INTERNATIONAL STANDARD

ISO 20819-1

First edition
2020-04

Plastics — Wood-plastic recycled composites (WPRC) —

Part 1: Specification

Plastiques — Composites recyclés bois-plastique (WPRC) —

Partie 1: Spécifications

Reference number
ISO 20819-1:2020(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, SC 11, *Products*.

This first edition of ISO 20819-1 cancels and replaces ISO 20819:2018, which has been technically revised.

The main changes compared to the previous edition are as follows:

— the condition of method B (emission test chamber method) has been described more precisely;

— the former Annex A has been divided to Annexes A and B.

A list of all parts in the ISO 20819 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Plastics — Wood-plastic recycled composites (WPRC) —

Part 1: Specification

1 Scope

This document specifies the types and proportions of raw materials to be used for wood-plastic recycled composites (hereafter referred to as WPRC). It also specifies the health and safety requirements for WPRC and the methods to test these properties.

This document is applicable to WPRC which are primarily used as building materials.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 472, *Plastics — Vocabulary*

ISO 12460-4, *Wood-based panels — Determination of formaldehyde release — Part 4: Desiccator method*

ISO 12846, *Water quality — Determination of mercury — Method using atomic absorption spectrometry (AAS) with and without enrichment*

ISO 13061-1, *Physical and mechanical properties of wood — Test methods for small clear wood specimens — Part 1: Determination of moisture content for physical and mechanical tests*

ISO 16000-3, *Indoor air — Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air — Active sampling method*

ISO 16000-9, *Indoor air — Part 9: Determination of the emission of volatile organic compounds from building products and furnishing — Emission test chamber method*

ISO 17294-2, *Water quality — Application of inductively coupled plasma mass spectrometry (ICP-MS) — Part 2: Determination of selected elements including uranium isotopes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
wood-plastic recycled composite
WPRC
mixture of woody material/natural fibre and thermoplastics, composited by means of plastic moulding and containing *recycled material* (3.2) as raw material forming at least 40 % of the total composite mass

3.2
recycled material
woody raw material (3.4), recycled plastic raw material, or other recyclable material that is disposed of as waste, which can be used as a raw material of *wood-plastic recycled composite* (3.1)

Note 1 to entry: Different national standards regarding raw material of recycled plastics which consist of halogenated flame retardant should be taken into account.

3.3
virgin material
plastics and other material in the form of pellets, granules, powder, floc, etc., that has not been subjected to use or processing other than that required for its initial manufacture

3.4
woody raw material
plant-derived virgin woody or herb-based material, or plant-derived secondary product to which some processing such as selection, crushing, or grinding has been applied, or woody material included in a WPRC for re-use, that is used as a raw material of *wood-plastic recycled composite* (3.1)

Note 1 to entry: Woody raw material does not include plant-derived plastic materials nor ashes of burned plant-derived materials.

3.5
other raw material
raw material used in *wood-plastic recycled composite* (3.1) other than *woody raw material* (3.4) and plastic raw material

3.6
non-foaming material
wood-plastic recycled composite (3.1) that does not contain internal air voids

3.7
cellular material
wood-plastic recycled composite (3.1) containing internal air voids scattered primarily for the purpose of weight reduction

Note 1 to entry: Cellular material can include material integrated with a non-foaming material using methods such as multilayer moulding.

4 Recycled material content

4.1 Indication of the recycled material content

The recycled material content of WPRC is defined as the ratio of the mass of the recycled materials used to the total mass of material, and shall be indicated as a percentage.

The numerical value of the recycled material content shall be rounded off to the nearest integer.

4.2 Classification of the recycled material content

The classification of recycled material content of WPRC and symbols used to indicate the classification shall be as listed in Table 1.

Table 1 — Classification and symbols of recycled material content

Content classification	Symbol
≥ 40 %	R40
≥ 50 %	R50

Table 1 *(continued)*

Content classification	Symbol
≥ 60 %	R60
≥ 70 %	R70
≥ 80 %	R80
≥ 90 %	R90

Use of the symbol for recycled material content of WPRC indicates that the product thus classified contributes to waste reduction, or is an environmentally friendly product/material promoting sound foresting and forest sink measures as well as environmental/land conservation.

4.3 Formulae for calculating the recycled material content, *R*

4.3.1 The recycled material content *R* of WPRC is calculated using mass values according to Formula (1):

$$R = \frac{m_{WR} + m_{PR} + m_{FR}}{m} \times 100 \quad (1)$$

where

R is the recycled material content, expressed as a percentage;

m_{WR} is the mass of recycled woody raw materials contained in the woody raw materials included in WPRC, expressed in kilograms;

m_{PR} is the mass of recycled thermoplastics raw materials contained in the thermoplastics raw materials included in WPRC, expressed in kilograms;

m_{FR} is the mass of recycled materials in the WPRC where woody raw materials and thermoplastics raw materials are excluded, expressed in kilograms;

m is the total mass of WPRC, expressed in kilograms.

Note in this context that:

$$m = m_W + m_P + m_F$$

$$m_W = m_{WV} + m_{WR}$$

$$m_P = m_{PV} + m_{PR}$$

$$m_F = m_{FV} + m_{FR}$$

where

m_W is the mass of woody raw materials contained in WPRC, expressed in kilograms;

m_{WV} is the mass of virgin woody raw materials contained in woody raw materials included in WPRC, expressed in kilograms;

m_P is the mass of thermoplastics raw materials contained in WPRC, expressed in kilograms;

m_{PV} is the mass of virgin thermoplastics raw materials contained in the thermoplastics raw materials included in WPRC, expressed in kilograms;

m_F is the mass of WPRC where woody raw materials and thermoplastics raw materials are excluded, expressed in kilograms;

m_{FV} is the mass of virgin materials in the WPRC where woody raw materials and thermoplastics raw materials are excluded, expressed in kilograms;

as shown in Table 2.

Table 2 — Components of total mass of WPRC

Total mass of WPRC m					
Woody raw material m_W		**Thermoplastics raw material** m_P		**Other raw material** m_F	
Virgin material m_{WV}	Recycled material m_{WR}	Virgin material m_{PV}	Recycled material m_{PR}	Virgin material m_{FV}	Recycled material m_{FR}

To calculate the total mass of WPRC (m), the values of m_W, m_{WV} and m_{WR} used shall be the values of the individual masses after drying as determined in accordance with ISO 13061-1. The moisture content determined shall be rounded to one decimal place.

4.3.2 Formula (2) is used to calculate the recycled material content of WPRC using mass fraction values, expressed as percentages of the recycled materials contained in each of the woody raw materials and plastic raw materials:

$$R = \frac{w_{WR} w_W}{100} + \frac{w_{PR} w_P}{100} + \frac{w_{FR} w_F}{100} \quad (2)$$

where

R is the recycled material content, expressed as a percentage;

w_W, w_P, w_F are the mass fractions, respectively, of woody raw materials, thermoplastics raw materials, and other raw materials contained in WPRC, expressed as percentages, where $w_W + w_p + w_F = 100$ %;

w_{WV}, w_{WR} are the mass fractions, respectively, of each of the virgin and recycled materials contained the in woody raw materials included in WPRC, expressed as percentages;

w_{PV}, w_{PR} are the mass fractions, respectively, of each of the virgin and recycled materials contained in plastic raw materials included in WPRC, expressed as percentages;

w_{FV}, w_{FR} are the mass fractions, respectively, of each of the virgin and recycled materials contained in raw materials (other than woody or plastic) included in WPRC, expressed as percentages.

Note in this context that:

$w_W + w_P + w_F = 100$ (% of WPRC);

$w_{WV} + w_{WR} = 100$ (% of woody raw materials);

$w_{PV} + w_{PR} = 100$ (% of plastic raw materials);

$w_{FV} + w_{FR} = 100$ (% of other raw materials);

as shown in Table 3.

Table 3 — Total mass fraction of WPRC

Total mass fraction of WPRC, where $w_W + w_P + w_F = 100$					
Woody raw material w_W		**Thermoplastics raw material** w_P		**Other raw material** w_F	
Virgin material w_{WV}	Recycled material w_{WR}	Virgin material w_{PV}	Recycled material w_{PR}	Virgin material w_{FV}	Recycled material w_{FR}

5 Raw materials

5.1 Traceability of raw materials

Raw materials for WPRC shall be verified to be virgin materials or recycled materials through documents or other forms certifying their quality when they are accepted.

5.2 Woody raw materials

Woody raw materials accepted as recycled materials shall be classified as construction-derived, industry-derived, forestry-derived, agriculture-derived, logistics-derived or other, as listed in Table A.1. Table A.2 lists for reference the sources of major items of woody raw materials accepted as recycled materials.

5.3 Plastic raw materials

Plastic raw materials shall be thermoplastics raw materials as listed in Table B. The symbols and abbreviated terms used are given in ISO 1043-1. In addition to those listed in Table B, plastics obtained as waste can also be used as components of WPRC.

5.4 Other raw materials

Other raw materials refer to additives such as lubricants, stabilizers, compatibilisers, pigments and plasticisers.

6 Raw material proportions

6.1 Proportion (mass fraction) of woody raw materials

The proportion of woody raw materials contained in WPRC [w_W (%)] shall be the ratio of the mass of the woody raw materials (m_W) to the total mass of WPRC (m), expressed as a percentage; it is calculated according to Formula (3):

$$w_W = \frac{m_W}{m} \times 100 \quad (3)$$

6.2 Proportion (mass fraction) of plastic raw materials

The proportion of plastic raw materials contained in WPRC [w_P (%)] shall be the ratio of the mass of the plastic raw materials (m_P) to the total mass of WPRC (m), expressed as a percentage; it is calculated according to Formula (4):

$$w_P = \frac{m_P}{m} \times 100 \quad (4)$$

7 Classification

Types of WPRC shall be classified as per Tables 4 and 5, according to moulding method and major use.

Table 4 — Classification by moulding method

Classification	Classification Symbol	Description
Non-foaming material	S	WPRC that does not contain internal air voids
Cellular material	F	WPRC containing internal air voids scattered primarily for the purpose of weight reduction, including material integrated with a non-foaming material using methods such as multilayer moulding.

Table 5 — Classification by major use

Use area	Use area symbol	Major use	Major use symbol	Description
Exterior	EX	— Deck materials, floorboard materials, bench materials — Louvre materials, fencing materials, gate materials, balcony materials, terrace materials, pergola materials — Forms	1	Used in outdoor areas considered to be exposed to relatively large external forces, e.g. people walking
		— Fixture materials, facing materials	2	Used in outdoor areas assumed not to be exposed to external forces, e.g. people walking
Interior	IN	— Flooring materials	1	Used in indoor areas considered to be exposed to relatively large external forces, e.g. people walking.
		— Fixture materials, facing materials	2	Used in indoor areas assumed not to be exposed to external forces, e.g. people walking.

8 Health and safety requirements for materials

The health and safety aspects of WPRC shall conform to Table 6 when tested according to 9.2.

Table 6 — Health and safety aspects

Test			Units	Use area symbol				Applicable test clause
				EX		IN		
				1	2	1	2	
Amount of volatile substance emissions	Formaldehyde	Method A: Desiccator method	mg/l	–		Subject to the standards of each country		9.2.1
		Method B: Emission test chamber method	µg/(m²·h)			Subject to the standards of each country		
	Toluene		µg/(m²·h)			Subject to the standards of each country		9.2.1
	Xylene					Subject to the standards of each country		
	Ethylbenzene					Subject to the standards of each country		
	Styrene					Subject to the standards of each country		
Amount of toxic substance eluted	Cadmium		mg/l	Subject to the standards of each country				9.2.2
	Lead			Subject to the standards of each country				
	Mercury			Subject to the standards of each country				
	Selenium			Subject to the standards of each country				
	Arsenic			Subject to the standards of each country				
	Hexavalent chromium			Subject to the standards of each country				

9 Test methods

9.1 Sampling of test pieces

The criteria for sampling of test pieces from both cellular and non-foaming materials are listed in Table 7.

Table 7 — Criteria for sampling from cellular and non-foaming materials

Test			Sample origin	Sample set criteria	Number of sets of test pieces
Amount of volatile substance emissions	Formaldehyde	Method A: Desiccator method	Taken from a product	One set comprising equivalent test pieces closest to 15 cm × 5 cm and having a total surface area of 1 800 cm^2	2
		Method B: Emission test chamber method	Taken from the product surface	In accordance with ISO 16000-9	1
	Toluene		Taken from a product	In accordance with ISO 16000-9	1
	Xylene				
	Ethylbenzene				
	Styrene				
Amount of toxic substance eluted	Cadmium, lead, mercury, selenium, arsenic, hexavalent chromium		Taken from the product surface	One set comprising equivalent test pieces closest to a total surface area of 2 000 cm^2, e.g. 18 test pieces of 10 cm × 5 cm × 0,5 cm	1

9.2 Health and safety tests

9.2.1 Tests for the volume of volatile substances emitted

The amount of formaldehyde emitted shall be measured using either test Method A [9.2.1 a)] or B [9.2.1 b)]:

a) **Method A** (desiccator method), in accordance with ISO 12460-4. The formaldehyde concentration shall be calculated to one decimal place, and the average of the values obtained from two sets of test pieces shall be rounded to one decimal place.

b) **Method B** (emission test chamber method), in accordance with ISO 16000-3 and ISO 16000-9. The formaldehyde emission rate shall be calculated to the nearest whole integer. This test conditions can be adapted to test methods which has already been established by each country. Furthermore, the result of the test method can't be compared with results of other one.

For the volume of toluene, xylene, ethyl benzene, and styrene emitted, tests shall be conducted in accordance with ISO 16000-9.

9.2.2 Toxic substance elution test

Immerse the test pieces in 1 l of distilled water at 23 °C for 24 h, and remove them. Treat the liquid left as the sample liquid. Analyse this sample liquid according to either test Method A [9.2.2 a)] or B [9.2.2 b)]:

a) **Method A**: Elution of cadmium, lead, selenium, arsenic and hexavalent chromium shall be measured in accordance with ISO 17294-2; the elution of mercury shall be measured in accordance with ISO 12846.

b) **Method B**: The standard analytical method of each country allowing proper determination of each toxic substance (cadmium, lead, selenium, arsenic, hexavalent chromium and mercury) shall be carried out.

Perform the same process without test pieces, as a blank test. Calculate the difference between the results of the analyses of the sample liquid and the blank test liquid.

10 Labelling

Products or packaging shall be labelled as follows; labelling per lot is acceptable:

a) symbol of recycled material content classification;

b) mass fraction (%) of woody raw material;

c) recycling symbol of plastic raw material;

d) mass fraction (%) of plastic raw material;

e) symbol of classification by moulding method;

f) symbols of use area and major use;

g) year and month, or abbreviation, of manufacture;

h) manufacturer's name or abbreviation;

i) type of raw material, indicated as shown in Figure 1 using Tables A.1, A.2 and Table B.1.

For example:

— woody raw material (construction-derived/forestry-derived);

— plastic raw material (PP).

Items a) through f) shall be indicated indelibly below the graphical symbol ISO 7001 - PI PF 066 as shown in Figure 1. Multi-recycled material content may be indicated as shown in Figure 1 through agreement between the sending and receiving parties.

If the WPRC contains more than one plastic raw material, that of the highest content shall be indicated for a) and d) using the symbols listed in Table B.1.

R80 W40 PP 30 S EX-1

R80 symbol indicating the recycled material content classification (see Table 1)

W40 mass fraction of woody raw material (%) (see 6.1)

PP symbol indicating plastic raw material (see 5.3)

30 mass fraction of plastic raw material (see 6.2)

S symbol indicating the classification by moulding (see Table 4)

EX-1 symbols indicating the use area and major use (see Table 5)

Figure 1 — Labelling of content of WPRC

11 Reports

The manufacturer shall submit a performance test report when requested by the user. The manufacturer shall also separately report the items described in Clause 10 in a format agreed between the sending and receiving parties, when requested by the user.

NOTE The purpose of this clause is to allow users to acquire the necessary information about the WPRC even after delivery, in order to facilitate multiple recyclings of WPRC.

Annex A
(normative)

Classification of woody raw materials accepted as recycled materials

Table A.1 — Woody and similar raw materials accepted as recycled materials

Classification group	Type of recycled material
Construction-derived	Construction/building waste
	Pruned branches
Industry-derived	Lumber and factory-processing waste
	Vegetable residues
	Paper manufacturing waste
Forestry-derived	Thinnings, bamboo, forestry-derived waste
Agriculture-derived	Agriculture-derived waste
Logistics-derived	Logistics-derived waste
Other	Waste from households and business offices

Table A.2 — Types of major woody raw materials (and similar) accepted as recycled materials

Type of recycled material	Source of major recycled material
Construction/ building waste	Housing waste composite panels (mould materials), park facility waste, wooden decks and similar, exterior construction waste, construction/building and demolition waste (lumber remnants and remaining materials generated during construction), construction demolition waste (pillars, beams, sleepers, joists, particle boards, and fibre boards)
Pruned branches	Roadside trees (maintained by national government or municipalities, e.g. prefectures, cities, towns and villages), garden trees (maintained by companies or individuals), pruned stalks of grasses.
Lumber and factory-processing waste	Bark, sawdust, shavings, lumber waste including lumber remnants, bamboo lumber scraps, powder from sanding, lumber remnants, particle boards, plywood, fibre boards, waste generated during factory production (e.g. fibre-reinforcing boards), grind-classified items, woody raw materials contained in recycled composite (lumber remnants/scrap wood)
Vegetable residues	Waste generated from the food industry (e.g. tea grounds, coffee grounds, soybean cake)
Paper manufacturing waste	Waste including chip dust and pulp sludge, waste paper
Thinnings	Thinnings for which official notification has been made
Bamboo	Bamboo primarily from bamboo groves left uncontrolled
Forestry-derived waste	Improvement cuttings, forest-thinning waste, branches, roots, driftwood, bark, sawdust
Agriculture-derived waste	Straw, chaff, bagasse, agriculture-derived biomass materials (e.g. kenaf[a]), rice straw, flax, hemp, sisal, coconut
Logistics-derived waste	Wooden pallets, wooden crates, wooden boxes, corrugated cardboard
NOTE Woody-based materials in the form of products (e.g. plant-derived adhesives) are excluded.	
[a] Kenaf in this context is waste generated after initial use for other purposes.	

Table A.2 *(continued)*

Type of recycled material	Source of major recycled material
Waste from households and business offices	Waste including furniture, scrap wood including woody raw materials contained in recycled composites
NOTE Woody-based materials in the form of products (e.g. plant-derived adhesives) are excluded.	
[a] Kenaf in this context is waste generated after initial use for other purposes.	