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Draft Indian Standard

**PLASTICS — ETHYLENE-VINYL ACETATE (EVA) MOULDING AND
EXTRUSION MATERIALS**

PART 1 DESIGNATION SYSTEM AND SPECIFICATIONS

(ICS No. 83.080.20)

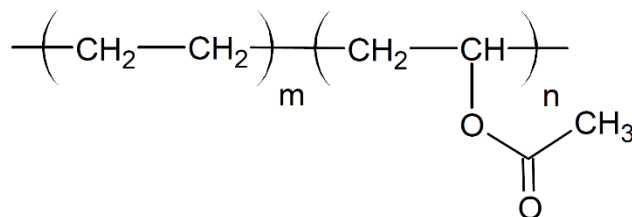
Plastics Sectional Committee,
PCD 12

Last date for receipt of comment is
18 May 2022

FOREWORD

(Formal clause to be added later)

Ethylene-vinyl acetate (EVA), also known as poly (ethylene-vinyl acetate), is the copolymer of ethylene and vinyl acetate with a structure as given below.



EVA is a thermoplastic elastomer that produces materials having "rubber-like" softness and flexibility. The material possesses good gloss and clarity, as well as characteristics like low-temperature durability, stress-crack resistance, waterproof hot-melt adhesive characteristics, and UV resistance. EVA has a vinegar-like odour and is competitive in many electrical applications with rubber and vinyl polymer materials.

Considerable assistance has been derived from ISO 21301-1, while preparing this standard. In order to have uniform practice in the designation system of various resins, IS number is designated as block 1.

The composition of the Committee responsible for the formulation of this standard is given in Annex A (to be included).

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2: 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

- 1.1** This Standard prescribes the requirements, methods of sampling and test for ethylene-vinyl acetate thermoplastic material and also establishes a system of designation for ethylene-vinyl acetate thermoplastic material.
- 1.2** The ethylene-vinyl acetate (EVA) plastics are differentiated from each other by a classification system based on appropriate levels of the designatory property like vinyl acetate content, melt mass-flow rate and on information about the intended application and/or method of processing, important properties, additives, colorants, fillers and reinforcing materials.
- 1.3** This standard is applicable to all ethylene vinyl acetate copolymers having a mass fraction of 3 percent to 50 percent (approximately 25 percent molar) of vinyl acetate. It applies to materials ready for normal use in the form of powder, granules or pellets and to materials unmodified or modified by colorants, additives, fillers, etc.
- 1.4** From this standard, it is not intended to imply that materials having the same designation give necessarily the same performance. This standard does not provide engineering data, performance data or data on processing conditions which might be required to specify a material for a particular application and/or method of processing. If such additional properties are required, they are determined in accordance with the test methods specified in IS XXXXX (Part 2) [PCD/12/19130].
- 1.5** In order to specify a thermoplastic material for a particular application or to ensure reproducible processing, additional requirements can be given in data block 6.

2 REFERENCES

The Indian standards and other publications listed below contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the edition indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

IS/Other Publication	Title
IS 2491 : 2013	Food hygiene — General principles — Code of practice (<i>third revision</i>)
IS 2828 : 2019/ISO 472 : 2013	Plastics — Vocabulary (<i>second revision</i>)
IS 9833 : 2018	List of colourants for use in plastics in contact with foodstuffs and pharmaceuticals (<i>second revision</i>)
IS 9845 : 1998	Determination of overall migration of constituents of plastics materials and articles intended to come in contact with foodstuffs — Method of analysis (<i>second revision</i>)
IS 13449 : 1992	Positive list of constituents of ethylene vinyl acetate (EVA) copolymers in contact with foodstuffs, pharmaceuticals and drinking water

IS 13601 : 1993	Ethylene vinyl acetate (EVA) copolymers for its safe use in contact with foodstuffs, pharmaceuticals and drinking water — Specification
ISO 1043-1 : 2011	Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics
ISO 1043-2 : 2011	Plastics — Symbols and abbreviated terms — Part 2: Fillers and reinforcing materials
ISO 8985 : 2022	Plastics — Ethylene/vinyl acetate copolymer (EVAC) thermoplastics — Determination of vinyl acetate content
PCD/12/19130 / ISO 21301-2 : 2019	Plastics — Ethylene-vinyl acetate (EVAC) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties (<i>under wide circulation</i>)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 2828 shall apply.

4 DESIGNATION SYSTEM

4.1 General

4.1.1 Designation code for EVA material shall be done based on six data blocks. The designation shall consist of following information given in the order presented and shall be codified in different blocks as indicated below:

Data Block 1	For Indian Standard
Data Block 2	For identification of the material and composition of the vinyl acetate monomer
Data Block 3	For fillers or reinforcing materials and their nominal content
Data Block 4	For intended application or method of processing, important properties, additives and supplementary information
Data Block 5	For designatory properties
Data Block 6	For additional information

4.1.2 Designation may also include an optional data block mentioning the description, before data block 1.

Example — The designation consists of an optional description block, reading “Thermoplastics”.

4.1.3 Each data block shall be separated by space or hyphen.

4.1.4 If a data block is not used, this shall be indicated by double comma (,,).

4.1.5 In case of data block 6, as it is for additional information, if no information is to be specified, double comma (,,) may or may not be used.

4.2 Designation System Codification

4.2.1 Data Block 1 — For Indian Standard.

4.2.2 Data Block 2

Code used for the identification of ethylene-vinyl acetate is EVA. In this data block, vinyl acetate content (percentage by mass) is also indicated.

The vinyl acetate content shall be determined in accordance with ISO 8985. The vinyl acetate content is classified by 8 cells and coded by 2-figure code-number as specified in Table 1.

Table 1 — Code for vinyl acetate content
(Clause 4.2.2)

Sl No.	Code-number	VA content (mass fraction in percentage)
(1)	(2)	(3)
i.	03	>3 to ≤ 5
ii.	08	>5 to ≤ 10
iii.	13	>10 to ≤ 15
iv.	18	>15 to ≤ 20
v.	23	>20 to ≤ 25
vi.	28	>25 to ≤ 30
vii.	35	>30 to ≤ 40
viii.	45	>40 to ≤ 50

4.2.3 Data Block 3

4.2.3.1 The type of filler or reinforcing material is coded by one letter in position 1 and its physical form by a second letter in position 2 as shown in Table 2. Subsequently, the mass content may be given by two figures in positions 3 and 4. The first figure number is presented by 0 and the second figure number is the figure of the mass content, if the mass content of filler and/or reinforcing material is less than 10 percent.

4.2.3.2 Mixtures of filler materials or forms may be indicated by combining the relevant codes using the sign “+” within parentheses followed by the total filler content outside the parenthesis. For example, a mixture of 25 percent glass fibres (GF) and 10 percent mineral powder (MD) would be indicated by (GF+MD)35 or (GF25+MD10).

Table 2 — Code-letters for fillers and reinforcing materials and their physical form in data block 2
(Clause 4.2.3)

Sl No.	Code-letter	Material (Position 1)	Form (Position 2)
(1)	(2)	(3)	(4)
i.	B	Boron	Beads, spheres, balls
ii.	C	Carbon ¹⁾	
iii.	D		Fines, powder

iv.	F		Fibre
v.	G	Glass	Ground
vi.	H		Whiskers
vii.	K	Calcium carbonate	
viii.	L	Cellulose	
ix.	M	Mineral ¹⁾ , metal ^{1), 2)}	
x.	S	Synthetic organic ¹⁾	Flakes
xi.	T	Talcum	
xii.	X	Not specified	Not specified
xiii.	Z	Others ^a	Others

NOTES:

- 1 These materials may be identified after the code-letter, e.g. by chemical symbol or additional codes as agreed between buyer and supplier.
- 2 Metal fillers shall be identified by their chemical symbol (in capital letters) after the mass content. For example, 5 percent steel whiskers may be designated "MH05FE".

4.2.4 Data Block 4

4.2.4.1 Information about intended application and/or method of processing is given in position 1 and information about important properties, additives and colour in positions 2 to 8. Code used for the intended application and/or method of processing and important properties, additives and colour shall be as per Table 3.

4.2.4.2 If information is given for important properties, additives and colour and no specific information is available for intended application and/or method of processing, the code X shall be used in position 1.

4.2.4.3 If information about important properties, additives and colour in position 2 to 8 is not applicable, then the designation code is not required. In such case, designation code will be of single digit (Position 1) for data block 4.

Table 3 — Code-letters used in data block 4
(Clause 4.2.4)

Sl No.	Code-letter	First letter	Letters 2 to 8
(1)	(2)	(3)	(4)
i.	A	Adhesives	Processing stabilized
ii.	B	Blow moulding	Antiblocking
iii.	C	Calendering	Coloured
iv.	D		Powder
v.	E	Extrusion	Expandable
vi.	F	Extrusion of films	Special burning characteristics
vii.	G	General use	Granules

viii.	H		Heat stabilized
ix.	K	Cable and wire	Metal deactivated
x.	L	Monofilament extrusion	Light stabilized
xi.	M	Moulding	Nucleated
xii.	N		Natural (no colour added)
xiii.	P		Impact modified
xiv.	Q	Compression moulding	
xv.	R	Rotational moulding	Mould release agent
xvi.	S	Sintering	Lubricated
xvii.	T	Tape manufacture	Transparent
xviii.	X	No indication	Crosslinkable
xix.	Y		Increased electrical
xx.	Z		Antistatic

4.2.5 Data Block 5

4.2.5.1 In this data block, the melt mass flow rate is coded by a letter and a 3-figure code number. If a property value falls on or near a range limit, the manufacturer shall state which range will designate the material. If subsequent individual test values lie on, or on either side of, the limit because of manufacturing tolerances, the designation is not affected.

NOTE — Not all combinations of the values of the designatory properties have to be provided for currently available polymers.

4.2.5.2 Melt Mass Flow Rate

Designatory property of material include melt mass flow rate. The test conditions used are coded by one letter, as specified in Table 4, in front of the cell code.

4.2.5.2.1 Test conditions B is used only for materials having a melt mass flow rate greater than 100 when tested under test conditions D.

4.2.5.2.2 Test conditions Z is used only for materials having a melt mass flow rate greater than 100 when tested under test conditions B.

Table 4 — Test conditions used for the determination of melt mass-flow rate
(Clause 4.2.5.2)

Sl No.	Code-letter	Temperature (°C)	Nominal load kg)
(1)	(2)	(3)	(4)
i.	D	190	2.16
ii.	B	150	2.16
iii.	Z	125	0.325

4.2.5.3 The melt mass flow rate is classified by sixteen cells and coded by three figures as specified in Table 5. The test conditions used shall be indicated by a single letter, selected from Table 4, immediately preceding the code-number.

Table 5 — Ranges of melt mass-flow rate in data block 4
(Clause 4.2.5)

Sl No.	Code-number	Range of melt flow rate (g/10 min)
(1)	(2)	(3)
i.	000	≤ 0.10
ii.	001	>0.10 to ≤ 0.20
iii.	003	>0.20 to ≤ 0.40
iv.	006	>0.40 to ≤ 0.80
v.	012	>0.80 to ≤ 1.5
vi.	022	>1.5 to ≤ 3.0
vii.	045	>3.0 to ≤ 6.0
viii.	090	>6.0 to ≤ 12
ix.	200	>12 to ≤ 25
x.	400	>25 to ≤ 50
xi.	700	>50 to ≤ 100
xii.	715	>100 to ≤ 200
xiii.	725	>200 to ≤ 300
xiv.	740	>300 to ≤ 450
xv.	750	>450 to ≤ 600
xvi.	770	>600 but ≤ 800

4.2.6 Data Block 6

The indication of additional requirements in this optional data block, in a way transforms a designation into a material's specification for a specific application. This can be accomplished by referring to a relevant Indian Standard.

4.3 Coding Example

There will be no space or hyphen between two alphabets/number within a block except data block 1, but each data block will be mentioned and separated by a space or hyphen. Each data block is restricted with maximum number of letter/ numbers as mentioned below.

Data Block 1	Maximum 8 character
Data Block 2	Maximum 5 character (3 character for polymer and 2 for Vinyl acetate content)
Data Block 3	Maximum 11 character
Data Block 4	Maximum 8 character
Data Block 5	Maximum 4 character (one for test condition and 3 for melt mass flow rate)
Data Block 6	Maximum 8 character

5 EXAMPLES OF DESIGNATIONS

5.1 An ethylene-vinyl acetate thermoplastic material (EVA) with a vinyl acetate content of a mass fraction of 4 percent (03) intended for extrusion of film (F) with lubricant (S) and a melt flow rate (MFR 190/2.16) (D) of 2 g/10 min (022) would be designated:

Description Block [optional]	Indian Standard number Block 1	Block 2	Block 3	Block 4	Block 5	Block 6
Thermoplastics	IS XXXXX	EVA03	”	FS	D022	”
Data Block 1						
Data Block 2: Abbreviated term VAC content						
Data Block 3: None						
Data Block 4: Position 1: For film extrusion Position 2: Lubricated						
Data Block 5: Melt mass-flow rate (conditions) Melt mass-flow rate (range)						
Data Block 6: No additional information						

Designation: Thermoplastics IS XXXXX-EVA03-,-FS-D022-,, or

IS XXXXX-EVA03-,-FS-D022-,, or

IS XXXXX-EVA03-,-FS-D022

5.2 An ethylene-vinyl acetate thermoplastic material (EVA) with a vinyl acetate content of a mass fraction of 17 percent (18), a mixture of 30 percent (30) glass (G) fibre (F), intended for injection moulding (M) with a melt flow rate (MFR 190/2.16) (D) of 19 g/10 min (200) would be designated:

Description Block [optional]	Indian Standard number Block 1	Block 2	Block 3	Block 4	Block 5	Block 6
Thermoplastics	IS XXXXX	EVA18	GF30	M	D200	"
Data Block 1						
Data Block 2: Abbreviated term VAC content						
Data Block 3: Reinforced with 30% glass fibres						
Data Block 4: Position 1: Injection moulding						
Data Block 5: Melt mass-flow rate (conditions) Melt mass-flow rate (range)						
Data Block 6: No additional information						

Designation: Thermoplastics IS XXXXX-EVA18-GF30-M-D200-, or
IS XXXXX-EVA18-GF30-M-D200-, or
IS XXXXX-EVA18-GF30-M-D200

6 REQUIREMENTS

6.1 Vinyl Acetate Content

The vinyl acetate content of the material shall be designated as per table 1, based on the value as agreed between purchaser and supplier. It shall be determined in accordance with Annex B of IS 13601 or ISO 8985.

6.2 Melt Mass Flow Rate

The melt mass flow rate of the material shall be designated as per table 5, based on the value as agreed between purchaser and supplier. It shall be determined in accordance with IS XXXXX / ISO 21301-2 [PCD/12/19130] under the test conditions specified in Table 4.

6.3 Special Requirements of Polymer Used for Molding or Extrusion Articles in Contact with Food Stuffs, Pharmaceutical and Drinking Water

6.3.1 Additives used in the material, which is meant for usage in contact with foodstuffs, pharmaceuticals and drinking water are given in IS 13449, for guidance purpose.

6.3.2 When the products are used in contact with foodstuffs, pharmaceuticals and drinking water, its requirements with respect to the material shall also be meet the following:

6.3.2.1 *Pigments and Colourants*

In case the coloured material is used for food-packaging applications it shall comply with the list and limits of the pigments and colourants prescribed in IS 9833.

6.3.2.2 *Overall Migration*

The material shall comply with the overall migration limits as detailed below when tested by the method prescribed in IS 9845.

- a) 60 mg/kg, *Max* of the foodstuff; in the case of liquid foodstuffs or of simulants, the limit shall be 60 mg/l, *Max*. However, the value of the overall migration limit shall be equal to 10 mg/dm² of the surface of the material or article in the following cases:
 - i) Containers or articles which are similar to containers or which in any case may be filled to a capacity less than 250 ml, provided it is possible to calculate the surface area of contact with the foodstuff.
 - ii) Sheets, foils and other non-fillable articles for which ratio between the surface area of the material or article and the quantity of foodstuffs, in contact may not be calculated.

6.3.2.3 *Storage and Control*

6.3.2.3.1 *Storage*

Plastics materials intended for food contact use shall be stored separately from materials in closed, properly identified containers.

6.3.2.3.2 *Control*

An authorized person shall supervise and control the issue of plastics materials to the process or manufacturing area and shall maintain appropriate records of the issue of such materials.

6.3.2.3.3 Adequate standards of hygiene (IS 2491) shall be maintained at all times and plant operators and store men shall be trained in proper hygiene practices.

6.3.3 The requirements mentioned in 6.3.2 will remain valid as long as the chemical composition and manufacturing process remains the same. In case of any change in chemical composition and/or manufacturing processes, the requirements mentioned in 6.3.2 shall be tested.

7. PACKING AND MARKING

7.1 Packing

The material shall be packed in suitable form of packing, as agreed to between the purchaser and the supplier.

7.2 Marking

7.2.1 Each bag and/or unit package whichever is smallest in size that is being delivered to the customer shall be clearly marked with the following:

- a) Name and type of the material;
- b) Designation code;
- c) Net mass of the material;
- d) Batch number/ Lot number;
- e) Month and year of manufacture of the material;

NOTE — Batch number/ Lot number may reflect Month and Year of Manufacture of the material. If not, it has to be printed separately as mentioned in (e).

- f) Name of the manufacturer and trademark, if any; and
- g) Any other statutory requirements.

7.2.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the Bureau of Indian Standards *Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

8 SAMPLING

8.1 GENERAL

In drawing, preparing, storing and handling samples, the precautions and directions given in **8.1.1** to **8.1.6** shall be observed.

8.1.1 Samples shall be collected in a closed environment.

8.1.2 The sampling instrument shall be of stainless steel or any other suitable material on which the material shall have no action. The instrument shall be clean and dry.

8.1.3 Precautions shall be taken to protect the samples, the materials being sampled, the sampling instrument and the containers for samples from adventitious contamination.

8.1.4 The samples shall be placed in a suitable clean, dry, air-tight, plastic/metal/glass container on which the material has no action. The sample container shall be of such a size that it is almost completely filled by the sample.

8.1.5 Each sample container shall be sealed air-tight with a stopper after filling and marked with full details of sampling, such as the date of sampling, the month and year of manufacture of the material, etc.

8.1.6 Samples shall be stored in such a manner that the temperature of the material does not vary unduly from the normal temperature.

8.2 Scale of Sampling

8.2.1 Lot/Batch

For continuous chemical processes like polymer production, the sampling shall be done from sealed bags/packages or other representative sampling points after proper homogenization of the material.

To get the representative samples from the entire lot/batch, random sampling to be done from the entire lots / batches irrespective of the size of lot/batch. The number of sampling to be done as per Table 6 based on the quantity of the lot / batch.

**Table 7 Number of Containers to be
Selected for Sampling**
(Clause 8.2.1)

Lot Size (MT)	Number of the Sealed Bag / Package for Sampling
(1)	(2)
Up to 600	3
> 600 to 1000	4
> 1000	5

Approximately 1 kg (or higher quantity required for testing) of sample collected from each of the above sealed bag into a clean plastic bag to have approximately 3 kg composite sample. Proper mixing to be done for homogenisation of composite sample before testing.

Based on the requirement of testing, the portion of the composite sample shall be stored properly in two containers as mentioned in **8.1.4**. Sample of the one container shall be used for testing in front of inspection authority at manufacturer site/laboratory. The other sample container shall be stored (maximum 6 months) and properly labelled as a reference sample for the testing in future, if it is required in case of any dispute or other requirement.

8.3 Sampling Instrument

8.3.1 The sampling instrument made of stainless steel shall be as shown in Fig. 1. It shall be capable of taking samples from all points when inserted into the container / bag. In case of multilayer film sack (FFS bag) sampling may be done by opening the bag and collect the sample.

8.3.2 From each of the containers / bags selected, portions of the material shall be drawn with the help of the sampling instrument. The total quantity of the material collected from each container/bag shall be sufficient to conduct tests for the determination of the various characteristics as required.

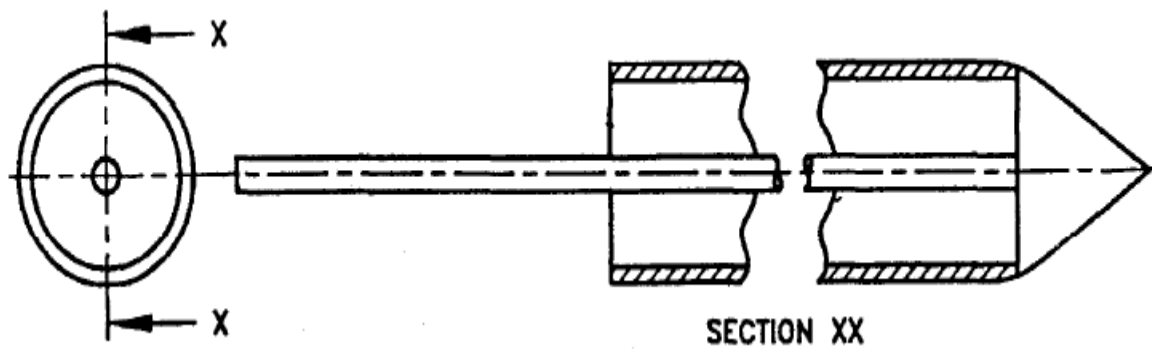


FIG. 1 SAMPLING INSTRUMENT

8.4 Number of Tests

8.4.1 Tests for the determination of vinyl acetate content and melt mass flow rate shall be conducted individually from a portion of composite samples, kept in the bottle/container.

8.5 Criteria for Conformity

a) Each of the test results for vinyl acetate content and melt mass flow rate shall satisfy the corresponding requirements given in **6.1** and **6.2**.