भारतीय मानक

Indian Standard

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उत्पादों में पुन: उपयोग किए गए घटकों के अनुपात का आकलन करने की सामान्य विधि

General Method for Assessing the Proportion of Reused Components in Products

ICS 13.020.01

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NATIONAL FOREWORD

This Indian Standard which is identical to IEC 63333 : 2023 ‘General method for assessing the proportion of reused components in products’ issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Standardization of Environmental Aspects of Electrical and Electronics Products Sectional Committee and approval of the Electrotechnical Division Council.

The text of IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain terminologies and conventions are, however, not identical to thoseused in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words ‘International Standard’ appear referring to this standard, theyshould be read as ‘Indian Standard’; and

b) Comma (,) has been used as a decimal marker, while in Indian Standards the currentpractice is to use a point (.) as the decimal marker.

For the purpose of deciding whether a particular requirement of this standard is complied withthe final value, observed or calculated expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding of numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of thespecified value in this standard.

CONTENTS

INTRODUCTION

This document provides general methods for assessing the proportion of reused components in products and is intended to be used by manufacturers that want to assess the proportion of reused components in their products. It can be also used by technical committees when developing assessment methods dedicated to their product or product-group publications.

Four calculation methods based on the mass of reused components and the number of reused components are presented. Other methods can exist and be more suitable for certain products or product-groups. While writing product publications on assessing the proportion of reused components, product technical committees can apply the most suitable method for their product (or groups of products).

This document is based on the European standard EN 45556:2019 [1][1], which is part of a family of publications developed by the European CEN and CENELEC Joint Technical Committee 10. It comprises the standardization deliverables in the numerical range of 45550 to 45559, covering topics related to the following material efficiency aspects:

– extending product lifetime;
– ability to reuse components or recycle materials from products at end-of-life;
– use of reused components or recycled materials in products or both.

[1] Numbers in square brackets refer to the Bibliography.

Indian Standard

GENERAL METHOD FOR ASSESSING THE PROPORTION OF REUSED COMPONENTS IN PRODUCTS

1 Scope

This document deals with the assessment of the proportion of reused components in products on a horizontal level, which can be applied at any point in the life of the product.

This document applies to electrical and electronic products. It can also be applied to other product types.

This document is intended to be used in the assessment of the proportion of reused components in products. It can also be used by technical committees when developing assessment methods dedicated to their product or product-group publications.

Aspects like performance, validation, verification and suitability of reused components are not in the scope of this document. It is the responsibility of the user of this document to address these aspects.

This document has the status of a horizontal publication in accordance with IEC Guide 108 [2].

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
component
constituent of a product which cannot be fragmented without losing its particular function

EXAMPLE Resistor, capacitor, diode, antenna, screw, mounting bracket.

[SOURCE: IEC 60050-151:2001, 151-11-21 [3], modified – In the definition "part of a device" has been replaced by "of a product", "physically divided into smaller parts" has been replaced by "fragmented" and the examples have been added.]

3.2
reused component
component removed from a product and used again in another product

Note 1 to entry: A component is reused with or without alteration (e.g. functional or aesthetics alteration).

Note 2 to entry: A component is reused for the same or a different purpose.

Note 3 to entry: A concept diagram of a reused component is shown in Figure 1.

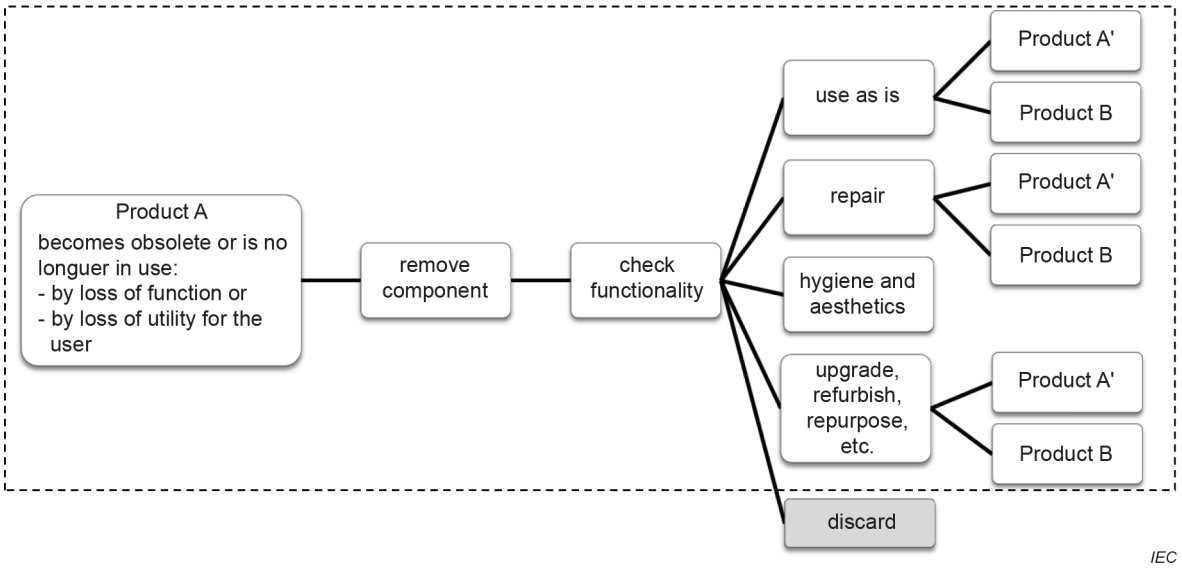


Figure 1 – Concept diagram of a reused component

4 Assessment method for the proportion of reused components in a product

4.1 General considerations

As there are no methods available for directly measuring the proportion of reused components in a product it can be only determined indirectly. Therefore, the verification is by means of documented evidence from the manufacturer, supplier or authorized distributor or any combination of the three. Aspects of traceability, including identification of the reused component or groups of reused components, shall be included in the documentation (see more details in Clause 5 and Annex A).

There is no obligation to collect information for all components, but only components verified as having been previously used can be accounted for as reused components.

NOTE The performance characteristics of reused components can change over time and can be relevant for some product groups. For this document, the performance characteristics of components are not taken into account.

4.2 Calculation of the proportion of reused components

4.2.1 General

The user of this document shall apply at least one of the formulas presented in 4.2.2 to 4.2.5 to calculate the proportion of reused components in products:

– based on product level, by assessing each product individually (as given in 4.2.2 and 4.2.3) or,

– based on mass balance or number balance over a period of time (4.2.4 and 4.2.5).

The period accounted shall be specified, not exceed one year and shall be representative of the production volume.

4.2.2 Proportion of reused components by mass on product level

Formula (1) shall be applied to obtain the proportion of reused components by mass on a product level (expressed in percentage):

$$R_{\text{pm}} = \left(\frac{m_{\text{re}}}{m_{\text{tot}}} \right) \times 100\% \quad (1)$$

where

m_{re} is the total mass of the used components or groups of components (e.g. a printed circuit board assembly, PCBA) in the assessed product;

m_{tot} is the total mass of the product;

R_{pm} is the proportion of reused components by mass of the product.

NOTE 1 All masses are expressed in the same unit and have the same number of significant digits to the right of the decimal separator.

NOTE 2 Components mass based calculation is easy to apply consistently across different products within a product group.

NOTE 3 In some cases, the mass of a component or a group of components does not correlate with its economic value or environmental impact.

See Annex B, Clause B.1 for examples of the application of Formula (1).

4.2.3 Proportion of reused components by number on product level

Formula (2) shall be applied to obtain the proportion of reused components by number on a product level (expressed in percentage):

$$R_{\text{pn}} = \left(\frac{n_{\text{re}}}{n_{\text{tot}}} \right) \times 100\% \quad (2)$$

where

n_{re} is the total number of the used components or groups of components in the assessed product;

n_{tot} is the total number of components in the product;

R_{pn} is the proportion of reused components by number on the product level.

NOTE 1 Assessment based on the number of components can be applied consistently across different products in a product group.

NOTE 2 In some cases, the number of components or groups of components do not correlate with their economic value or environmental impact.

It is essential that at a product or product-group level, a common way to identify and count components and groups of components is defined.

See Clause B.2 for examples of the application of Formula (2).

4.2.4 Proportion of reused components by mass balance

Formula (3) shall be applied to obtain the proportion of reused components by mass balance over the defined period of time (expressed in percentage):

$$R_{\text{bm}} = \frac{\sum_{i=1}^{k} m_{\text{bt}\_i}}{\sum_{i=1}^{k}\left(n_{\text{units}\_i} \times m_{\text{unit}\_i}\right)} \times 100\ \% \tag{3}$$

where

m_{bt_i} is the total mass of used components or groups of components per product type in the defined period;

n_{units_i} is the number of units per product type in the defined period;

m_{unit_i} is the mass per unit of each product type;

R_{bm} is the total proportion of reused components by mass in the defined period for all the assessed products;

k is the number of different product types.

NOTE 1 All masses are expressed in the same unit and have the same number of significant digits to the right of the decimal separator.

NOTE 2 Product types refer to one or both:

- different products of the same category (e.g. television (TV) set) but with different identification numbers (e.g. TV set type A and B);
- products from different categories (e.g. TV set and refrigerator).

Different products can require different forms to obtain the total mass of reused components, depending on for example, the complexity of the business, weight of the product, number of products handled in the accounted period. The user of this document shall determine the most suitable approach to evaluate the total mass of reused components in the defined period and document the chosen approach accordingly.

See Clause B.3 for examples of application of Formula (3) applying both single and multiple product types.

4.2.5 Proportion of reused components by number balance

Formula (4) shall be applied to obtain the proportion of reused components by number balance which is the total number of reused components (measured as input into the system) divided by the total number of the produced products (measured as output) [4] over the defined period of time (expressed in percentage):

$$R_{\text{bn}} = \frac{\sum_{i=1}^{k} n_{\text{bt}\_i}}{\sum_{i=1}^{k}\left(n_{\text{units}\_i} \times n_{\text{components}\_i}\right)} \times 100\ \% \tag{4}$$

where

n_{bt_i} is the total number of used components or groups of components applied to the different product types in the defined period;

n_{units_i} is the number of units of the different product types in the defined period;

$n_{\text{components}\_i}$ is the total number of components per unit for each product type;

R_{bn} is the total proportion of reused components or groups of components by number in the defined period for the assessed products;

k is the number of different product types.

See Clause B.4 for examples of application of Formula (4) applying both single and multiple product types.

5 Documenting the assessment of the proportion of reused components

5.1 General

The assessment of the proportion of the reused components of a product or product group shall be documented.

The need to report the proportion of the reused components to the different target audiences shall be evaluated, and the data classified within the different sensitivity levels 1, 2, and 3 according to Annex A. See more details in [5].

The correlation between information on the results of the assessment and the input data and assumptions used shall be demonstrated.

The documentation shall have the structure specified in 5.2.

5.2 Elements of the assessment

5.2.1 General

1) initiator of the assessment;
2) date of report, place, etc.

5.2.2 Scope of the assessment

1) description of product assessed;
2) description of assumptions applied, e.g. number of products assessed.

5.2.3 Input data and approach for the assessment of the proportion of the reused components

1) description of data and other information used or needed for the assessment, e.g.:
   - mass of the used components or groups of components in the assessed product;
   - total mass of the product;
   - number of the used components or groups of components in the assessed product;
   - total number of components in the product;
   - total mass of used components or groups of components used in the defined period of the products;
   - number of units in the defined period;
   - mass per unit;
   - total number of used components or groups of components used in the defined period;
   - total number of components or groups of components per unit;
2) calculations and accounted period if applicable, e.g.:
   - calculation;
   - accounted period;

3) method(s) used in the assessment:
   - proportion of reused components by mass on product level;
   - proportion of reused components by number on product level;
   - proportion of reused components by mass balance;
   - proportion of reused components by number balance.

5.2.4 Output of the assessment

1) result of the assessment covering a list of qualitative and quantitative reused components content that shall be reported to the different target audiences e.g.:
   - proportion of reused components by mass of the product;
   - proportion of reused components by number of the product;
   - total proportion of reused components by mass in the defined period for the assessed products;
   - total proportion of reused components by number in the defined period for the assessed products;
2) list of applicable references (including standards, legislation, and other requirements).

Annex A
(normative)

Target audience and sensitivity levels

A.1 Target audience and sensitivity levels

When planning provision of information on the proportion of reused components in a product, the needs and capabilities of the intended target audience(s) shall be addressed. Consideration shall be given by the product publications on how the target audience(s) are likely to use or manage the product (including end of use). Matters such as age range, language, technical knowledge, and technical discipline shall also be taken into account.

NOTE 1 ISO 14020 [6] ISO 14021 [7], ISO 14024 [8] and ISO 14025 [9] can be useful for additional information on reused components declarations.

The target audience(s) shall be defined and specified when determining the information on the proportion of reused components to be provided. The material efficiency information is likely to be directed at more than one target audience (e.g. consumers and individuals responsible for repair, or certain types of maintenance).

Three key target audience(s) are defined in this document, representing the receivers of information on the proportion of reused components. Product publications shall take into account all three groups when developing the strategy for ME information provision:

– end-users (including consumers);
– professionals;
– market surveillance authorities.

NOTE 2 End-users can also be business organizations using the product.

NOTE 3 Professionals include but are not limited to installers, repairers, (re-)manufacturers, maintenance operators, upgrade services, treatment and preparing for reuse operators, and retailers.

A.2 Data sensitivity

A.2.1 General

The proportion of reused components information to be communicated can be classified as confidential, restricted or public [10]. Disclosure, alteration or loss of, for instance, confidential data, can cause damage to the manufacturer, its affiliates, or third parties or all three.

Therefore, the provision of data considered as confidential by the manufacturer is at the discretion of the manufacturer, except when mandated by legislation or by voluntary agreements signed by the manufacturer.

The purpose of establishing different data sensitivity levels is to create a communication strategy for the proportion of reused components content based on its level of sensitivity for the manufacturer and relevance for the target audience. The proportion of reused components content can be shared according to three levels, depending on the type and sensitivity of the information with the receiver (target audience) in mind.

The level will depend on, among other aspects, product type, market needs, regulations and sensitivity of the data including for example product safety aspects.

A.2.2 Level 1 – Public

The proportion of reused components content is classified as "public" when the disclosure, alteration or loss of that content would result in little or no damage to the manufacturer and its affiliates, to third parties or customers. Public content also refers to data that shall be disclosed in view of legislation or to comply with a voluntary agreement.

A.2.3 Level 2 – Restricted

The proportion of reused components content is classified as "restricted" when the disclosure, alteration or loss of that content can result in moderate damage to the manufacturer or its affiliates, as well as risks to third parties. Restricted information can be shared by the manufacturer with authorized third parties.

A.2.4 Level 3 – Confidential

The proportion of reused components content is classified as "confidential" when the disclosure, alteration or loss of that content can cause significant damage to the manufacturer or its affiliates, as well as risks to third parties. Confidential data are highly sensitive or valuable information, proprietary or private or both. The highest level of security controls should be applied to confidential data.

Annex B
(informative)

Examples of calculations applying the formulas in this document

B.1 Proportion of reused components by mass on product level

In this example an organization produces three different products (A, B and C) with weights of 10 kg, 12 kg, and 20 kg respectively. For each of these products three different types of reused components ($m_{re(1)}$; $m_{re(2)}$; $m_{re(3)}$) are being applied with different masses:

– mass of the used components $m_{re(1)}$, $m_{re(2)}$ and $m_{re(3)}$ in product A is, respectively, 2 kg, 1 kg, and 1 kg;
– mass of the used components $m_{re(1)}$, $m_{re(2)}$ and $m_{re(3)}$ in product B is, respectively, 1 kg, 1 kg, and 1 kg;
– mass of the used components $m_{re(1)}$, $m_{re(2)}$ and $m_{re(3)}$ in product C is, respectively, 1 kg, 2 kg, and 5 kg.

Applying Formula (1) for each of the products separately, a different proportion of reused components (R_{pm}) by mass for each of these products can be obtained and is shown in Table B.1.

Table B.1 – Overview of the data and results of calculation of the proportion of reused components by mass for different product examples

Variables	Units	Product A	Product B	Product C
$m_{re} = m_{re(1)} + m_{re(2)} + m_{re(3)}$	kg	2 + 1 + 1 = 4	1 + 1 + 1 = 3	1 + 2 + 5 = 8
m_{tot}	kg	10	12	20
R_{pm}	%	4 / 40 × 100 = 40	3 / 12 × 100 = 25	8 / 20 × 100 = 40

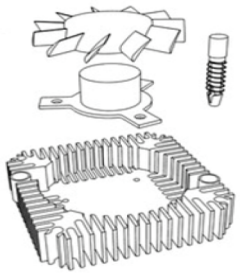
In conclusion, the proportion of reused components for product A is 40 %, for product B is 25 % and for product C, 40 %.

B.2 Proportion of reused components by number on product level

In this example an organization produces three different products (A, B and C) containing 100, 150 and 300 components, respectively. For each of these products four different types of used components ($n_{re(1)}$, $n_{re(2)}$, $n_{re(3)}$ and $n_{re(4)}$ – see examples in Table B.2) are being applied in different quantities namely, 20, 15, 25, 5 for A; 30, 40, 10, 10 for B and 40, 20, 20, 10 for C.

Applying Formula (2) for each of the products separately, the proportion of reused components (R_{pn}) by number is obtained as shown in Table B.2.

Table B.2 – Components examples, data overview and results of calculation for the proportion of reused components by number for different products

Variables	Units	Reused components (examples)	Product A	Product B	Product C
$n_{re(1)}$	—	 IEC	20	30	40
$n_{re(2)}$	—		15	40	20
$n_{re(3)}$	—		25	10	20
$n_{re(4)}$	—		5	10	10
n_{re}	—	$n_{re(1)} + n_{re(2)} + n_{re(3)} + n_{re(4)}$	65	90	90
n_{tot}	—		100	150	300
R_{pm}	%		65	60	30
NOTE The components used in this example are for demonstration purposes only and do not correspond to an actual situation.					

The proportion of reused components by number for products A, B and C is respectively, 65 %, 60 % and 30 %.

B.3 Proportion of reused components by mass balance for a single and multiple product types

B.3.1 Single product type example

In this example an organization produced 30 products of the same type in a certain period of time, in which a total of 36 kg of used components were applied. The mass per unit is 2 kg. Using Formula (3), the (average) proportion of reused components (R_{bm}) by mass per product in the given period can be calculated and is shown in Table B.3.

Table B.3 – Overview of the data and results of calculation for the proportion of reused components by mass balance for a single product type

Variable	Unit	Data and result of calculation
k		1
m_{bt_1}	kg	36
n_{units_1}	—	30
m_{unit_1}	kg	2
R_{bm}	%	60

The proportion of reused components by mass balance in the defined period for the product example is 60 %.

B.3.2 Multiple product types example

In this example an organization produces in a year three different products as follows:

– 200 units of a table-top refrigerator (product A) with a mass of 30 kg;
– 100 units of a standing freezer-refrigerator combination (product B) with a mass of 50 kg;
– 50 units of a microwave-oven combination (product C) with a mass of 20 kg;

where

– three different used components are applied, each having the following masses: re(1): 5 kg, re(2): 2 kg, and re(3): 4 kg

and

– product A uses 2 pieces of re(1), 5 pieces of re(2), and 1 piece of re(3);
– product B uses 5 pieces of re(1), 3 pieces of re(2), and 4 pieces of re(3);
– product C uses 0 pieces of re(1), 3 pieces of re(2), and 2 pieces of re(3).

Applying Formula (3), the total proportion of reused components by mass in the defined period for the whole group of assessed products in the given year is calculated to be 85 % (see details in Table B.4).

Table B.4 – Overview of the data and calculation of the proportion of reused components by mass balance in the defined period for multiple product types)

Variables	Unit	Data and result of the calculation	
k		3	
$m_{bt\_1} + m_{bt\_2} + m_{bt\_3}$	kg	200 × (5 × 2 + 2 × 5 + 4 × 1) + 100 × (5 × 5 + 2 × 3 + 4 × 4) + 50 × (5 × 0 + 2 × 3 + 4 × 2) = 4 800 + 4 700 + 700	10 200
$n_{units\_1} \times m_{unit\_1} + n_{units\_2} \times m_{unit\_2} + n_{units\_3} \times m_{unit\_3}$	kg	200 × 30 + 100 × 50 + 50 × 20 = 6 000 + 5 000 + 1 000	12 000
R_{bm}	%	10 200 / 12 000 × 100	85

B.4 Proportion of reused components by number balance for a single and multiple product types

B.4.1 Single product type example

In this example in a period of one year an organization produced 30 units of a certain product containing 5 components per unit and applying 15 used components in total.

Applying Formula (4), the total proportion of reused components by number in the defined period for the assessed products can be calculated and is shown in Table B.5.

Table B.5 – Overview of the data and calculation of the proportion of reused components by number balance in the defined period for a single product type

Variables	Units	Data and result of calculation
n_{bt_1} (K = 1)	—	15
n_{units_1} (K = 1)	—	30
$n_{components\_1}$ (K = 1)	—	5
R_{bn}	%	10

B.4.2 Multiple product types example

The same example from Clause B.4 is used, but now calculated per number balance. The organization produces in a year three different products as follows:

– 200 units of a table-top refrigerator (product A) containing 30 (groups of) components per unit and applying 9 used (groups of) components;

– 100 units of a standing freezer-refrigerator combination (product B) containing 50 (groups of) components per unit and applying 12 used components;

– 50 units of a microwave-oven combination (product C) containing 40 (groups of) components per unit and applying 20 used components.

Applying Formula (4), the total proportion of reused components by number in the defined period for the whole group of assessed products can be calculated, which is 30,8 %. See details in Table B.6.

Table B.6 – Overview of the data and calculation of the proportion of reused components by number balance in the defined period for multiple product types

Variables	Unit	Data and result of calculation	
k		3	
n_{units_1}; n_{units_2}; n_{units_3}		200; 100; 50	
$n_{components\_1}$; $n_{components\_2}$; $n_{components\_3}$		30; 50; 40	
$n_{bt\_1} + n_{bt\_2} + n_{bt\_3}$		200 × 9 + 100 × 12 + 50 × 20	4 000
$n_{units\_1} \times n_{components\_1} + n_{units\_2} \times n_{components\_2} + n_{units\_3} \times n_{components\_3}$		200 × 30 + 100 × 50 + 50 × 40	13 000
R_{bn}	%	4 000 / 13 000 × 100 =	30,8

Bibliography

[1] EN 45556:2019*, General method for assessing the proportion of reused components in energy-related products*

[2] IEC Guide 108, *Guidelines for ensuring the coherence of IEC publications – Horizontal functions, horizontal publications and their application*

[3] IEC 60050-151, *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices,* available at http://www.electropedia.org

[4] ISO 22095:2020, *Chain of custody – General terminology and models*

[5] EN 45559:2019, *Methods for providing information relating to material efficiency aspects of energy-related products*

[6] ISO 14020:2022, *Environmental statements and programmes for products – Principles and general requirements*

[7] ISO 14021:2016, *Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling)*

[8] ISO 14024:2018, *Environmental labels and declarations – Type I environmental labelling – Principles and procedures*

[9] ISO 14025:2006, *Environmental labels and declarations – Type III environmental declarations – Principles and procedures*

[10] Carnegie Mellon University. *Guidelines for Data Classification,* [viewed 2023-04-19]. Available at http://www.cmu.edu/iso/governance/guidelines/data-classification.html

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BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

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