



## **Final Manufacturing Stage Process Definitions**

Last Revision: December 2024

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# TABLE OF CONTENTS

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- REVISION HISTORY ..... 1**
- 1 OVERVIEW..... 3**
  - 1.1 Purpose and Content..... 3
  - 1.2 Standard Requirements Referencing the Final Manufacturing Stage ..... 3
  - 1.3 Supporting Documents ..... 3
- 2 FINAL MANUFACTURING STAGE DEFINITIONS ..... 4**
  - 2.1 Scope of the Final Manufacturing Stage Processes..... 4
  - 2.2 Final Manufacturing Stage Processes ..... 4
- 3 REFERENCES ..... 12**

# REVISION HISTORY

REVISION DATE	SECTION	TYPE OF CHANGE
October 2015	Initial Release	
April 16, 2017	3.2	Added "Drying" to the processes for the "Builder's Joinery and Carpentry of Wood" category.
April 16, 2017	3.2	Clarified definition of "Finished Metal Products" category
April 16, 2017	3.2	Added "Extrusion" and "Pelletizing" to the processes for the "Primary Forms" Plastics category.
April 16, 2017	3.2	Added "Printing" and "Washing/Laundrying (prior to shipment/sale)" to the processes for the "Apparel" category.
April 16, 2017	3.2	Deleted sorting and grating from the processes for Yarn.
April 16, 2017	3.2	Clarified the processes for Apparel to include all finishing processes (except for yarn dyeing).
March 2018	3.2	Added new Table for Raw Textile Materials.
March 2018	3.2	Added "Aluminum Lighting Columns" to product examples of Finished Metal Products.
March 2018	3.2	Clarified definition of Finished Metal Products to refer to single <i>metal</i> material types
October 2020	3.2	Clarified that mixing at point of sale is not included in the final manufacturing for formulated products.
October 2020	3.2	Clarified that processes occurring during logging are not required to be included for Builder's Joinery and Carpentry of Wood.
October 2020	3.2	Added several final manufacturing stage processes for Paper and Cardboard Packaging.
October 2020	3.2	Added Insulated Panels to the table for Metals and Metal Products.
October 2020	3.2	Added several final manufacturing stage processes for Rubber and Plastic Products
August 2022	2.0	Removed sections 2.1-2.5 that listed the Version 3.1 requirements applicable to the final manufacturing stage. Please refer to Version 3.1 or Version 4.0 for this information.
August 2022	1 and 2	Combined Sections 1 and 2 into a new Section 1

December 2022	2.2	Added a note regarding site visit requirements below Table 6. (This information was inadvertently removed when the document was last updated.)
December 2022	3	Removed inactive hyperlinks in the References section
December 2024	2.1	Added a note about product category rules.
December 2024	2.2	Clarified that final manufacturing stage processes may occur at both applicant and supplier facilities.
December 2024	2.2	Clarified that packaging and transport between final manufacturing processes should always be included in the final manufacturing stage.
December 2024	2.2	Added clarification for parts of multi-component products sold separately to Table 1.
December 2024	2.2	Removed the language in Table 1 that previously indicated the assessor is responsible for defining the scope.
December 2024	2.2	Added new product category in Table 1– “Multi-Component Products that are assembled primarily at construction sites”.
December 2024	2.2	Added product examples for “Other Formulated Products”.
December 2024	2.2	Added new product category in Table 4 – “(Semi-finished) Basic Wood Products”.
December 2024	2.2	Added processes to the product categories “Builder’s Joinery and Carpentry of Wood” and “Printed Materials” in Table 4.
December 2024	2.2	Added cut-off to the product categories “Glass and Ceramic” and “Plastic and Rubber Products” in Table 5 and Table 7.
December 2024	2.2	Modified product category in Table 6 – “Metal Alloys and (Semi-Finished) Basic Metal Products”.
December 2024	2.2	Added product examples to “Finished Metal Products” and examples for the process “Forming”.
December 2024	2.2	Added plastic packaging as a product example for “Rubber and Plastic Products”.
December 2024	2.2	Changed the product category name “Leather Footwear” to “Footwear”. Added processes to the product category “Footwear” in Table 8.

# 1 OVERVIEW

## 1.1 PURPOSE AND CONTENT

This document defines the processes that constitute the final manufacturing stage by product type for products undergoing assessment for conformance with the Cradle to Cradle Certified Product Standard (the 'Standard') requirements.

## 1.2 STANDARD REQUIREMENTS REFERENCING THE FINAL MANUFACTURING STAGE

A number of requirements in the standard necessitate defining the processes that constitute the final manufacturing stage of a product in order to assess the product for certification. Please refer to the applicable version of the standard (Version 3.1, Version 4.0 or Version 4.1) to review the requirements for which the final manufacturing stage definitions must be applied.

It is also necessary to have defined the final manufacturing stage to determine which facilities require a manufacturing facility site visit. Please refer to the Version 3.1 Standard, Version 4.0 User Guidance and Version 4.1 User Guidance for information regarding the site visit requirements.

## 1.3 SUPPORTING DOCUMENTS

The following documents are to be used in conjunction with this document:

- *Cradle to Cradle Certified® Product Standard, Version 3.1*
- *Cradle to Cradle Certified® Product Standard, Version 4.0*
- *Cradle to Cradle Certified® Product Standard, Version 4.1*
- *C2C Certified® Circularity Standard Version 4.1*
- *C2C Certified Material Health Certificate™ Standard Version 4.0*
- *C2C Certified Material Health Certificate™ Standard Version 4.1*
- *Any applicable supporting documents and guidance posted on the C2CPII website*

Visit the Cradle to Cradle Products Innovation Institute website to download the Standard documents and obtain the most current information regarding the product Standard (<http://www.c2ccertified.org/resources>).

# 2 FINAL MANUFACTURING STAGE DEFINITIONS

## 2.1 SCOPE OF THE FINAL MANUFACTURING STAGE PROCESSES

Due to the variability of manufacturing processes, this document is not intended to be an exhaustive list of processes to include in the final manufacturing stage of each product. It serves instead as an outline of the basic processes to include (when applicable) during the assessment, to be supplemented with any other relevant production processes employed.

If a product does not appear to fit into any of the categories, please send a proposed list of final manufacturing stage processes to the Cradle to Cradle Products Innovation Institute ([certification@c2ccertified.org](mailto:certification@c2ccertified.org)). Where applicable, the proposed list should be based on the processes included in the "Other" field for the relevant industry. For product types that are not yet listed in this document, it is recommended to refer to existing product category rules (if any) as the starting point for defining final manufacturing. The Institute will review and approve proposed lists of processes and add the new product types to future revisions of this document.

## 2.2 FINAL MANUFACTURING STAGE PROCESSES

### 2.2.1 PROCESSES TO BE INCLUDED FOR ALL PRODUCT TYPES

- Packaging process(es) before shipping the product to customers. "Packaging processes" do not include the final manufacturing processes of the packaging itself, unless the packaging is the certified product, certified as a separate product or assessed separately from the product in the Material Health and Product Circularity categories.
- Transport between final manufacturing processes in scope.

### 2.2.2 PROCESSES TO BE INCLUDED BY INDUSTRY CATEGORY

The processes that constitute the final manufacturing stage are defined by industry category in Tables 1-9 below. The definitions were developed using the data sources referenced in Section 3 and experience gained from the assessment of manufacturing processes for certified products to date. The processes listed in the Tables for a given category are required to be included as part of the final manufacturing stage unless they do not occur. These processes may be conducted at applicant facility(ies) and/or at supplier facility(ies). When processes occur at supplier facilities, they are still in scope. This means that the relevant suppliers are subject to the standard requirements applicable to the final manufacturing stage or to final manufacturing stage facilities.

## Table 1: Multi-Component Products

Products that are assemblies of several components are considered “multi-component products.” Examples include (but are not limited to) office chairs and other furniture. When assessing a multi-component product that does not fit into any of the categories outlined in Tables 2 – 8, please follow the general instructions in the table below.

For multi-component products where one or more component(s) are sold separately and included in the certification scope, the final manufacturing processes of those component(s) need to be determined separately and included. Exemption: The component(s) sold separately were specifically designed to be used in the multi-component product and communicated as such, i.e., they can be considered as spare or replacement parts for the multi-component product.

Category	Final Manufacturing Processes	Product Examples	Reference #
Multi-Component Products	All Operations for Final Assembly (excluding operations occurring at the purchaser’s site). “Final assembly” usually refers to assembly occurring at the last facility before the product is shipped to the customer. In general, the scope must include the most significant final assembly processes. If these processes do not occur at the last facility, it may be necessary to include multiple facilities and/or supplier facilities within the scope. Note: If you are unsure how to define the final manufacturing stage, please contact C2CPII for guidance.	Office Systems, Tables, Bed Frames, Mattresses, Pens, Wires, Green Walls and Roofs, Dispensing Systems, Playground Systems	31, 32, 33, 34, 35
Multi-Component Products that are assembled primarily at construction sites	The final manufacturing processes must include those for the majority of the product components ( $\geq 50\%$ by weight) and, within those, the facilities responsible for manufacturing the majority ( $\geq 50\%$ by weight) of the components in scope. Refer to the processes per material type in the tables below as applicable.	Windows that are assembled at the construction site	



**Table 2: Formulated Products**

Category	Final Manufacturing Processes	Product Examples	Reference #
Soaps and Cleaners	Mixing, Pumping, Spray Drying, Extruding (for bar soaps), Filling, Heating, Grinding, Degassing, Cooling	Body Wash, Hair Care, Soaps, Detergents, Cleaning Products	1, 2, 3, 4, 5
Paints and Coatings	Formulation, Paint-Blending <sup>i</sup> , Grinding, Mixing, Filling	Paints, Finishes, Fire-Proofing, Sealants	6
Other Formulated Products	Blending/Mixing <sup>i</sup> , Heating/Cooling (of blending vessel), Filling	Admixtures, Tanning Agents, Coloring Agents, Latex, Dye Formulations, Textile Auxiliaries	7

<sup>i</sup>For formulated products made of discrete components that will be mixed by a professional at point of sale (e.g., paint and color concentrate mixed onsite at a paint shop), the final manufacturing stage is not required to include the final mixing of components.

**Table 3: Construction Products**

Category	Final Manufacturing Processes	Product Examples	Reference #
Cement	Grinding, Mixing, Forming Clinker, Milking, Bagging	Cement	7
Concrete	Pre-Cast: Mixing Concrete, Casting, Curing Ready Mix: Mixing of Concrete, Bagging	Concrete	8
Engineered Stone	Crushing, Mixing, Molding, Leveling, Compressing, Heating in Kiln, Setting, Hardening, Grinding, Finishing	Quartz Countertops	9
Insulation	Fiberglass: Finishing, Sizing, Binding, Compression, Oven Curing, Cooling, Winding, Oven Drying, Oven Cooling, Fabrication, Packaging	Fiberglass Insulation	10

Natural Stone	Block Sawing, Polishing, Sizing, Reinforcement, Finishing	Granite, Marble	11
Tiles, Flagstones, Bricks	Blending, Forming, Finishing, Heating/Drying	Clay Products, Bricks	12
Other	Any processes involved combining/assembling inputs		13

**Table 4: Forestry, Wood, and Paper**

Category	Final Manufacturing Processes	Product Examples	Reference #
Absorbent Hygiene Products	Adding Polymer, Formation, Lamination, Shaping, Cutting, Pressing, Bonding, Finishing	Diaper Linings, Feminine Hygiene	14
(Semi-Finished) Basic Wood Products	Debarking, Sawing, Drying, Edging, Trimming, Planing, Chipping, Sorting, Wood Preservation (e.g. Insecticides, Fungicides)	Structural Wood, Roundwood, Sawnwood <sup>ii</sup>	68, 69, 70
Builder's Joinery and Carpentry of Wood	Cutting, Drying <sup>iii</sup> , Surfacing, Sawing <sup>iv</sup> , Forming, Special Cutting, Joint-Making, Finishing, Impregnation, Wood Treatment	Shingles, Wall Guards, Hardwood Flooring	7, 15
Corrugated Paper and Paperboard	Layering, Pressing, Drying, Embossing, Impregnation, Printing and Pigment Coating, Finishing	Cartons, Boxes, Cases, Record Sleeves	16, 17
Processed Paper and Paperboard	Screening, Silting, De-Watering, Pressing, Smoothing, Drying, Cutting, Calendaring, Embossing, Impregnation, Coating, Printing, Packing, De-Inking	Toilet Paper, Copy Paper	7, 18, 19, 20, 21, 22, 23, 24, 25
Printed Materials	Die Cutting, Cutting, Printing, Binding, Glueing	Journals, Books, Calendars	
Paper and Cardboard Packaging	Converting, Embossing, Impregnation, Printing and Pigment Coating, Finishing	Mailing envelopes	

Wood Particle and Fiberboard	<p><b>General:</b> Screening, Refining, Gluing, Layer Conformation, Boardpress, Coating, Pressing, Cutting, Sanding</p> <p><b>Particleboard:</b> Raw Furnish Drying, Board Shaping by Screening, Blending, Forming, Pressing; Board Finishing by Cooling, Trimming and Sanding.</p> <p><b>Laminate Flooring:</b> Bonding, Pressing, Cooling, Milling, Finishing</p>	Fiberboard, Particleboard, Laminate Flooring	7, 25, 26, 27, 28
Other	Debarking, Cutting, Heating, Drying, Screening, Treatment, Resin Application, Pressing, Sawing, Finishing		29

<sup>ii</sup>Sawnwood products correspond to the definition by Eurostat, FAO, ITTO, and UNECE. 2021.

<sup>iii</sup>“Joint Forest Sector Questionnaire Definitions.”: “Wood that has been produced from roundwood, either by sawing lengthways or by a profile-chipping process and that exceeds 6 mm in thickness. It includes planks, beams, joists, boards, rafters, scantlings, laths, boxboards and “lumber”, etc., in the following forms: un-planed, planed, end-jointed, etc.”

<sup>iii</sup>Cutting and drying refer to processes that may occur during final manufacturing, not to the initial cutting and drying of trees during logging.

<sup>iv</sup>Note that some processes occur both for (Semi-Finished) Basic Wood Products and Builder’s Joinery and Carpentry of Wood, e.g. Sawing. Sawing steps that occur to produce (Semi-Finished) Basic Wood Products may be excluded for Builder’s Joinery and Carpentry of Wood. However, sawing steps involved in Builder’s Joinery and Carpentry of Wood must still be included.

## Table 5: Glass and Ceramics

Category	Final Manufacturing Processes	Product Examples	Reference #
Glass and Ceramics (products that are predominantly [~95-100 %] a single homogenous glass or ceramic material)	Batching, Melting, Coloring, Forming, Stretching, Chemical Treatments, Tempering, Annealing, Grinding, Polishing, Washing, Cutting, Finishing	Glass, Glass Products, Ceramics, Other Non-Metallic Products, Architectural Glass, Glass Packaging	7

**Table 6: Metals and Metal Products**

Category	Final Manufacturing Processes	Product Examples	Reference #
Metal Alloys and (Semi-Finished) Basic Metal Products <sup>v</sup>	Processing, Melting, Alloying, Mixing, Separation, Casting, Extrusion, Rolling, Drawing, Forging, Stamping, Finishing	Steel Alloys and Metal Products in Basic Forms (e.g. Ingots, Billets, Plates, Tubes, Bars, Pipes, Angle, Shapes, Sections, Wires, Sheets)	30, 65, 66, 67
Finished Metal Products (products that are predominantly [~95-100 %] a single homogeneous metal material, except for coatings, fasteners, and labels)	Fabrication (e.g., welding, cutting, bending, hammering, machining, etc.), Spinning, Blanking, Stamping, Annealing, Die-Casting, Molding, Calendaring, Coating, Blowing, Pressing, Forming (e.g., extrusion, drawing, forging, casting, etc.), Finishing <sup>vi</sup>	Mechanical Systems, Structural Metals, Metal Products, Aluminum Lighting Columns, Metal Packaging, Metal Window Frames	7
Insulated Panels	Embossing, De-coiling, Profiling, Edge detailing, Chemical laydown, Lamination, Cutting, Cooling, Stacking		63

<sup>v</sup>(Semi-Finished) Basic Metal Products are those with basic forms that will be further processed into Finished Metal Products, Basic Metal Products correspond to UN Central Product Classification (CPC) Version 2.1, Group 412 and 415.

<sup>vi</sup>Note that some processes might occur for both (Semi-Finished) Basic Metal Products and Finished Metal Products, e.g. Extrusion, Casting, Stamping and Finishing. Process steps that occur to produce (Semi-Finished) Basic Metal Products may be excluded for a Finished Metal Product. However, similar process steps that occur to manufacture Finished Metal Products must be included.

**Table 7: Plastics**

Category	Final Manufacturing Processes	Product Examples	Reference #
Primary Forms	Polymer Production, Compounding, Extrusion, Pelletizing	Resins, Plastic Filament	7, 36
Rubber and Plastic Products (products that are predominantly [~95-100 %] a single plastic type (e.g., PET), except for coatings, fasteners, and labels)	Molding, Mixing (e.g., mixing polymer pellets with a colorant), Extruding, Fabricating, Calendaring, Blowing, Pressing, Spinning, Blending, Thermoforming, Labeling, Foaming, Kneading, Cooling, Powdering, Rolling, Vulcanisation (special pressing), Grinding, Blanking, Finishing	Membranes, Plastic Flooring, Wall Guards, Rubber Carpet Pads, Foam Carpet Pads, Composite Products, Plastic Packaging	37, 63

**Table 8: Textiles, apparel, and footwear**

Category	Final Manufacturing Processes	Product Examples	Reference #
Carpet and Artificial Turf	Tufting, Carpet Dyeing <sup>vii</sup> (yarn dyeing excluded), Coating <sup>vii</sup> , Shearing, Weaving, Finishing, Tile or Roll Cutting	Carpet Rolls, Carpet Tiles, Artificial Turf	38
Apparel	Cutting, Sewing, Dyeing/Printing/Finishing <sup>vii</sup> (yarn dyeing excluded, but includes textile dyeing that occurs prior to cutting/sewing), Washing/Laundering (prior to shipment/sale)	Garments	
Footwear	Cutting, Die Cutting, Sewing, Folding, Binding, Assembly of Footwear-Specific Components (Upper, Sole, Laces, etc.), Finishing	Suede Shoes	39, 64
Nonwoven Textiles	Formation (Spun, Staple, Airlaid, Web etc.), Textile Dyeing <sup>vii</sup> (fiber dyeing excluded), Lamination, Finishing	Nonwoven Upholstery, Sponges	40, 41

Plush Toys	Cutting, Sewing, Stuffing, Finishing	Stuffed Animals	42
Textiles (Woven, Knit, Crocheted)	Weaving, Knitting, Warping, Sizing, Ennoblement, Scoring, Thermofinishing, Fabric Formation, Wet Processing, Textile Dyeing <sup>vii</sup> (yarn dyeing excluded), Printing <sup>vii</sup> , Steaming, Chemical <sup>vii</sup> /Mechanical Finishing	Shadecloths, Fiber Carpet Pads, Towels, Blankets, Polyester	7, 43, 44, 45, 46, 47, 48
Yarn	Scouring, Spinning, Drawing, Extrusion, Texturing, Blending, Multiplying/ Folding/Cabling, Dyeing <sup>vii</sup>	Natural and Synthetic Yarns	7, 49, 50

<sup>vii</sup>Exposure concerns are considered exceptionally high at facilities where these processes occur. A manufacturing facility site visit is required at the facility(ies) where these processes occur even if these processes do not occur at the 'main' final manufacturing facility. See Section 9 of the Cradle to Cradle Certified Product Standard, Version 3.1 or the Version 4.0 User Guidance, Appendix 1 as applicable for additional information about site visits.

**Table 9: Raw Textile Materials**

Category	Final Manufacturing Processes	Product Examples	Reference #
Wool Handling	Shearing, Pick-up, Wool Rolling, Pen-up, Pressing	Wool bale	51, 52
Silk Production	Silk Reeling, Twisting	Raw silk	53, 54, 55
Cotton Production	Cotton Fiber Separation (cotton gin)	Cotton bale	56
Flax Fiber Production	Rippling, Retting, Washing and Drying, Decortication, Breaking, Scutching, Hackling	Flax Fiber	57, 58
Jute Fiber Production	Rippling, Retting, Washing and Drying, Decortication, Breaking, Extraction of Fiber, Grading	Jute Fiber	59, 60
Hemp Fiber Production	Rippling, Retting, Washing and Drying, Decortication, Breaking, Scutching, Hackling	Hemp Fiber	61, 62

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