmental impact of the printing industry.

A. PAPER MILL CERTIFICATION

ISO 14001¹⁶ is an internationally accepted standard for environmental management systems. These systems are used at paper mills to develop policy to minimize the impact of their operations on the environment, comply with applicable laws, and continue to reduce their environmental impact.

EMAS¹⁷ (Eco Management and Audit Scheme) is a voluntary European Union regulatory/environmental management standard, which has the same requirements as ISO 14001, along with additional requirements such as regular environmental reporting.

ISO 50001¹⁸ provides a practical way to improve energy use during paper production, through the development of an energy management system.

ISO 45001¹⁹ This occupational health and safety standard provides a framework to increase safety, reduce workplace risks, and enhance the health and well-being of employees at work.

Forest Stewardship Council (FSC)²⁰ certification ensures that products come from responsibly managed forests, providing provide environmental, social, and economic benefits.

PEFC (Programme for the Endorsement of Forest Certification)²¹ implies that the forest-based

16 <https://www.iso.org/iso-14001-environmental-management.html>

17 https://ec.europa.eu/environment/emas/index_en.htm

18 <https://www.iso.org/iso-50001-energy-management.html>

19 <https://www.iso.org/standard/63787.html>

20 <https://fsc.org/en>

21 <http://pefc.org>

material within the product comes from PEFC certified forests which are managed in line with the strictest environmental, social, and economic requirements.

B. PAPER CERTIFICATION

ECF (Elemental Chlorine Free): When paper receives an ECF certificate, it signifies that the paper has been bleached using chlorine dioxide instead of more harmful chlorine gas.

TCF (Totally Chlorine Free): When paper receives the TCF certificate, it signifies that the paper has been bleached with using hydrogen peroxide instead of chlorine dioxide. This is currently the most environmentally friendly method for bleaching paper.

Paper is also certified based on **FSC and PEFC**.

CONCLUSION

Procurement must clearly describe the technical specification for the books to be procured. Specifications must include a detailed description of the paper types for covers and interior pages, printing and binding requirements, packaging requirements, and the required standards and certifications. To ensure that bidders can fulfil the specifications, they should be required to provide a list of their printing and binding machines, technical datasheets for the cover and inside paper required in the specifications, and a copy of their certifications (see example Annex 15).

Clear and detailed technical specifications ensure the procurement process is easy to follow for both the printers and the buyers.

Annexes to this guide contain an overview of recommended minimum technical specifications for 13 different types of books, with comments on the recommendations.

Softcover books

- Annex 1 Softcover Student Textbook
- Annex 2 Softcover Reading Book
- Annex 3 “Big Book” softcover Read-Aloud Book
- Annex 4 Workbooks for first grade Students
- Annex 5 Softcover reading Book for libraries
- Annex 6 Flexibound Layflat Teacher’s guides
- Annex 7 Laminated Story Cards

Hardcover books

- Annex 8 Hardcover Student Textbooks
- Annex 9 Hardcover library Book for primary schools
- Annex 10 Reference Book

Board Books

- Annex 11 “Big Book” Board Read-Aloud Book
- Annex 12 Board Book

Bulky paper Book

- Annex 13 Textbook using Bulky paper



ANNEXES

ANNEX 1: SOFTCOVER STUDENT TEXTBOOK

1	Comments on the recommendations (values are minimum recommended)	
Softcover Student Textbook		
Expected durability in countries with appropriate storage (years)	6	
Expected durability in countries with moderately appropriate storage (years)	3	
Expected durability in countries with poor storage (years)	1	
Book size in millimeters (width x height) (mm)	200 x 270	The size maximizes the amount of surface for text and illustrations while still being manageable for young children seated close together.
Cover		
Number of pages	4	
Paper type	C1S	C1S is more durable than C2S
Basis Weight (ISO 536) (g/m ²)	250	This weight provides a good balance between durability and cost.
Brightness D65/10° (ISO 2470-2) (%)	85	Covers are usually printed in color. Higher brightness won't improve the quality, but will be more expensive.
CIE Whiteness (ISO 11475:2017) (%)	95	Covers are usually printed in color. Higher whiteness won't improve the quality, but will be more expensive.
Opacity ISO (2471) (%)	95	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Paper grain parallel to the spine	Yes	
Colors	4/0	
Finish and protection	Glossy UV coating	UV coating provides sufficient protection and is less expensive than lamination.
Inside		
Number of pages	128	
Paper type	Woodfree or Recycled uncoated	Woodfree uncoated is widely used, but recycled uncoated or mechanical coated are good alternatives, environmentally friendly, and less expensive.
Basis Weight (ISO 536) (g/m ²)	80	This weight provides sufficient durability at lower cost.
Brightness D65/10° (ISO 2470-2) (%)	85	This provides a good level of brightness at a reasonable cost.
CIE Whiteness (ISO 11475:2017) (%)	95	This provides a good level of whiteness at a reasonable cost.
Opacity ISO (2471) (%)	90	This opacity is sufficient to avoid see-through.
Bulk (ISO 534) (cm ³ /g)	between 1.1 and 1.3	Low bulk reduces the space required for storage and in children's book bags.
Paper grain parallel to the spine	Yes	This avoids the curling of inside pages.
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/4	
Binding	Section sewn or perfect bound or PUR perfect bound	PUR binding is less expensive, faster, and almost as durable as hotmelt with section sewing.
Cardboard box interior size (L x W x H) in (mm)	420 x 280 x 260	Manageable size and weight

ANNEX 2: SOFTCOVER READING BOOK (FOR HOME USE)

2	Comments on the recommendations (values are minimum recommended)	
Softcover Reading Book (for home use)		
Expected durability in countries with appropriate storage (years)	4	
Expected durability in countries with moderately appropriate storage (years)	3	
Expected durability in countries with poor storage (years)	2	
Book size in millimeters (width x height) (mm)	176 x 250	The size is optimized for home use and storage.
Cover		
Number of pages	4	
Paper type	C2S	C2S is more flexible and less expensive than C1S. Its strength is sufficient for home use.
Basis Weight (ISO 536) (g/m ²)	170	Relatively low paper grammage for home use at an affordable cost.
Brightness D65/10° (ISO 2470-2) (%)	90	
CIE Whiteness (ISO 11475:2017) (%)	110	
Opacity ISO (2471) (%)	90	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Paper grain parallel to the spine	Yes	For this binding method it is important that the paper grain is parallel to the spine, in order to avoid cracking of the paper during the folding process.
Colors	4/0	
Finish and protection	Aqueous coating	Aqueous coating is a sufficient cover protection for home use.
Inside		
Number of pages	96	
Paper type	Silk or Matte coating	Coated paper will intensify the colors and sharpness of illustrations, making books more appealing for students.
Basis Weight (ISO 536) (g/m ²)	70	
Brightness D65/10° (ISO 2470-2) (%)	92	
CIE Whiteness (ISO 11475:2017) (%)	115	
Opacity ISO (2471) (%)	90	
Bulk (ISO 534) (cm ³ /g)	between 0.88 and 1.1	Low bulk reduces the space required for storage and in children's book bags.
Paper grain parallel to the spine	Yes	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/4	Interior pages are usually printed in four colors on both sides.
Binding	Saddle stitching with galvanized steel staples	This binding method is affordable and fast.
Cardboard box interior size (L x W x H) in (mm)	370 x 260 x 280	Manageable size and weight

ANNEX 3: “BIG BOOK” SOFTCOVER READ-ALoud BOOK

3		Comments on the recommendations (values are minimum recommended)
“Big Book” Softcover Read-Aloud Book		
Expected durability in countries with appropriate storage (years)	6	
Expected durability in countries with moderately appropriate storage (years)	4	
Expected durability in countries with poor storage (years)	2	
Book size in millimeters (width x height) (mm)	297 x 420	The size ensures that pictures are visible at the back of the classroom and is small enough for the teacher to handle.
Cover		
Number of pages	4	
Paper type	C2S	
Basis Weight (ISO 536) (g/m ²)	300	A Big Book is a large size book, and the cover paper should be strong enough to hold the inner pages together.
Brightness D65/10° (ISO 2470-2) (%)	90	The high cover brightness to attract the learner and increase visibility at the back of the class.
CIE Whiteness (ISO 11475:2017) (%)	110	The high cover whiteness to attract the learner and increase visibility at the back of the class.
Opacity ISO (2471) (%)	95	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Paper grain parallel to the spine	Yes	For this binding method it is important that the paper grain is parallel to the spine, in order to avoid cracking of the paper during the folding process.
Colors	4/4	Both sides of the paper of the cover are printed in four colors (CMYK), to attract the learners.
Finish and protection	Glossy UV Coating	The cover should have a glossy UV coating finish, which prevents dust/fingerprints from sticking to the paper..
Inside		
Number of pages	48	
Paper type	Silk or Matte coated	Coated paper will intensify the colors of the images in the Big Book.
Basis Weight (ISO 536) (g/m ²)	170	This grammage is needed as the pages should be strong enough for the teacher to turn frequently and to be held upright for the children in the back of the classroom to see.
Brightness D65/10° (ISO 2470-2) (%)	92	
CIE Whiteness (ISO 11475:2017) (%)	115	
Opacity ISO (2471) (%)	94	
Bulk (ISO 534) (cm ³ /g)	between 0.88 and 1.1	Low bulk reduces the space required for storage and in children’s book bags.
Paper grain parallel to the spine	Yes	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/4	Both sides of the paper of the cover are printed in four colors (CMYK), to attract the learners.
Binding	Saddle stitched with 4 staples	Four staples are used to increase the durability and strength of the book.
Cardboard box interior size (L x W x H) in (mm)	430 x 310 x 250	Manageable size and weight

ANNEX 4: WORKBOOK FOR FIRST GRADE STUDENTS

4	Comments on the recommendations (values are minimum recommended)	
Workbook for first grade students		
Expected durability in countries with appropriate storage (years)	3	
Expected durability in countries with moderately appropriate storage (years)	2	
Expected durability in countries with poor storage (years)	1	
Book size in millimeters (width x height) (mm)	176 x 250	This size maximizes the amount of surface for text and illustrations while still being manageable for young children seated close together.
Cover		
Number of pages	4	
Paper type	Kraft paper	Kraft paper increases the strength and durability of the book, however Kraft paper is brownish in color.
Basis Weight (ISO 536) (g/m ²)	160	Good durability at an affordable cost.
Brightness D65/10° (ISO 2470-2) (%)	NA	
CIE Whiteness (ISO 11475:2017) (%)	NA	
Opacity ISO (2471) (%)	NA	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Paper grain parallel to the spine	Yes	For this binding method it is important that the paper grain is parallel to the spine, in order to avoid cracking of the paper during the folding process.
Colors	4/0	
Finish and protection	none	Kraft paper will not have a coating, as it is a strong paper in itself.
Inside		
Number of pages	32 to 96	
Paper type	Recycled uncoated or mechanical pulp	The paper is uncoated, as this makes it easier for students to write in it with pencil and pen.
Basis Weight (ISO 536) (g/m ²)	70	The weight provides sufficient durability at lower cost.
Brightness D65/10° (ISO 2470-2) (%)	80	This provides sufficient brightness for workbooks.
CIE Whiteness (ISO 11475:2017) (%)	90	This provides sufficient whiteness for workbooks.
Opacity ISO (2471) (%)	88	The opacity is sufficient to avoid see through.
Bulk (ISO 534) (cm ³ /g)	1.2	
Paper grain parallel to the spine	Yes	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	1/1	Only one color to reduce costs.
Binding	Saddle stitching with 4 staples	This binding method is cost-effective and fast.
Cardboard box interior size (L x W x H) in (mm)	420 x 280 x 260	Manageable size and weight

ANNEX 5: SOFTCOVER READING BOOK FOR A LIBRARY

5		Comments on the recommendations (values are minimum recommended)
Softcover reading book for a library		
Expected durability in countries with appropriate storage (years)	6	
Expected durability in countries with moderately appropriate storage (years)	3	
Expected durability in countries with poor storage (years)	1	
Book size in millimeters (width x height) (mm)	200 x 270	This size maximizes the amount of surface for text and illustrations while still being manageable for young children seated close together.
Cover		
Number of pages	4	
Paper type	C1S	C1S is more durable than C2S
Basis Weight (ISO 536) (g/m ²)	250	This weight is a good balance between durability and costs.
Brightness D65/10° (ISO 2470-2) (%)	85	Covers are usually printed in color. Higher brightness won't improve the quality, but will be more expensive.
CIE Whiteness (ISO 11475:2017) (%)	95	Covers are usually printed in color. Higher whiteness won't improve the quality, but will be more expensive.
Opacity ISO (2471) (%)	95	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Paper grain parallel to the spine	Yes	For this binding method it is important that the paper grain is parallel to the spine, in order to avoid cracking of the paper during the folding process.
Colors	4/0	
Finish and protection	Glossy UV coating	The cover should have a glossy UV Coating finish, which prevents dust/fingerprints sticking on the paper.
Inside		
Number of pages	160	
Paper type	Silk or matte coated	Coated paper will intensify the colors and image sharpness of the reading book, making it more appealing to the learner.
Basis Weight (ISO 536) (g/m ²)	80	
Brightness D65/10° (ISO 2470-2) (%)	92	The high brightness makes the book more attractive for the learner.
CIE Whiteness (ISO 11475:2017) (%)	90	The high whiteness makes the book more attractive for the learner.
Opacity ISO (2471) (%)	88	The opacity is sufficient to avoid see through.
Bulk (ISO 534) (cm ³ /g)	between 0.88 and 1.1	
Paper grain parallel to the spine	Yes	This avoids curling of the inside pages.
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/4	
Binding	Sewn section and perfect bound or PUR perfect bound	PUR binding is less expensive, faster, and almost as durable as hotmelt with section sewing.
Cardboard box interior size (L x W x H) in (mm)	420 x 280 x 260	Manageable size and weight

ANNEX 6: FLEXIBOUND LAYFLAT TEACHER'S GUIDE

6		Comments on the recommendations (values are minimum recommended)
Flexibound Layflat Teacher's guide		
Expected durability in countries with appropriate storage (years)	8	
Expected durability in countries with moderately appropriate storage (years)	5	
Expected durability in countries with poor storage (years)	3	
Book size in millimeters (width x height) (mm)	210 x 297	This size is easy for teachers to handle, and ensures that the pictures, diagrams and text are large enough to read when the guide is flat on the teachers desk.
Cover		
Number of pages	4	
Paper type	C2S	
Basis Weight (ISO 536) (g/m ²)	350	High cover page weight to increase durability.
Brightness D65/10° (ISO 2470-2) (%)	90	
CIE Whiteness (ISO 11475:2017) (%)	110	
Opacity ISO (2471) (%)	90	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Paper grain parallel to the spine	Yes	For this binding method it is important that the paper grain is parallel to the spine, in order to avoid cracking of the paper during the folding process.
Colors	4/0	
Finish and protection	Lamination	
Endsheets	140g uncoated paper (grain direction parallel to spine)	
Inside		
Number of pages	256	
Paper type	Silk or matte coated	Coated paper will intensify the colors of the images in the teacher guide.
Basis Weight (ISO 536) (g/m ²)	80	
Brightness D65/10° (ISO 2470-2) (%)	92	
CIE Whiteness (ISO 11475:2017) (%)	90	
Opacity ISO (2471) (%)	88	The opacity is sufficient to avoid see through.
Bulk (ISO 534) (cm ³ /g)	between 0.88 and 1.1	
Paper grain parallel to the spine	Yes	This avoids curling of the inside pages.
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/4	
Binding	Section sewn with gauze and Flexibound	The gauze strip will increase the strength of the spine of the sewn block, and ensure that the book can lay flat. Flexibound falls between perfect binding and case binding, but is less expensive to produce than case binding.
Cardboard box interior size (L x W x H) in (mm)	430 x 310 x 250	Manageable size and weight

ANNEX 7: LAMINATED STORY CARDS

7		Comments on the recommendations (values are minimum recommended)
Laminated Story Cards		
Expected durability in countries with appropriate storage (years)	10	
Expected durability in countries with moderately appropriate storage (years)	8	
Expected durability in countries with poor storage (years)	6	
Book size in millimeters (width x height) (mm)		
Card		
Number of pages	2	
Paper type	C2S	
Basis Weight (ISO 536) (g/m ²)	350	High cover page weight to increase durability.
Brightness D65/10° (ISO 2470-2) (%)	90	A high brightness will increase the readability of the images and the text on the story card.
CIE Whiteness (ISO 11475:2017) (%)	110	A high whiteness will increase the readability of the images and the text on the story card.
Opacity ISO (2471) (%)	95	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Paper grain parallel to the spine	No	Laminated story cards do not have a binding, therefore the grain direction of the paper is not important.
Colors	4/4	
Finish and protection	Plastified	Plastification is the most durable way to finish paper and is best for storycards that receive heavy use by young children. Is is also very expensive.

ANNEX 8: HARDCOVER STUDENT TEXTBOOK

8		Comments on the recommendations (values are minimum recommended)
Hardcover Student Textbook		
Expected durability in countries with appropriate storage (years)	10	
Expected durability in countries with moderately appropriate storage (years)	5	
Expected durability in countries with poor storage (years)	3	
Book size in millimeters (width x height) (mm)	200 x 270	This size maximizes the amount of surface for text and illustrations while still being manageable for young children seated close together.
Cover		
Number of pages	4	
Paper type	C2S (grain direction parallel to spine)	
Basis Weight (ISO 536) (g/m ²)	130	The cover paper can be relatively low, as it will be reinforced by board pages.
Brightness D65/10° (ISO 2470-2) (%)	90	Hardcover books are designed to last longer than softcover books, therefore a higher brightness, whiteness and opacity is preferred for the cover paper.
CIE Whiteness (ISO 11475:2017) (%)	110	
Opacity ISO (2471) (%)	90	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/0	
Finish and protection	Lamination	Lamination provides a high level of protection and book durability.
Board type	grey board (grain direction parallel to spine)	
Thickness in mm	2.5	
Required certifications	Recycled	
Endsheets	140g uncoated paper (grain direction parallel to spine)	
Inside		
Number of pages	256	
Paper type	Silk or matte coated	Coated paper will intensify the colors of the images in the textbook.
Basis Weight (ISO 536) (g/m ²)	70	Inside paper will be protected by the case, therefore it can be relatively low in weight.
Brightness D65/10° (ISO 2470-2) (%)	92	Hardcover books are designed to last longer than softcover books, therefore a higher brightness, whiteness and opacity is preferred for the cover paper.
CIE Whiteness (ISO 11475:2017) (%)	115	
Opacity ISO (2471) (%)	90	
Bulk (ISO 534) (cm ³ /g)	between 0.88 and 1.1	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/4	
Binding	Section sewn, square casebound with gauze strip	Books bound with a case binding are highly durable, but generally heavier than saddle stitched or perfect bound, which may result in higher shipping costs.
Cardboard box interior size (L x W x H) in (mm)	420 x 280 x 260	Manageable size and weight

ANNEX 9: LIBRARY BOOK FOR PRIMARY SCHOOL

9		Comments on the recommendations (values are minimum recommended)
Library Book for Primary School		
Expected durability in countries with appropriate storage (years)	6	
Expected durability in countries with moderately appropriate storage (years)	4	
Expected durability in countries with poor storage (years)	2	
Book size in millimeters (width x height) (mm)	210 x 297	As the books will stay in the library and do not have to be carried around by children, the size of the books is bigger.
Cover		
Number of pages	4	
Paper type	C2S (grain direction parallel to spine)	
Basis Weight (ISO 536) (g/m ²)	130	The cover paper can be relatively low, as it will be reinforced by board.
Brightness D65/10° (ISO 2470-2) (%)	90	Hardcover books are designed to last longer than softcover books, therefore a higher brightness, whiteness and opacity is preferred for the cover paper.
CIE Whiteness (ISO 11475:2017) (%)	110	
Opacity ISO (2471) (%)	90	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/0	
Finish and protection	Lamination	Lamination provides a high level of protection and book durability.
Board type	grey board (grain direction parallel to spine)	
Thickness in mm	2.5	
Required certifications	Recycled	
Endsheets	140g uncoated paper (grain direction parallel to spine)	
Inside		
Number of pages	160	
Paper type	Silk or matte coated	Coated paper will intensify the colors of the images in the textbook.
Basis Weight (ISO 536) (g/m ²)	70	Inside paper will be protected by the case, therefore it can be relatively low in weight.
Brightness D65/10° (ISO 2470-2) (%)	92	Hardcover books are designed to last longer than softcover books, therefore a higher brightness, whiteness and opacity is preferred for the cover paper.
CIE Whiteness (ISO 11475:2017) (%)	115	
Opacity ISO (2471) (%)	90	
Bulk (ISO 534) (cm ³ /g)	between 0.88 and 1.1	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/4	
Binding	Section sewn, square casebound with gauze strip	Books bound with a case binding are highly durable, but generally heavier than saddle stitched or perfect bound, which may result in higher shipping costs.
Cardboard box interior size (L x W x H) in (mm)	430 x 310 x 250	Manageable size and weight

ANNEX 10: REFERENCE BOOK

10		Comments on the recommendations (values are minimum recommended)
Reference Book		
Expected durability in countries with appropriate storage (years)	15	
Expected durability in countries with moderately appropriate storage (years)	10	
Expected durability in countries with poor storage (years)	3	
Book size in millimeters (width x height) (mm)	200 x 270	Reference books are generally long, this size will ensure that they are easy to handle.
Cover		
Number of pages	4	
Paper type	C2S (grain direction parallel to spine)	
Basis Weight (ISO 536) (g/m ²)	130	The cover paper can be relatively low, as it will be reinforced by board.
Brightness D65/10° (ISO 2470-2) (%)	90	Hardcover books are designed to last longer than softcover books, therefore a higher brightness, whiteness and opacity is preferred for the cover paper.
CIE Whiteness (ISO 11475:2017) (%)	110	
Opacity ISO (2471) (%)	90	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/0	
Finish and protection	Lamination	Lamination provides a high level of protection and book durability.
Board type	grey board (grain direction parallel to spine)	
Thickness in mm	3.5	
Required certifications	Recycled	
Endsheets	140g uncoated paper (grain direction parallel to spine)	
Inside		
Number of pages	352	
Paper type	Silk or matte coated	Coated paper will intensify the colors of the images in the textbook.
Basis Weight (ISO 536) (g/m ²)	70	Inside paper will be protected by the case, therefore it can be relatively low in weight.
Brightness D65/10° (ISO 2470-2) (%)	92	Hardcover books are designed to last longer than softcover books, therefore a higher brightness, whiteness and opacity is preferred for the cover paper.
CIE Whiteness (ISO 11475:2017) (%)	115	
Opacity ISO (2471) (%)	90	
Bulk (ISO 534) (cm ³ /g)	between 0.88 and 1.1	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/4	
Binding	Section sewn, hardcase roundback bound with gauze strip, head and tail bands, ribbon marker.	Head and tail bands are attached to make the book more attractive. The ribbon marker is used as a bookmark.
Cardboard box interior size (L x W x H) in (mm)	420 x 280 x 260	Manageable size and weight

ANNEX 11: “BIG BOOK” BOARD READ-ALOUD BOOK

11		Comments on the recommendations (values are minimum recommended)
“Big Book” board Read-Aloud Book		
Expected durability in countries with appropriate storage (years)	10	
Expected durability in countries with moderately appropriate storage (years)	5	
Expected durability in countries with poor storage (years)	3	
Book size in millimeters (width x height) (mm)	297 x 420	This size ensures that the images are still visible at the back of the class, and is still small enough for the teachers to handle
Board		
Number of pages cover included	18	
Board type	C1S or GC2	
Brightness D65/10° (ISO 2470-2) (%)	90	
CIE Whiteness (ISO 11475:2017) (%)	110	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/4	
Finish and protection	Machine varnish	As pages made out of board are thick and sturdy, the board finish does not have to be as strong.
Thickness in mm	0.65	
Board required stiffness	Bending stiffness DIN 5o MD, mNm minimum 90 and Bending stiffness DIN 5o CD, mNm, minimum 40	
Binding	Board book binding, rounded corners	The corners are rounded so that the edges don't get damaged.
Cardboard box interior size (L x W x H) in (mm)	430 x 310 x 250	Manageable size and weight

ANNEX 12: BOARD BOOK

12		Comments on the recommendations (values are minimum recommended)
"Big Book" board Read-Aloud Book		
Expected durability in countries with appropriate storage (years)	6	
Expected durability in countries with moderately appropriate storage (years)	4	
Expected durability in countries with poor storage (years)	2	
Book size in millimeters (width x height) (mm)	150 x 150	This board book will be handled by young children. Square books are easier to hold.
Board		
Number of pages cover included	18	
Board type	C1S or GC2	
Brightness D65/10° (ISO 2470-2) (%)	90	
CIE Whiteness (ISO 11475:2017) (%)	110	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/4	
Finish and protection	Machine varnish	As pages made out of board are thick and sturdy, the board finish does not have to be as strong.
Thickness in mm	0.65	
Board required stiffness	Bending stiffness DIN 5o MD, mNm minimum 90 and Bending stiffness DIN 5o CD, mNm, minimum 40	
Binding	Board book binding, rounded corners	The corners are rounded so that the edges don't get damaged.
Cardboard box interior size (L x W x H) in (mm)	310 x 310 x 280	Manageable size and weight

ANNEX 13: TEXTBOOK USING BULKY PAPER

13		Comments on the recommendations (values are minimum recommended)
Textbook using Bulky paper		
Expected durability in countries with appropriate storage (years)	4	
Expected durability in countries with moderately appropriate storage (years)	2	
Expected durability in countries with poor storage (years)	1	The durability is only affected by the yellowing of paper.
Book size in millimeters (width x height) (mm)	200 x 270	The size maximizes the amount of surface for text and illustrations while still being manageable for young children seated close together.
Cover		
Number of pages	4	
Paper type	C1S	C1S is more durable than C2S
Basis Weight (ISO 536) (g/m ²)	250	This weight provides a good balance between durability and cost.
Brightness D65/10° (ISO 2470-2) (%)	85	Covers are usually printed in color. Higher brightness won't improve quality, but will be more expensive.
CIE Whiteness (ISO 11475:2017) (%)	95	Covers are usually printed in color. Higher whiteness won't improve quality, but will be more expensive.
Opacity ISO (2471) (%)	95	
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Paper grain parallel to the spine	yes	
Colors	4/0	
Finish and protection	Glossy UV coating	UV Coating provides sufficient protection and is less expensive than lamination.
Inside		
Number of pages	128	
Paper type	Bulky paper	Woodfree uncoated is widely used, but Bulky paper provides a similar touch and feel at much lower costs.
Basis Weight (ISO 536) (g/m ²)	50	This weight provides sufficient durability at lower cost.
Brightness D65/10° (ISO 2470-2) (%)	80	This provides a good level of brightness at a reasonable cost.
CIE Whiteness (ISO 11475:2017) (%)	85	This provides a good level of whiteness at a reasonable cost.
Opacity ISO (2471) (%)	95	The opacity is sufficient to avoid see-through.
Bulk (ISO 534) (cm ³ /g)	Minimum 2.0	The high bulk allows to reduce the basis weight of the paper.
Paper grain parallel to the spine	yes	This avoids the curling of the inside pages.
Papermill required certifications	ISO 14001, EMAS, ISO 50001, ISO 45001, FSC or PEFC	
Paper required certifications	ECF or TCF, FSC or PEFC	
Colors	4/4	
Binding	Section sewn and perfect bound or PUR perfect bound	PUR binding is less expensive, faster, and almost as durable as hotmelt with section sewing.
Cardboard box interior size (L x W x H) in (mm)	420 x 280 x 260	Manageable size and weight

ANNEX 14: EXAMPLES OF TECHNICAL SPECIFICATIONS FOR PAPER

Novel

by Stora Enso



Novel is an uncoated mechanical book paper grade with a bluish-white shade.

- High bulk
- Good printability

PRODUCER

Anjala Mill

TYPICAL END USES

Hard and soft cover books
Paperbacks
Text books
Children's books
School books
Puzzle books

SHADE

Bluish-white

PRINTING METHODS

CSWO
HSWO
SFO
Digital

L* a* b* values

	L*	a*	b*
ISO 5631-3 (D50/2°) Novel 76	91.6	0.5	4.9
ISO 5631-3 (D50/2°) Novel 80	90.2	0.4	0.4

TECHNICAL SPECIFICATIONS - NOVEL 76 (target values)

Substance		g/m ²	50	60	65	70
Bulk	ISO 534	cm ³ /g	1.6-2.0	2.0	2.0	2.0
Thickness	ISO 534	µm	80-100	120	130	140
Brightness	ISO 2470-2 (D65/10°)	%	76	76	76	76
Opacity	ISO 2471	%	91	94	95	96

TECHNICAL SPECIFICATIONS - NOVEL 80 (target values)

Substance		g/m ²	56	60
Bulk	ISO 534	cm ³ /g	2.0	1.6
Thickness	ISO 534	µm	112	96
Brightness	ISO 2470-2 (D65/10°)	%	80	80
Opacity	ISO 2471	%	94	94

REEL SPECIFICATIONS

Core: 76 mm
Trimmed width: 8500 mm
Width: min. 300 mm, max. 2500 mm
Diameters: min. 1000 mm, max. 1250 mm
Max. weight: 3000 kg

CERTIFICATES

EU Ecolabel FI/011/007
Quality ISO 9001
Environment ISO 14001
Health & Safety ISO 45001
Energy ISO 50001
[FSC® CoC \(FSC® C015932\) *](#)
[PEFC™ CoC \(PEFC/02-31-86\) *](#)
(* FSC or PEFC paper is only delivered on customer request.)
For more information:
www.storaenso.com/paper-sustainability

ENVIRONMENT

Renewable fibre
Recyclable paper
Recyclable packaging materials

STORAGE AND HANDLING

- Store the paper in a humidity and temperature controlled area at 50% relative humidity and room temperature between 19°C and 23°C.
- If the paper is stored in non-air conditioned warehouse, it is absolutely necessary to allow a stabilisation period in the print room.
- Open the protective wrapping at the moment of use.

BOOK

The paper has a smooth, fine surface and is appreciated by both end users and printers. Holmen BOOK is a high quality product that has been on the market since 2003.

TECHNICAL DATA

Target values subject to production variations. Updates will be done continuously.

Target value	Grammage g/m ²	Brightness % ISO	Bulk cm ³ /g	*Caliper µm	Opacity %
Holmen BOOK	49	74	1.6	76	94
	52	74	1.6	81	94
	52	74	1.8	90	94
	55	74	1.8	96	95
	55	74	2.0	106	95
	60	74	2.0	116	96
	70	74	2.0	136	97
Holmen BOOK Cream	52	73.5	1.6	81	89
	60	73.5	1.6	92	91
	70	73.5	1.6	108	93
	80	73.5	1.6	123	95
	60	73.5	1.8	104	91
	70	73.5	1.8	122	93
	80	73.5	1.8	140	95
	**49	73.5	2.0	95	89
	52	73.5	2.0	101	90
	55	73.5	2.0	107	91
	60	73.5	2.0	116	92
	70	73.5	2.0	136	93
	80	73.5	2.0	154	95
	**90	73.5	2.0	174	96
	65	73.5	2.2	138	92
Holmen BOOK Bulky	50	58	2.3	109	93
	52	58	2.3	114	93
		Brightness % D65/10°			
Holmen BOOK Extra	65	80	2.0	125	95
	80	80	2.0	154	96
	** 90	80	2.0	174	97
Holmen BOOK Extra Cream	**70	80	2.0	136	93
	**80	80	2.0	154	95
Holmen BOOK Extra White	70	80	1.6	108	97
	**80	80	1.6	123	98



UPM FINE H/C

The name says it all. UPM Fine. It provides high brightness, optimal opacity and outstanding suitability for processing. UPM Fine is a flexible multi-use paper. It's ideal grade for flyers, business reports, magazines and posters.

UPM FINE H/C:

Category	Heatset web offset papers Coldset web offset papers
Grade	Woodfree uncoated (WFU)
End use	Advertising material Books Business forms Direct mailing Magazines Newspaper supplements Posters
Finish	Machine finished
Furnish	Hardwood and softwood sulphate pulp
Printing method	Coldset web offset Heatset web offset Waterless printing
Format/Size	Reels
Reel Diameter (cm)	100,0 - 140,0
Reel Width (cm)	17,0 - 283,0
Core (mm)	70,0 / 76,0 / 152,0
Wrapping	Strong moisture proof polyethylene laminated kraft paper
Certificates and labels	EES+ ISO 50001 EU Ecolabel FSC Chain-of-Custody EN 71/3:1988 D Safety of Toys 94/62 EC Heavy Metal Certificate BfR Food Certificate PEFC Chain-of-Custody Permanent Paper ISO 9706 EMAS ISO 9001 ISO 45001 ISO 14001
Note	FSC® and PEFC™ on request but subject to availability.



TECHNICAL TARGET VALUES:

Basis Weight (ISO 536) (g/m²)	60.0	70.0	80.0	90.0	100.0	110.0	120.0	140.0	150.0	170.0	190.0	250.0	300.0	350.0
Thickness (ISO 534) (µm)	75.0	88.0	100.0	113.0	125.0	132.0	144.0	161.0	173.0	187.0	209.0	275.0	330.0	385.0
Bulk (ISO 534) (cm³/g)	1.25	1.25	1.25	1.25	1.25	1.20	1.20	1.15	1.15	1.10	1.10	1.10	1.10	1.10
Brightness D65 (ISO 2470-2) (%)	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0
CIE Whiteness (ISO 11475:2017)	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0
L-value D65 (D65/10°) (ISO 5631-2)	93.9	93.9	93.9	93.9	93.9	93.9	93.9	93.9	93.9	93.9	93.9	93.9	93.9	93.9
a-value D65 (D65/10°) (ISO 5631-2)	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
b-value D65 (D65/10°) (ISO 5631-2)	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Opacity ISO (2471) (%)	87.0	90.0	92.5	94.5	95.5	96.5	97.0	98.0	98.5	99.0	99.5	99.7	99.9	99.9
Roughness Bendtsen (ISO 8791-2) (ml/min)	200.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0

Please note: Technical values are informative and subject to production variations.

PREPRESS GUIDELINES:

Characterisation data	Fogra 47, Fogra 52
------------------------------	--------------------

UPM FINE H/C



ANNEX 15: FSC CERTIFICATION EXAMPLE



Certificate SGSCH-COC-002249
SGSCH-CW-002249

The Organization

UPM-Kymmene Corporation

Alvar Aallon katu 1
Finland - 00101 Helsinki



has been assessed and certified as meeting the requirements of

FSC® Chain-of-Custody

The company was assessed against the following standards:

- FSC-STD-40-003 V2.1 Chain of Custody Certification of Multiple Sites – November 2014
- FSC-STD-40-004 V3.0 FSC Standard for Chain of Custody Certification – April 2017
- FSC-STD-40-007 V2.0 Sourcing reclaimed material for use in FSC Product Groups or FSC Certified Projects – April 2011
- FSC-STD-50-001 Requirements for use of the FSC trademarks by Certificate Holders

for the products detailed in the scope below

This certificate is valid from 21 July 2019 until 20 July 2024
Issue 13. Certified since July 2009
SGS Ref # CH12/1588

This is multi site scheme
Additional site details are listed on the subsequent page

Authorised by




SGS Société Générale de Surveillance SA
1, place des Alpes, 1211 Geneva, Switzerland
t +41 (0)22 739-91-11 f +41 (0)22 739-98-86 www.sgs.com



The mark of responsible forestry

The validity of this certificate shall be verified on <http://info.fsc.org/>
For the full list of product groups covered by the certificate see <http://info.fsc.org/>
This certificate itself does not constitute evidence that a particular product supplied by the certificate holder is FSC-certified [or FSC Controlled Wood].
Products offered, shipped or sold by the certificate holder can only be considered covered by the scope of this certificate when the required FSC claim is clearly stated on sales and delivery documents. This certificate remains the property of SGS.
The certificate and all copies or reproductions shall be returned or destroyed if requested by SGS.

Page 1 of 3




This document is issued by the Company subject to its General Conditions of Certification Services accessible at www.sgs.com/terms_and_conditions.htm. Attention is drawn to the limitations of liability, indemnification and jurisdictional issues established therein. The authenticity of this document may be verified at <http://www.sgs.com/en/certified-clients-and-products/certified-client-directory>. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.



Image references

COVER:

Ismail Salad Osman Hajji D from Unsplash.com

Photo © Dominic Chavez/World Bank

Pierre Bamin from Unsplash.com

Contents page:

Photo © Candice Turvey

Photo Ecole du Cirque, National Initiative for Human Development Support Project (INDH)

Page 4:

Robert Kooreny from Unsplash.com

Page 25:

Pierre Bamin from Unsplash.com

Photo © Dominic Chavez/World Bank



© 2021 International Bank for Reconstruction and Development / The World Bank
1818 H Street NW, Washington, DC 20433
Telephone: 202-473-1000; Internet: www.worldbank.org