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फ़्लोरोपॉलीमर डिस्पर्स तथा संकचन और बहिर्वेधन के लिए सामग्री
भाग 1 अभिमान प्रणाली

Draft Indian Standard

FLUOROPOLYMER DISPERSIONS AND MOULDING AND EXTRUSION MATERIALS
PART 1 DESIGNATION SYSTEM

[*Second Revision of* IS 14635 (Part 1)]

(ICS 83.080.20)

Plastics Sectional Committee,	Last date for Comments
PCD 12	**11 August 2024**

FOREWORD

Polytetrafluoroethylene is commonly known by its acronym 'PTFE'. It is also referred to TFE resin or TFE fluorocarbon resin, the acronym for the monomer is sometimes used misleadingly by itself to mean the polymer, PTFE.

PTFE was developed from research on new refrigerants by the Du Pont Co, USA. A combination of extreme resistance to chemicals and to very high temperatures, superb electrical properties and unique surface properties made the inroads for the commercial production of the material and after World War II, the polymer became available for critical industrial uses. PTFE is made by a free-radical initiated polymerization of the gaseous monomer, tetrafluoroethylene, in an aqueous medium under pressure. It is available as two major kinds of polymer with various sub-classes within each, namely, granular (coarse-ground powder, finely divided powders), agglomerated forms of the finely divided type, presintered powder and the dispersion-based polymer.

PTFE is a remarkably tough thermoplastic as compared to most other plastics materials. Its upper use temperature is 260°C and is reported to give ductile rather than brittle failures at temperatures just above absolute zero. The mechanical properties of PTFE at room temperatures are similar to those of medium density polyethylene relatively soft with high elongation; the properties are retained to a useful extent over the wide range of temperatures. PTFE does not absorb

electromagnetic radiation in the visible or ultraviolet range and as such has a very high resistance to outdoor weathering. It has got a very low dielectric constant, 10 SS factor as low or lower than any other material, high dielectric strength, high surface resistivity and high resistance to arcing, which are maintained over both a wide range of temperatures and a very wide range of electrical frequencies. Resistance to chemical attack was the first property of PTFE that was used in practice and remains a major factor in current applications. It has been dissolved in only a very few, very rare chemicals. It is, however, attacked by molten alkali metals and by elemental fluorine and pure oxygen at elevated temperatures. The critical surface tension of PTFE is so low that it provides an excellent anti-stick or release surfaces. Surprisingly, its resistance to wear during rubbing or sliding is poor, which, however, is improved the most when PTFE is compounded with chopped glass fibres and many other particulate fillers.

PTFE is selected for a wide range of applications, such as, gaskets, seals, coatings or linings in large tanks or process vessels, component parts of valves, piping (solid, lined or laminated), etc, in chemical process industries; in electrical insulation covering the entire wire, cable and speciality electrical products industry; seal rings in automotive power-steering equipment and automatic transmissions, piston rings in non-lubricated compressor equipment; cookware and bakeware products; coverings on rollers in food processing equipment; xerographic copiers and saw-blades; coatings on snow shovels; cardiovascular grafts, heart patches, ligaments for knees using special forms of PTFE (high strength porous products) architectural fabric making used as roofs in wide variety buildings especially where a large area must be enclosed with minimum support, etc. However, in many applications for which PTFE is functionally satisfactory, it is not used because of its very high cost, being not competitive economically.

The rheological properties of PTFE are so different from the usual thermoplastic materials that the common techniques of melt processing (extrusion or injection moulding) are not feasible. A series of techniques have been developed that are unique to PTFE industry and each type of operation has its own name in the industry, namely, with granular powders — billet moulding and skiving, sheet moulding, preforming and sintering, ram extrusion; with fine powders (dispersion based) — lubricated extrusion; with aqueous dispersion — coating, casting, impregnation, coagulation, etc. Broadly, nearly all the PTFE is processed by forming the resin to an approximate final shape at or near room temperature and then completing the operation by heating (sintering) the material at a temperature above the melting point and cooling to adjust the crystalline content of the final product.

This wide scope of PTFE materials has demanded a national standard to specify accurately those properties of the material which would satisfy their specific requirements.

This Indian Standard was originally published in 1999 and subsequently revised in 2020. The original standard was formulated based on ISO 899-1 : 1993 ‘Plastics — Determination of creep behaviour Part 1: Tensile creep’ issued by the International Organization for Standardization (ISO) and ASTM D1457 : 1990 ‘Standard specification for polytetrafluoroethylene (PTFE) moulding and extrusion materials’ issued by the American Society for Testing and Materials (ASTM), USA.

During the first revision, the Committee split the standard into two parts, as given below:

Part 1 Designation system
Part 2 Preparation of test specimens and determination of properties

The Committee also decided to restrict Perfluorooctanoic Acid (PFOA) [CAS No 335-67-1, EC No 206-397-9] and its salts which is classified by International Agency for Research on Cancer (IARC), Lyon under group 2B that is Possibly carcinogenic to humans. PFOA is identified as a substance meeting the criteria of Article 57 (c) of Regulation (EC) 1907/2006 (REACH) owing to the recent RAC opinion which concludes that PFOA should be classified as toxic for reproduction category 1B in accordance with the CLP Regulation (Regulation (EC) 1272/2008. This corresponds to classification as toxic to reproduction category 2 in accordance with Directive 67/548/EEC. The substance is identified as PBT according to Article 57 (d) of REACH.

In this revision (second), the major changes are as follows:

i) Additional designatory properties (tensile strength and elongation at break) have been included for melt-processable resins;
ii) Cross-referred has been updated; and
iii) Editorial corrections have been made.

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 : 2022 'Rules for rounding off numerical values (*second revision*)'. 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 (Part 1) prescribes a designation system, method of sampling and test for fluoropolymer materials.

1.2 The various types of fluoropolymer are differentiated from each other by a classification system based on appropriate levels of the designatory properties and on information about the intended application and/or method of processing, important properties, additives, colorants, fillers and reinforcing materials.

1.2.1 *For Polytetrafluoroethylene (PTFE)*

For PTFE granular moulding and ram extrusion materials, and for PTFE resin produced from coagulation of dispersion

a) Standard specific gravity (SSG)
b) Thermal instability index (TII)
c) Bulk density
d) Particle size
e) Tensile properties (tensile strength and tensile yield stress, percentage elongation at break and tensile modulus)

f) Dielectric strength (for PTFE granular moulding and ram extrusion materials, only)
g) Powder flow time (for PTFE granular moulding and ram extrusion materials, only)
h) Deformation temperature under load
j) Melting peak temperature
k) Extrusion pressure (for PTFE resin produced from coagulation of dispersion, only)
m) Stretching void index (for PTFE resin produced from coagulation of dispersion, only)

1.2.2 *For Aqueous Dispersion of PTFE*

a) PTFE percentage in dispersion
b) Surfactant percentage in dispersion
c) Surfactant tolerance level

1.2.3 *For Melt-processable Resins (CPT, ECTFE, EFEP, ETFE, FEP, PFA, PVDF, PVF, VDF/CTFE, VDF/HFP, VDF/TFE, VDF/TFE/HFP)*

a) Melting peak temperature
b) Melt mass-flow rate
c) Density
d) Deformation temperature under load
e) Tensile Strength
f) Elongation at Break

1.2.4 *For PCTFE*

a) Zero-strength time (ZST)

1.2.5 *For TFE/PDD (Test Method and Description Not Included)*

a) Glass transition temperature (T_g)

1.2.6 *For Aqueous Dispersion of Melt-processable Resins (ETFE, FEP, PFA, PVDF, PVF, VDF/CTFE, VDF/HFP, VDF/TFE, VDF/TFE/HFP)*

a) Polymer percentage in dispersion
b) Surfactant percentage in dispersion
c) Surfactant tolerance level

1.3 The designation system is applicable to all fluoropolymers and blends. It applies to unmodified materials ready for normal use and materials modified, for example, by colorants, additives, fillers, reinforcing materials and polymer modifiers.

1.4 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 may be required to specify a material. If such additional properties

are required, they are intended to be determined in accordance with the test methods specified in IS 14635 (Part 2).

1.5 In order to specify a thermoplastic material for a particular specification, the requirements are to be given in data block 5 (*see* **4.1**).

2 REFERENCES

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

IS No./Other Publication	*Title*
IS 2828: 2019	Plastics — Vocabulary (*second revision*)
IS 4905: 2015	Random sampling and randomization procedures (*first revision)*
IS 13360	Plastics — Methods of testing
(Part 3/Sec 10): 2021/ISO 1183-1: 2019	Physical and dimensional properties, Section 10 Determination of density of non-cellular plastics — Immersion method liquid pyknometer method and titration method (*first revision*)
(Part 3/Sec 11): 2021/ISO 1183-2: 2019	Physical and dimensional properties, Section 11 Determination of density of non-cellular plastics — Density gradient column method (*first revision*)
(Part 5/ Sec 2): 2017	Mechanical properties, Section 2 Determination of tensile properties — Test conditions for moulding and extrusion plastics (*first revision)*
(Part 6/Sec 17): 2017	Thermal properties, Section 17 Determination of temperature of deflection under load — Plastics and ebonite (*second revision)*
14635 (Part 2): 2020	Fluoropolymer dispersions and moulding and extrusion materials : Part 2 Preparation of test specimens and determination of properties (*first Revision*)
ISO 1043-1: 2011	Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics
ISO 11357-2: 2020	Plastics — Differential scanning calorimetry (DSC) — Part 2: Determination of glass transition temperature and glass transition step height
ISO 25101: 2009	Water quality — Determination of perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) — Method for unfiltered samples using solid phase extraction and liquid chromatography/mass spectrometry
IEC 60243-1: 2013	Electric strength of insulating materials — Test methods Part 1 Tests at power frequencies
ASTM D149: 2020	Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

ASTM D1430: 2017	Standard Classification System for Polychlorotrifluoroethylene (PCTFE) Plastics
ASTM D4591: 2017	Standard Test Method for Determining Temperatures and Heats of Transitions of Fluoropolymers by Differential Scanning Calorimetry

3 TERMS AND DEFINITIONS

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

3.1 Melt-processable — Capable of being processed by, for example, injection moulding, screw extrusion and other operations typically used with thermoplastics.

3.2 Presintered Resin — Resin that has been treated thermally at or above the melting point of the resin at atmospheric pressure without having been previously preformed.

3.3 Reprocessed Plastic — Material from the manufacture of semi-finished forms of fluoropolymers that has been converted to a form suitable for further use.

3.4 Sintering — Thermal treatment during which the material is melted and recrystallized by cooling, with coalescence occurring during the treatment.

3.5 Standard Specific Gravity (SSG) — Specific gravity of a specimen of PTFE material preformed, sintered and cooled through the crystallization point at a rate of 1 °C per minute in accordance with the appropriate sintering schedule as described in IS 14635 (Part 2).

NOTE — The SSG of unmodified PTFE is inversely related to its molecular mass.

3.6 Zero-strength Time (ZST) — Measure of the relative molecular mass of PCTFE.

NOTE — The ZST of PCTFE is proportionally related to its molecular mass.

4 DESIGNATION

4.1 General

The designation system for thermoplastics is based on the following standard pattern:

<table>
<tr><td></td><td colspan="6">Designation</td></tr>
<tr><td rowspan="3">Description Block (optional)</td><td colspan="6">Identity Block</td></tr>
<tr><td rowspan="2">For Indian Standard</td><td colspan="5">Individual Item Block</td></tr>
<tr><td>Data Block 1</td><td>Data Block 2</td><td>Data Block 3</td><td>Data Block 4</td><td>Data Block 5</td></tr>
</table>

The designation consists of an optional description block, reading “Thermoplastics”, and an identity block comprising the Indian Standard number and an individual-item block. For

unambiguous designation, the individual-item block is subdivided into five data blocks comprising the following information:

Data block 1	Identification of the plastic by its abbreviated term for the fluoropolymer as listed in Table 1 and information about the composition of the polymer (*see* Table 1 and Table 2) (*see* **4.2**)
Data block 2	Fillers or reinforcing materials and their nominal content (*see* **4.3**).
Data block 3	Position 1 — Intended application and/or method of processing (*see* **4.4**). Positions 2 to 8 — Important properties, additives and supplementary information (*see* **4.4**).
Data block 4	Designatory properties (*see* **4.5**).
Data block 5	For the purpose of specifications, the fifth data block contains appropriate information (*see* **4.6**).

The first character of the individual-item block shall be a hyphen. The data blocks shall be separated from each other by a comma. If a data block is not used, this shall be indicated by doubling the separation sign, that is by two commas (,,).

NOTE — Data blocks 1 and 2 together form the part marking symbol.

4.1.1 Each member of the fluoropolymer family has its own set of designatory properties. Annex A provides the information regarding designatory properties associated to any fluoropolymer in tabular form.

4.2 Data Block 1

In this block, fluoropolymers are identified by the abbreviated term in accordance with ISO 1043-1 (supplemented by the abbreviated term listed in Table 1) and, after a hyphen, a symbol indicating the additional information as specified in Table 2.

Table 1 Symbols Indicating the Chemical Structure of Fluoropolymers Materials in Data Block 1
(*Clause* 4.2)

Sl No.	Code	Meaning of Code
(1)	(2)	(3)
i)	CPT	chlorotrifluoroethylene-perfluoroalkoxy-tetrafluoroethylene copolymer
ii)	ECTFE	ethylene-chlorotrifluoroethylene copolymer
iii)	EFEP	ethylene-tetrafluoroethylene-hexafluoropropene copolymer
iv)	ETFE	ethylene-tetrafluoroethylene copolymer
v)	FEP	perfluoro (ethylene-propene) copolymer
vi)	PCTFE	polychlorotrifluoroethylene
vii)	PFA	perfluoro (alkoxy alkane)

viii)	PTFE	polytetrafluoroethylene
ix)	PVDF	poly (vinylidene fluoride)
x)	PVF	poly (vinyl fluoride)
xi)	TFE/PDD	tetrafluoroethylene-perfluorodioxole copolymer
xii)	VDF/CTFE	vinylidene fluoride-chlorotrifluoroethylene copolymer
xiii)	VDF/HFP	vinylidene fluoride-hexafluoropropene copolymer
xiv)	VDF/TFE	vinylidene fluoride-tetrafluoroethylene copolymer
xv)	VDF/TFE/HFP	vinylidene fluoride-tetrafluoroethylene-hexafluoropropene copolymer

Table 2 Meaning of Code Letter, when used, for Additional Information in Data Block 1
(*Clause* 4.2)

Sl No.	Code	Meaning of Code
(1)	(2)	(3)
i)	A	Modified
ii)	D	Dispersion
iii)	E	Emulsion polymer
iv)	F	Filler resin (additive resin)
v)	H	Homopolymer
vi)	K	Copolymer
vii)	S	Suspension polymer
viii)	SS	Presintered suspension polymer
ix)	Z1	In-house-recovered material; out of specification/waste
x)	Z2	Reprocessed; byproduct from processing
xi)	Z3	Postconsumer material

NOTE — Blends can be made from materials mentioned in both Table 1 and Table 2 (*see* ISO 1043-1). For polymer blends or alloys, use the abbreviated terms for the basic polymers, with the main component in first place followed by the other components in descending order according to their mass fractions, separated by a plus sign and no space before or after the plus sign.

Example — A blend of FEP and PFA is designated: FEP+PFA.

4.3 Data Block 2

In this block, the type of filler and/or reinforcing material is represented by a single code-letter in position 1 and its physical form by a second code-letter in position 2, the code-letters being as specified in Table 3. Subsequently (without space), the actual content by mass percentage shall be given by a two-figure number in position 3.

Table 3 Symbols for Fillers and Reinforcing Materials and Form or Structure in Data Block 2
(*Clause* 4.3)

No.	Code	Material [1)]	Code	Form or Structure

(1)	(2)	(3)	(4)	(5)
i)	B	Boron	B	Bead, spheres, balls
ii)	C	Carbon	C	Chips, cuttings
iii)	C1	Coke	D	Powder
iv)	C2	Partially graphitized carbon	F	Fibre
v)	C-G	Graphite	G	Ground
vi)	E	Clay	H	Whiskers
vii)	G	Glass	K	Knitted fabric
viii)	K	Calcium carbonate	L	Layer
ix)	M	Mineral, metal	M	Mat(thick)
x)	M1	Aluminium oxide	N	Non-woven and thin
xi)	M2	Bronze	P	Paper
xii)	M3	Calcium fluoride	S	Rovings
xiii)	M4	Molybdenum disulfide	T	Scales, flakes
xiv)	M5	Stainless Steel	V	Cord
xv)	P	Mica	W	Veneer
xvi)	Q	Silica	X	Not Specified
xvii)	R	Aramid	Y	Yarn
xviii)	S	Synthetic, organic	Z	Others
xix)	S-X	X is the abbreviated term for a polymer used as the filler		
xx)	T	Talcum		
xxi)	X	Not Specified		
xxii)	Z1	In-house-recovered material		
xxiii)	Z2	Reprocessed material		
xxiv)	Z3	Postconsumer material		
1) The materials may be further defined, for example, by their chemical symbols or by additional symbols defined in the relevant International Standard.				

NOTE — Mixtures of materials or forms may be indicated by combining the relevant codes using the "+" sign and placing the whole between parentheses.

Example — A mixture of 25 percent glass fibres (GF) and 8 percent mineral powder (MD) would be indicated by (GF25 + MD8).

4.4 Data Block 3

In this block, information about the 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. The code-letters are specified in Table 4. If information is presented in positions 2 to 8 and no specific information is given in position 1, the letter X (no indication) shall be inserted in position 1.

Table 4 Code Used in Data Block 3
(*Clause* 4.4)

Sl No.	**Intended Application or Method of Processing**		**Essential Properties, Additives or Other Information**	
	Code	Position 1	Code	Position 2 to 8
(1)	(2)	(3)	(4)	(5)
i)	A	Adhesives	C	Coloured
ii)	B	Blow moulding	D	Powder
iii)	B1	Extrusion blow moulding	D1	Dry blend
iv)	B2	Injection blow moulding	D2	Free-flowing
v)	C	Calendaring	D3	Not free-flowing
vi)	E	Extrusion	E	Expandable
vii)	F	Filled compounds	F	Special burning characteristics
viii)	G	General use	F1	Oxygen index > 95 percent
ix)	H	Coating	F2	Flame retarded
x)	H1	Powder coating	F4	Reduced smoke emission
xi)	H2	Dip coating	G	Granules
xii)	H3	Wet coating	G1	Pellets
xiii)	H4	Impregnation	G2	Lentils
xiv)	H5	Spray coating	G3	Beads
xv)	K	Cable and wire coating	H1	Stabilized against radiation
xvi)	L	Monofilament extrusion	L	Light and weather stabilized
xvii)	M	Moulding	M	Nucleated
xviii)	M1	Injection moulding	M1	Modified by comonomer
xix)	M2	Transfer moulding	N	Natural (no colour added)
xx)	P	Paste extrusion	N1	Suitable for food contact
xxi)	Q	Compression moulding	N2	High purity
xxii)	Q1	Automatic moulding	P	Impact modified
xxiii)	Q2	Isostatic moulding	R	Mould release agent
xxiv)	R	Rotational moulding	S	Lubricated
xxv)	S	Sintering	S1	External lubrication
xxvi)	T	Tape manufacture	T	Transparent
xxvii)	T1	Skived tape or film	T1	Translucent
xxviii)	T2	Unsintered tape or film	T2	Opaque
xxix)	T3	Expanded tape or film	T3	Improved transmission in UV
xxx)	V	Thermoforming	T4	Reduced transmission in UV
xxxi)	X	No indication	V	Heat shrinkable
xxxii)	Y	Textile yarns, spinning	W1	Improved chemical resistance

xxxiii)	Z	Tubing	X	Crosslinkable
xxxiv)	RE	Ram extrusion	Y	Increased electrical conductivity
xxxv)			Z	Antistatic

4.5 Data Block 4

Each member of the fluoropolymer family has its own set of designatory properties selected from the properties listed below. There is one position in data block 4 for each of the designatory properties for a particular fluoropolymer. Therefore, data block 4 may have more positions for one fluoropolymer than for another. The code for melt mass-flow rate may require more than one letter or number. The code-symbols of designatory properties are separated from each other by hyphens.

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 range limit because of manufacturing tolerances, the designation is not affected.

Not all combinations of the values of the designatory properties may be possible for currently available materials.

4.5.1 *PTFE*

PTFE resins are homopolymers of tetrafluoroethylene or modified homopolymers containing not more than 1 percent by weight of other fluoromonomers.

4.5.1.1 *For polytetrafluoroethylene (PTFE-S) granular moulding and ram extrusion materials and for polytetrafluoroethylene (PTFE-E) resin produced from coagulation of dispersion*

In this block, standard specific gravity is represented by one-figure code-number, bulk density is represented by one-figure code-number and particle size is represented by one-figure code number. The three code-numbers are separated from each other by hyphens.

4.5.1.1.1 Standard specific gravity (SSG)

Standard specific gravity (SSG) is the property usually used to measure the relative molecular mass of the polymers used in the PTFE industry. SSG shall be determined in accordance with IS 14635 (Part 2). The possible values of SSG are divided into eight ranges, each represented by one numeric code as given in Table 5.

Table 5 Codes and Ranges for Standard Specific Gravity (SSG) in Data Block 4
(*Clause* 4.5.1.1.1)

Sl No.	Code	Standard Specific Gravity
(1)	(2)	(3)
i)	0	2.000 to < 2.140

ii)	1	2.140 to < 2.160
iii)	2	2.160 to < 2.180
iv)	3	2.180 to < 2.200
v)	4	2.200 to < 2.220
vi)	5	2.220 to < 2.240
vii)	6	2.240 to < 2.260
viii)	7	2.260 to < 2.400

4.5.1.1.2 *Thermal instability index (TII)*

Thermal Instability Index (TII) is a measure of the decrease in molecular weight of PTFE material which has been heated for a prolonged period of time. TII shall be determined in accordance with IS 14635 (Part 2). Codes and ranges of TII are given in Table 6.

Table 6 Codes and Ranges for Thermal Instability Index (TII) in Data Block 4
(*Clause* 4.5.1.1.2)

Sl No.	**Code**	**Thermal Instability Index (TII)**
(1)	(2)	(3)
i)	0	15, *Max*
ii)	1	16 to 50

4.5.1.1.3 *Bulk density*

Bulk density shall be determined in accordance with IS 14635 (Part 2). The possible values of bulk density is divided into five ranges, each represented by one numeric code as given in Table 7.

Table 7 Codes and Ranges for Bulk Density in Data Block 4
(*Clause* 4.5.1.1.3)

Sl No.	**Code**	**Bulk Density** (g/l)
(1)	(2)	(3)
i)	0	1 to < 200
ii)	1	200 to < 500
iii)	2	500 to < 800
iv)	3	800 to < 1 100
v)	4	1 100 to < 2 000

4.5.1.1.4 *Particle size*

Particle size shall be determined in accordance with IS 14635 (Part 2). The methods include wet- or dry-sieve analysis, electric sensing-zone testing and light scattering. The particle size is divided into eight ranges, each represented by one numeric code as given in Table 8.

Table 8 Codes and Ranges for Particle Size (50 Percent Retention) in Data Block 4
(*Clause* 4.5.1.1.4)

Sl No.	**Code**	**Particle Size** (μm)
(1)	(2)	(3)
i)	0	0.1 to < 10
ii)	1	10 to < 125
iii)	2	125 to < 250
iv)	3	250 to < 355
v)	4	355 to < 500
vi)	5	500 to < 710
vii)	6	710 to < 1 000
viii)	7	1 000 to < 1 400

4.5.1.1.5 *Tensile properties*

Tensile strength and tensile yield stress, percentage elongation at break and modulus properties shall be determined in accordance with the principles of IS 13360 (Part 5/Sec 2), modified by details given in IS 14635 (Part 2). Tables 9 to 12 provide the codes to use for each range of tensile strength (including specimen thickness for PTFE-S) and tensile yield stress, percentage elongation at break and tensile modulus.

Table 9 Codes and Ranges for Tensile Strength and Tensile Yield Stress in Data Block 4
(*Clause* 4.5.1.1.5)

Sl No.	**Code**	**Tensile Strength and Tensile Yield Stress** (MPa)
(1)	(2)	(3)
i)	A	< 15
ii)	B	15 to < 20
iii)	C	20 to < 25
iv)	D	25 to < 30
v)	E	30 to < 35
vi)	F	35 to < 40
vii)	G	40 to < 45
viii)	H	45 to < 50
ix)	I	50 to < 55
x)	J	≥ 55

Table 10 Codes and Ranges for Percentage Elongation at Break in Data Block 4
(*Clause* 4.5.1.1.5)

Sl No.	**Code**	**Elongation at Break** (Percentage)
(1)	(2)	(3)
i)	A	< 50

ii)	B	50 to < 100
iii)	C	100 to < 150
iv)	D	150 to < 200
v)	E	200 to < 250
vi)	F	250 to < 300
vii)	G	300 to < 350
viii)	H	350 to < 400
ix)	I	400 to < 500
x)	J	500 to < 600
xi)	K	600 to < 800
xii)	L	≥ 800

Table 11 Codes and Ranges for Tensile Modulus in Data Block 4
(*Clause* 4.5.1.1.5)

Sl No.	**Code**	**Tensile Modulus** (MPa)
(1)	(2)	(3)
i)	A	< 500
ii)	B	500 to < 800
iii)	C	800 to < 1 200
iv)	D	1 200 to < 1 600
v)	E	1 600 to < 2 000
vi)	F	2 000 to < 3 000
vii)	G	3 000 to < 4 000
viii)	H	4 000 to < 6 000
ix)	I	≥ 6 000

Table 12 Codes and Ranges for Specimen Thickness for PTFE-S in Data Block 4
(*Clause* 4.5.1.1.5)

Sl No.	**Code**	**Specimen Thickness** (mm)
(1)	(2)	(3)
i)	1	< 0.125
ii)	2	0.125 to < 0.500
iii)	3	0.500 to < 1.00
iv)	4	≥ 1.00

4.5.1.1.6 *Dielectric strength*

Dielectric strength shall be determined in accordance with IEC 60243-1 or ASTM D149. The possible values of dielectric strength are divided into five ranges, each represented by a one alphabet code as specified in Table 13.

NOTE — Dielectric strength, which is expressed in kilovolts per millimetre, varies with the thickness of the test specimen.

Table 13 Codes and Ranges for Dielectric Strength in Data Block 4
(*Clause* 4.5.1.1.6)

Sl No.	**Code**	**Dielectric Strength** (kV/mm)
(1)	(2)	(3)
i)	A	< 25
ii)	B	25 to < 50
iii)	C	50 to < 75
iv)	D	75 to < 100
v)	E	> 100

4.5.1.1.7 *Powder-flow time*

Powder-flow time shall be determined in accordance with IS 14635 (Part 2). Codes and ranges are given in Table 14.

Table 14 Codes and ranges for powder-flow time in Data Block 4
(*Clause* 4.5.1.1.7)

Sl No.	**Code**	**Powder-flow Time** (s)
(1)	(2)	(3)
i)	0	Test inappropriate
ii)	1	< 10
iii)	2	10 to 20
iv)	3	> 20

4.5.1.1.8 *Deformation temperature under load*

Deformation temperature under load of the material shall be as agreed between the purchaser and the supplier and shall be determined in accordance with the procedures as given in IS 13360 (Part 6/Sec 17).

4.5.1.1.9 *Melting-peak temperature*

The melting-peak temperature shall be determined in accordance with IS 14635 (Part 2). Melting-peak temperature shall be used as a designatory property. Codes and ranges are given in Table 15.

Table 15 Codes and Ranges for Melting-Peak Temperature in Data Block 4
(*Clause* 4.5.1.1.9)

Sl No.	**Code**	**Range of Temperature** (°C)
(1)	(2)	(3)
i)	A	100 to < 110
ii)	B	110 to < 120

iii)	C	120 to < 130
iv)	D	130 to < 140
v)	E	140 to < 150
vi)	F	150 to < 160
vii)	G	160 to < 170
viii)	H	170 to < 180
ix)	I	180 to < 190
x)	J	190 to < 200
xi)	K	200 to < 210
xii)	L	210 to < 220
xiii)	M	220 to < 230
xiv)	N	230 to < 240
xv)	O	240 to < 250
xvi)	P	250 to < 260
xvii)	Q	260 to < 270
xviii)	R	270 to < 280
xix)	S	280 to < 290
xx)	T	290 to < 300
xxi)	U	300 to < 310
xxii)	V	310 to < 320
xxiii)	W	320 to < 330
xxiv)	X	330 to < 340
xxv)	Y	340 to < 350

4.5.1.1.10 *Extrusion pressure*

Extrusion pressure shall be determined in accordance with IS 14635 (Part 2). The possible values of extrusion pressure are divided into ranges, each represented by one alphabet code as given in Table 16 and Table 17.

Table 16 Codes and Ranges for Extrusion Pressure in Data Block 4
(*Clause* 4.5.1.1.10)

Sl No.	**Code**	**Extrusion Pressure** (MPa)
(1)	(2)	(3)
i)	1	< 15
ii)	2	15 to 35
iii)	3	> 35
NOTE — Determined using a reduction ratio of 400: 1		

Table 17 Codes and Ranges for Extrusion Pressure in Data Block 4
(*Clause* 4.5.1.1.10)

Sl No.	**Code**	**Extrusion Pressure** (MPa)

(1)	(2)	(3)
i)	1	15 to <65
ii)	2	65 to <75
NOTE — Determined using a reduction ratio of 1600: 1		

4.5.1.1.11 *Stretching void index (SVI)*

The SVI gives one indication of the potential for induced-void content of a solid fabricated resin product in use. Such void content may contribute to susceptibility to the formation of cracks and failures under extreme stretching and stress or, in some environments, when stressed. Stretching void index (SVI) shall be determined in accordance with IS 14635 (Part 2). Codes and ranges of SVI are given in Table 18.

NOTE — SVI will be reported in case of emulsion polymerised modified high reduction ratio PTFE.

Table 18 Codes and Ranges of Stretching Void Index (SVI) in Data Block 4
(*Clause* 4.5.1.1.11)

Sl No.	Code	Stretching Void Index (SVI)
(1)	(2)	(3)
i)	0	> 200
ii)	1	101 – 200
iii)	2	51 – 100
iv)	3	0 – 50

4.5.1.2 *Aqueous dispersion of polytetrafluoroethylene (PTFE-D)*

In this block, PTFE percentage in dispersion is represented by one-figure code-number, nominal content of surfactant based on dry PTFE is represented by one-figure code-number and surfactant tolerance level is represented by one-figure code-number. The three code-numbers are separated from each other by hyphens.

4.5.1.2.1 PTFE percentage in dispersion

Percentage PTFE in dispersion shall be determined in accordance with IS 14635 (Part 2). Codes and ranges are given in Table 19.

Table 19 Codes and Ranges for PTFE Percentage in Dispersions in Data Block 4
(*Clause* 4.5.1.2.1)

Sl No.	Code	PTFE Percentage in Dispersion
(1)	(2)	(3)

i)	0	> 0 to < 10
ii)	1	10 to < 40
iii)	2	40 to < 70
iv)	3	70 to < 100

4.5.1.2.2 Surfactant percentage in dispersion

Surfactant percentage in dispersion shall be determined in accordance with IS 14635 (Part 2). The codes and ranges are given in Table 20.

Table 20 Codes and Ranges for Added-Surfactant Content in Data Block 4
(*Clause* 4.5.1.2.2)

Sl No.	Code	Surfactant Percentage in Dispersion, Nominal
(1)	(2)	(3)
i)	0	0
ii)	1	> 0 to < 5
iii)	2	5 to < 10
iv)	3	10 to < 15
v)	4	15 to < 20
vi)	5	20 to < 25
vii)	6	25 to < 30
NOTE — Calculated as a percentage of the mass of the polymer		

4.5.1.2.3 Surfactant tolerance level

The codes of surfactant tolerances are given in Table 21.

Table 21 Codes and Ranges for Surfactant Tolerance Level in Data Block 4
(*Clause* 4.5.1.2.3)

Sl No.	Code	Percentage Surfactant Tolerance
(1)	(2)	(3)
i)	0	± 0.5
ii)	1	± 1.0
iii)	2	± 2.0

4.5.2 *Melt processable resins*

4.5.2.1 *CPT, ECTFE, EFEP, ETFE, FEP, PFA, PVDF, PVF, VDF/CTFE, VDF/HFP, VDF/TFE, VDF/TFE/HFP*

In this block, melting-peak temperature is represented by one code-letter and melt mass-flow rate is represented by three code-symbols (one code-number, one code-letter and one code-number). Melting-peak temperature and melt mass-flow rate codes are separated from each other by hyphens.

4.5.2.1.1 *Melting-peak temperature*

The melting-peak temperature shall be determined in accordance with IS 14635 (Part 2). Melting-peak temperature shall be used as a designatory property. Codes and ranges are given in Table 22.

Table 22 Codes and Ranges for Melting-Peak Temperature in Data Block 4
(*Clause* 4.5.2.1.1)

Sl No.	**Code**	**Range of Temperature** (°C)
(1)	(2)	(3)
i)	A	100 to < 110
ii)	B	110 to < 120
iii)	C	120 to < 130
iv)	D	130 to < 140
v)	E	140 to < 150
vi)	F	150 to < 160
vii)	G	160 to < 170
viii)	H	170 to < 180
ix)	I	180 to < 190
x)	J	190 to < 200
xi)	K	200 to < 210
xii)	L	210 to < 220
xiii)	M	220 to < 230
xiv)	N	230 to < 240
xv)	O	240 to < 250
xvi)	P	250 to < 260
xvii)	Q	260 to < 270
xviii)	R	270 to < 280
xix)	S	280 to < 290
xx)	T	290 to < 300
xxi)	U	300 to < 310
xxii)	V	310 to < 320
xxiii)	W	320 to < 330
xxiv)	X	330 to < 340
xxv)	Y	340 to < 350

4.5.2.1.2 *Melt mass-flow rate (MFR)*

Melt mass-flow rate shall be determined in accordance with IS 14635 (Part 2) using test conditions selected from Tables 23 and Table 24. The melt mass-flow rate is indicated in data block 4 by the

codes for temperature and load given in Tables 23 and Table 24 followed by the codes and ranges given in Table 25.

Table 23 Codes and Ranges for Melt Mass-Flow Rate (MFR) Test Temperature in Data Block 4
(*Clause* 4.5.2.1.2)

Sl No.	**Code**	**Test Temperature** (°C)
(1)	(2)	(3)
i)	1	372 ± 1
ii)	2	297 ± 1
iii)	3	271.5 ± 1
iv)	4	265 ± 1
v)	5	230 ± 1

Table 24 Codes for Melt Mass-Flow Rate (MFR) Test Load in Data Block 4
(*Clause* 4.5.2.1.2)

Sl No.	**Code**	**Test Load** (kg)
(1)	(2)	(3)
i)	A	0.325
ii)	B	1.20
iii)	C	2.16
iv)	D	3.8
v)	E	5.0
vi)	F	10.0
vii)	G	12.5
viii)	H	21.6
ix)	I	31.6

Table 25 Codes and Ranges for Melt Mass-Flow Rate (MFR) in Data Block 4
(*Clause* 4.5.2.1.2)

Sl No.	**Code**	**MFR** (g/10 min)
(1)	(2)	(3)
i)	0	0.0 to < 0.1
ii)	1	0.1 to < 0.2
iii)	2	0.2 to < 0.5
iv)	3	0.5 to < 1.0
v)	4	1.0 to < 2.0
vi)	5	2.0 to < 5.0
vii)	6	5.0 to < 10.0
viii)	7	10.0 to < 20.0
ix)	8	20.0 to < 50.0

x)	9	50.0 to < 100.0

4.5.2.1.3 *Tensile Properties*

Tensile strength percentage elongation at break and modulus properties shall be determined in accordance with the principles of IS 13360 (Part 5/Sec 2), modified by details given in IS 14635 (Part 2). Tables 26 to 29 provide the codes to use for each range of tensile strength and percentage elongation at break.

Table 26 Codes and Ranges for Tensile Strength for PFA polymer in Data Block 4
(*Clause* 4.5.2.1.3)

Sl No.	**Code**	**Tensile Strength** (MPa)
i)	A	≥25
ii)	B	22 to < 25
iii)	C	18 to <22
iv)	D	15 to < 18
v)	E	<15

Table 27 Codes and Ranges for percentage elongation at break for PFA polymer in Data Block 4
(*Clause* 4.5.2.1.3)

Sl No.	**Code**	**Elongation at Break** (%)
i)	A	≥300
ii)	B	275 to < 300
iii)	C	250 to < 275
iv)	D	200 to < 250
v)	E	<200

Table 28 Codes and Ranges for Tensile Strength for FEP polymer in Data Block 4
(*Clause* 4.5.2.1.3)

Sl No.	**Code**	**Tensile Strength** (MPa)
i)	A	>22
ii)	B	20 to < 22
iii)	C	17 to < 20
iv)	D	14 to < 17
v)	E	<14

Table 29 Codes and Ranges for percentage elongation at break for FEP polymer in Data Block 4
(*Clause* 4.5.2.1.3)

Sl No.	**Code**	**Elongation at Break** (%)
i)	A	≥275
ii)	B	250 to < 275
iii)	C	200 to < 250
iv)	D	175 to < 250
v)	E	<175

4.5.2.1.4 *Density*

Density shall be determined in accordance with the principles of IS 13360 (Part 3/Sec 10) and IS 13360 (Part 3/Sec 11) as specified in IS 14635 (Part 2). The codes and ranges for density are listed in Table 30.

Table 30 Codes and Ranges for Density in Data Block 4
(*Clause* 4.5.2.1.4)

Sl No.	**Code**	**Density** (g/cm^3 at 23 °C)
(1)	(2)	(3)
i)	A	< 1.6
ii)	B	1.6 to < 1.7
iii)	C	1.7 to < 1.8
iv)	D	1.8 to < 1.9
v)	E	1.9 to < 2.0
vi)	F	2.0 to < 2.1
vii)	G	2.1 to < 2.2
viii)	H	2.2 to < 2.3
ix)	I	2.3 to < 2.4
x)	J	2.4 to < 2.5
xi)	K	2.5 to < 3.0
xii)	L	3.0 to < 3.5
xiii)	M	3.5 to < 4.0
xiv)	N	4.0 to < 4.5
xv)	O	4.5 to < 5.0
xvi)	P	5.0 to < 5.5
xvii)	Q	5.5 to < 6.0
xviii)	R	6.0 to < 6.5
xix)	S	6.5 to < 7.0
xx)	T	≥ 7.0

4.5.2.1.5 *Deformation temperature under load*

Determine this temperature in accordance with the procedure as given in IS 13360 (Part 6/Sec 17).

4.5.2.2 *PCTFE*

In this block, Zero-strength time (ZST) is represented by one-figure code-number. Zero-strength time (ZST) shall be determined as described in ASTM D1430. Codes and ranges are given in Table 31.

Table 31 Codes and Ranges for Zero-Strength Time (ZST) in Data Block 4
(*Clause* 4.5.2.2)

Sl No.	**Code**	**ZST** (s)
(1)	(2)	(3)
i)	0	1 to < 100
ii)	1	100 to < 200
iii)	2	200 to < 300
iv)	3	300 to < 450
v)	4	450 to < 600

4.5.2.3 *TFE/PDD*

4.5.2.3.1 *Glass transition temperature*

Glass transition temperature shall be determined in accordance with ISO 11357-2 or ASTM D4591. Codes and ranges are given in Table 32.

Table 32 Codes and Ranges for Glass Transition Temperature
(*Clause* 4.5.2.3.1)

Sl No.	**Code**	**Range of temperature** (°C)
(1)	(2)	(3)
i)	A	< 20
ii)	B	20 to < 30
iii)	C	30 to < 40
iv)	D	40 to < 50
v)	E	50 to < 60
vi)	F	60 to < 70
vii)	G	70 to < 80
viii)	H	80 to < 90
ix)	I	90 to < 100
x)	J	100 to < 110
xi)	K	110 to < 120
xii)	L	120 to < 130
xiii)	M	130 to < 140
xiv)	N	140 to < 150
xv)	O	150 to < 160
xvi)	P	160 to < 170

xvii)	Q	170 to < 180
xviii)	R	180 to < 190
xix)	S	190 to < 200
xx)	T	200 to < 210
xxi)	U	210 to < 220
xxii)	V	220 to < 230
xxiii)	W	230 to < 240
xxiv)	X	240 to < 250
xxv)	Y	250 to < 260
xxvi)	Z	260 to < 270
xxvii)	1	270 to < 280
xxviii)	2	280 to < 290
xxix)	3	290 to < 300
xxx)	4	300 to < 310
xxxi)	5	310 to < 320
xxxii)	6	320 to < 330
xxxiii)	7	330 to < 340
xxxiv)	8	340 to < 350
xxxv)	9	350 to < 360
xxxvi)	0	≥ 360

4.5.2.4 *Aqueous dispersion of melt processable resins (ETFE, FEP, PFA, PVDF, PVF, VDF/CTFE, VDF/HFP, VDF/TFE, VDF/TFE/HFP)*

In this block, the polymer percentage in dispersion is represented by one-figure code-number, nominal content of surfactant based on the dry polymer is represented by one-figure code-number and surfactant tolerance level is represented by one-figure code-number. The three code-numbers are separated from each other by hyphens.

4.5.2.4.1 *Polymer percentage in dispersions*

Polymer percentage in dispersion shall be determined in accordance with IS 14635 (Part 2). Codes and ranges are listed in Table 33.

Table 33 Codes and Ranges for 1 Polymer percentage in dispersions
(*Clause* 4.5.2.4.1)

Sl No.	**Code**	**Polymer Percentage in Dispersion**
(1)	(2)	(3)
i)	0	> 0 to < 10
ii)	1	10 to < 40
iii)	2	40 to < 70
iv)	3	70 to < 100

4.5.2.4.2 *Surfactant percentage in dispersion*

The surfactant percentage in dispersion shall be determined as described in IS 14635 (Part 2). The codes and ranges are listed in Table 34.

Table 34 Codes and Ranges for Added-Surfactant Content in Data Block 4
(*Clause* 4.5.2.5.2)

Sl No.	Code	Surfactant Percentage, Nominal
(1)	(2)	(3)
i)	0	0
ii)	1	> 0 to < 2
iii)	2	2 to < 4
iv)	3	4 to < 6
v)	4	6 to < 8
vi)	5	8 to < 10
vii)	6	10 to < 12
viii)	7	12 to < 14
ix)	8	14 to < 16
NOTE — Calculated as a percentage of the mass of the polymer.		

4.5.2.4.3 *Surfactant tolerance level*

The codes of surfactant tolerances are given in Table 35.

Table 35 Codes and Ranges for Surfactant Tolerance Level in Data Block 4
(*Clause* 4.5.2.5.3)

Sl No.	Code	Percentage Surfactant Tolerance
(1)	(2)	(3)
i)	0	± 0.5
ii)	1	± 1.0
iii)	2	± 2.0

4.6 Data Block 5

Indication of additional requirements in this data block transforms the designation of a material into a specification for a particular material. This may be done, for example, by reference to a suitable national standard or a standard-like, generally established specification.

5 PERFLUOROOCTANOIC ACID (PFOA) AND ITS SALTS

The fluoropolymer material shall not show the presence of PFOA beyond the limits as given below:

Characteristic	*Requirement*
(1)	(2)
Perfluorooctanoic acid (PFOA) and its Salts in fluoropolymer material	≤ 25 ppb of PFOA including its salts or 1 000 ppb of one or a combination of PFOA related substances.
NOTE — Limiting value is restricted to environmental and health concerns and does not address food safety regulatory compliance.	

6 PACKING AND MARKING

6.1 Packing

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

6.2 Marking

Each package shall be clearly marked with the following:

a) Name of the material;
b) Designation code;
c) Net mass;
d) Batch number;
e) Month and year of manufacture of the material; and
f) Indication of the source of manufacture and trade mark; if any.

6.3 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.

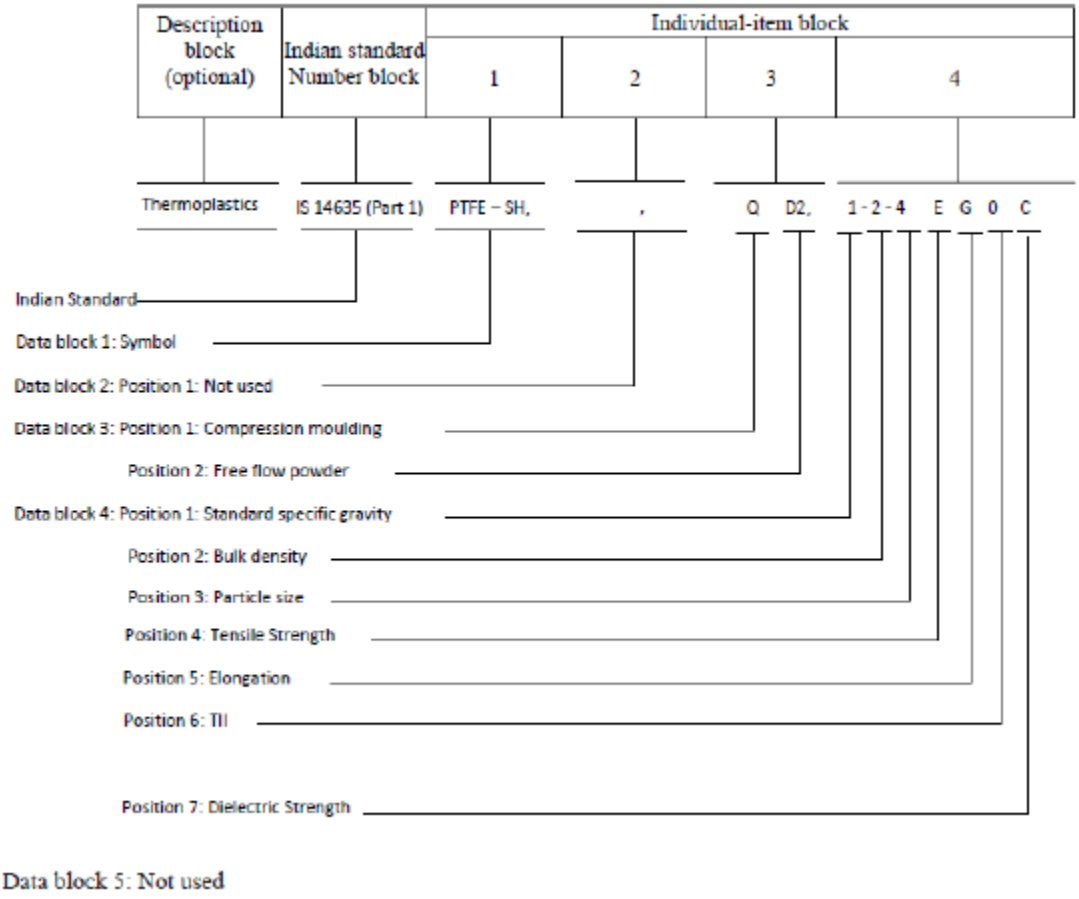
7 SAMPLING

7.1 Unless otherwise agreed upon between the manufacturer/supplier and purchaser, the material shall be sampled in accordance with Annex B. Adequate statistical sampling prior to packaging shall be considered on acceptable alternative.

7.2 A batch or lot of moulding compound shall be considered as unit of manufacture as prepared for dispatch and may consist of a blend of two or more ‘production runs’ materials.

8 EXAMPLES OF DESIGNATIONS

8.1 A polytetrafluoroethylene, suspension polymer/ homopolymer material (PTFE-SH), no filler (,,) intended for compression moulding (Q), free flow powder (D2), having standard specific gravity of 2.140 to < 2.160 (1), bulk density of 500 g/l to 800 g/l (2), particle size of 400 µm to < 500 µm (4), tensile strength of 30 MPa to < 35 MPa (E), elongation of 300 to < 350 percent (G), TII of 16 to 50(0) sand Dielectric Strength of 50 to < 75 kV/mm (C) would be designated as follows.

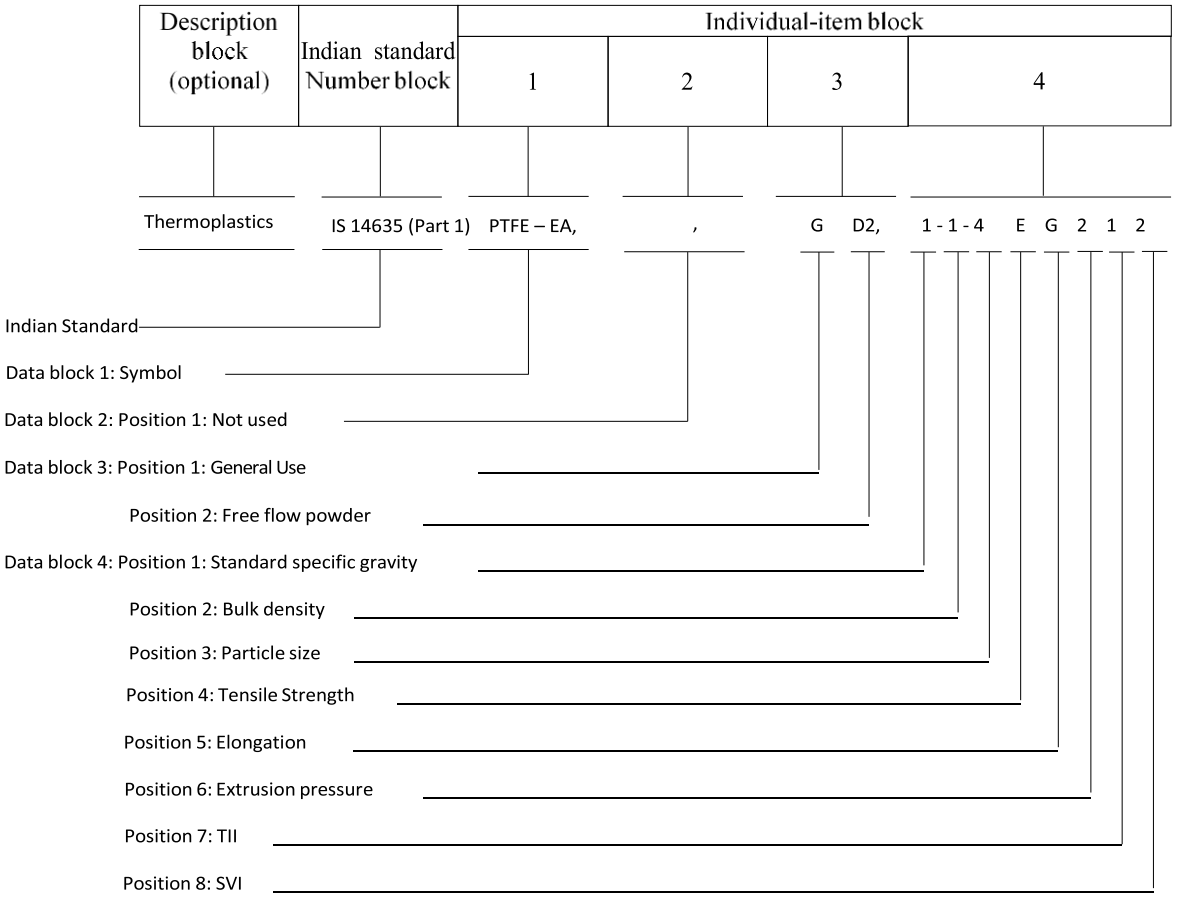


Data block 5: Not used

Designation: (Thermoplastics) IS 14635 (Part 1) -PTFE-SH,,QD2,1-2-4EG0C

A polytetrafluoroethylene, suspension polymer/ homopolymer material (PTFE-SH), no filler (,,) intended for compression moulding (Q), free flow powder (D2), having standard specific gravity of 2.140 to < 2.160 (1), bulk density of 800 g/l to 1100 g/l (3), particle size of 400 µm to < 500 µm (4), tensile strength of 30 MPa to < 35 MPa(E), elongation of 300 to < 350 percent (G), TII of 16 to 50(0) and Dielectric Strength of 50 to < 75kV/mm(C) would have the specification: (Thermoplastics) IS 14635 (Part 1) -PTFE-SH,QD2,,1- 3-4EG0C.

8.2 A polytetrafluoroethylene, emulsion polymer/ modified polymer material (PTFE-EA), no filler(,,) intended for general use (G), free flow powder (D2), having standard specific gravity of 2.140 to < 2.160 (1), bulk density of 200 g/l to < 500 g/l (1), particle size of 355 µm to < 500 µm (4), tensile strength of 30 MPa to < 35 MPa(E), elongation of 300 to < 350 percent (G), Extrusion Pressure of 15 MPa to < 35 MPa at RR of 400 : 1 (2), TII of maximum of 15 (1) and SVI of 51 to 100 (2) would be designated as follows.

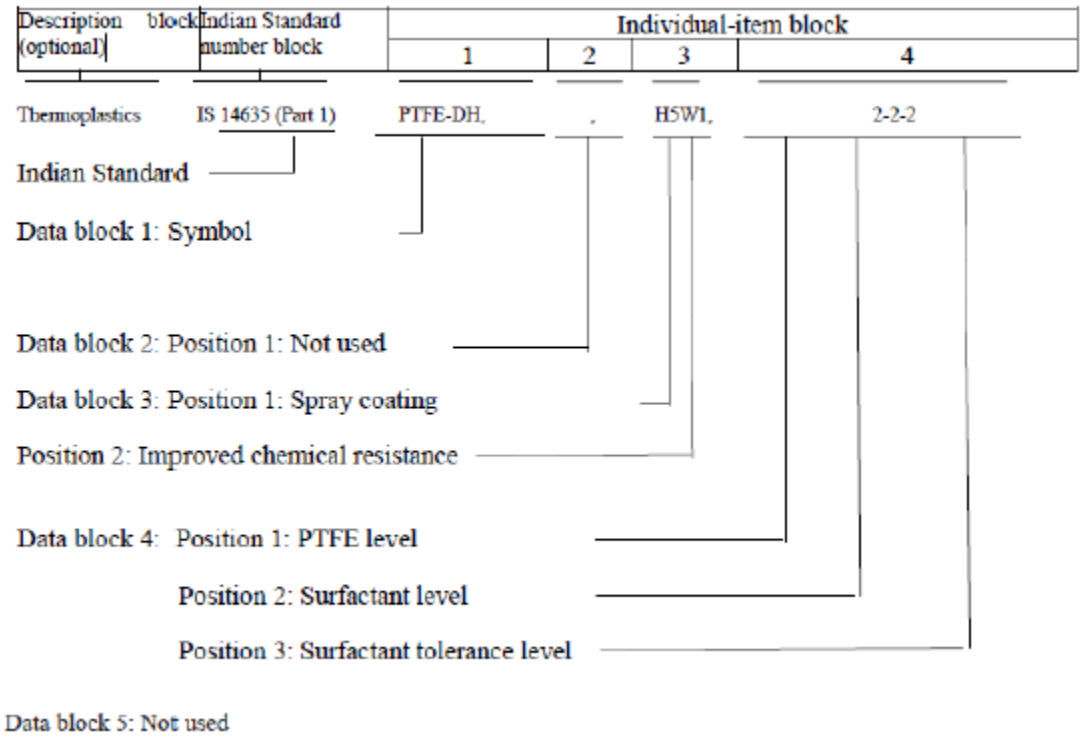


Designation: (Thermoplastics) IS 14635 (Part 1) -PTFE-EA,,GD2,2-1-4EG2

A polytetrafluoroethylene, emulsion polymer/modified polymer material (PTFE-EA), no filler (,,) intended for general use (G), free flow powder (D2), having standard specific gravity of 2.140 to < 2.160 (2), bulk density of 200 g/l to < 500 g/l (1), particle size of 355 µm to < 500 µm (4), tensile strength of 30 MPa to < 35 MPa(E), elongation of 300 to < 350 percent (G), Extrusion Pressure of 15 MPa to < 35 MPa at RR of 400 : 1 (2), TII of maximum of 15 (1) and SVI of 51 to 100 (2) would have the specification: (Thermoplastics) IS 14635 (Part 1) -PTFE-EA,,GD2,2-1-4EG212.

8.3 A polytetrafluoroethylene, dispersion/homopolymer material (PTFE-DH), no filler (,,), intended for spray coating (H5), improved chemical resistance (W1), having 50 percent PTFE in

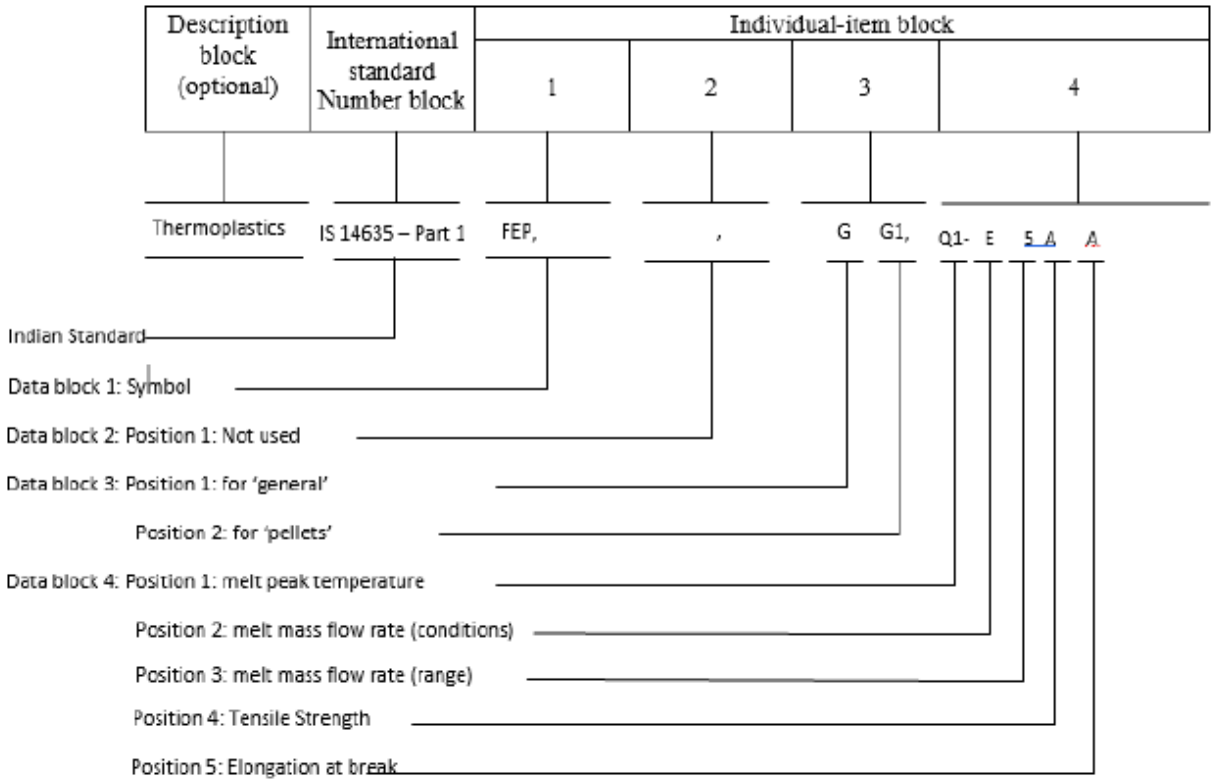
dispersion (2), 6 percent surfactant in dispersion (2) and ± 2.0 surfactant tolerance level (2), would be designated as follows.



Designation: (Thermoplastics) IS 14635 (Part 1)-PTFE-DH,,H5W1,2-2-2

A polytetrafluoroethylene, dispersion/homopolymer material (PTFE-DH), no filler (,,), intended for spray coating (H5), improved chemical resistance (W1), having 50 percent PTFE in dispersion (2), 6 percent surfactant in dispersion (4) and ± 2.0 surfactant tolerance level (2) would have the specification: (Thermoplastics) IS 14635 (Part 1) – PTFE-DH,,H5W1,2-4-2.

8.4 A perfluoro(ethylene-propene) copolymer material (FEP), no filler (,,) intended for general use (G), pellets (G1) having melt-peak temperature 260 °C to < 270 °C (Q) and melt mass-flow rate tested at 372 ± 1 °C (1) with test load 5.0 kg (E) having melt-flow rate 2.0 g/10 min to < 5.0 g/10 min (5), with Tensile strength >22 MPa (A) and percentage elongation at break > 275 (A) would be designated as follows.



Designation: (Thermoplastics) IS 14635 (Part 1)-FEP,, GG1, Q-1E5AA

8.5 A perfluoro(alkoxy alkane) (PFA), no filler (,,) intended for general use (G), pellets (G1) having melt-peak temperature 300 °C to < 310 °C (U) and melt mass-flow rate tested at 372 ± 1 °C (1) with test load 5.0 kg (E) having melt-flow rate 10 g/10 min to < 20 g/10 min (7), with Tensile strength >25 MPa (A) and percentage elongation at break > 300 (A) would be designated: (Thermoplastics) IS 14635 (Part 1)-PFA,, GG1, U-1E7AA

8.6 An ethylene-tetrafluoroethylene copolymer material (ETFE), no filler (,,) intended for general use (G), pellets (G1) having melt-peak temperature 260 °C to < 270 °C(Q) and melt mass-flow rate tested at 297 ± 1 °C (2) with test load 5.0 kg (E) having melt-flow rate 5.0 g/10 min to <10.0 g/10 min (6), would be designated: (Thermoplastics) IS 14635 (Part 1)-ETFE,,GG1, Q-2E6.

8.7 An ethylene-tetrafluoroethylene-hexafluoropropene copolymer material (EFEP), no filler (,,) intended for general use (G), pellets (G1) having melt-peak temperature 190 °C to < 200 °C (J) and melt mass-flow rate tested at 265 ± 1 °C (4) with test load 5.0 kg (E) having melt-flow rate 20.0 g/10 min to < 50.0 g/10 min (8), would be designated: (Thermoplastics) IS 14635 (Part 1)-EFEP,, GG1, J-4E8.

8.8 A chlorotrifluoroethylene-perfluoroalkoxy-tetrafluoroethylene copolymer material (CPT), no filler (,,) intended for general use (G), pellets (G1) having melt-peak temperature 240 °C to < 250 °C (O) and melt mass-flow rate tested at 297 ± 1 °C (2) with test load 5.0 kg (E) having melt-flow rate 20.0 g/10 min to < 50.0 g/10 min (8), would be designated: (Thermoplastics) IS 14635 (Part 1)-CPT,, GG1, O-2E8.

8.9 A vinylidene fluoride-tetrafluoroethylene copolymer material (VDF/TFE), no filler (,,) intended for general use (G), pellets (G1) having melt-peak temperature 210 °C to < 220 °C (L) and melt mass-flow rate tested at 297 ± 1 °C (2) with test load 5.0 kg (E) having melt-flow rate 1.0 g/10 min to < 2.1 g/10 min (4), would be designated: (Thermoplastics) IS 14635 (Part 1)-VDF/ TFE,,GG1, L-2E4.

8.10 A vinylidene fluoride-tetrafluoroethylene-hexafluoropropene copolymer (VDF/TFE/HFP), no filler (,,) intended for general use (G), pellets (G1) having melt-peak temperature 120 °C to < 130 °C (C) and melt mass-flow rate tested at 265 ± 1 °C (4) with test load 5.0 kg (E) having melt-flow rate 20.0 g/10 min to <50.0 g/10 min (8), would be designated: (Thermoplastics) IS 14635 (Part 1)-VDF/ TFE/HFP,,GG1,C-4E8.

8.11 A polychlorotrifluoroethylene material (PCTFE), no filler (,,) intended for general use (G), powder (D) having zero-strength time 300 s to < 450 s (3), would be designated: (Thermoplastics) IS 14635 (Part 1) -PCTFE,, GD, 3.

8.12 A tetrafluoroethylene-perfluorodioxole copolymer (TFE/PDD), no filler (,,) intended for general use (G), powder (D) having glass transition temperature 160 °C to < 170 °C (G), would be designated: (Thermoplastics) IS 14635 (Part 1)-TFE/PDD,, GD, G.

ANNEX A
(*Clause* 4.1.1)
DESIGNATORY PROPERTIES FOR FLUOROPOLYMER TYPES

A-1 This standard (Part 1) is particularly concerned with, but is not limited to, the materials included in this annex. In Tables 36 and Table 37, X indicates that the property concerned is used as a designatory property.

Table 36 Polytetrafluoroethylene (PTFE)
(*Clause* A-1)

Sl No. (1)	**Properties** (2)	**S** (3)	**E** (4)	**SS** (5)	**Z** (6)	**F** (7)	**D** (8)
i)	Thermal properties:						
	a) Melting-peak temperature						
	b) Glass-transition temperature						
	c) Deformation temperature under load						
	d) Thermal Instability Index	X	X				
ii)	Relative molecular mass:						
	a) SSG	X	X				X
	b) MFR (use three codes — value, temperature, load)					X	
	c) ZST						
iii)	Mechanical properties:						
	a) Tensile strength	X	X				
	b) Thickness of specimen	X					
	c) Percentage elongation at break	X	X				
	d) Stretching void index		X				
iv)	Dispersions:						
	a) Percentage polymer						X
	b) Percentage surfactant						X
v)	Particle size	X	X	X	X	X	
vi)	Bulk density	X	X	X		X	
vii)	Powder-flow time						
viii)	Extrusion pressure		X				
ix)	Dielectric Strength	X		X			
	S (suspension material) is known as granular PTFE;						
	E (emulsion polymer) is known as CD (coagulated dispersion) or FP (fine powder);						
	SS (suspension sintered) is known as presintered granular;						
	D (dispersion) is known as emulsion;						

	F (filler resin) includes the materials often referred to as micropowders or						
	L (lubricating) powders.						

Table 37 Conventional Thermoplastic Fluoropolymers
(*Clause* A-1)

Sl No. (1)	**Properties** (2)	**PFA, ECTFE, FEP, VDF/TFE/HFP,EFEP, VDF/TFE, ETFE** (3)	**PVDF, VDF/HFP, VDF/CTFE** (4)	**PCTFE** (5)	**PVF** (6)
i)	Thermal properties:				
	a) Melting-peak temperature	X	X	X	X
	b) Glass-transition temperature				
	c) Deformation temperature under load				
ii)	Relative molecular mass:				
	a) SSG				
	b) MFR (use three codes — value, temperature, load)	X	X		X
	c) ZST			X	
iii)	Mechanical properties:				
	a) Tensile Yield Stress		X		
	b) Tensile strength	X	X		X
	c) Percentage elongation at break	X	X	X	X
	d) Tensile modulus		X		
iv)	Density [1)]	X	X	X	X
v)	Dispersions [2)]:				
	a) Percentage polymer	X	X		
	b) Percentage surfactant	X	X		
vi)	Particle size [3)]	X	X	X	

[1)] Only for pellets of conventional thermoplastic fluoropolymers.
[2)] Only for dispersions of conventional thermoplastic fluoropolymers.
[3)] Only for powders of conventional thermoplastic fluoropolymers.

ANNEX B
(*Clause* 7.1)
SAMPLING OF FLUOROPOLYMER DISPERSIONS AND MOULDING AND EXTRUSION MATERIALS

B-1 GENERAL REQUIREMENTS OF SAMPLING

B-1.1 Sample shall not be taken in an exposed place.

B-1.2 The sampling instrument which shall be made of glass, stainless steel or any other material on which fluoropolymer dispersions and moulding and extrusion materials have no action, shall be clean and dry.

B-1.3 Precautions shall be taken to protect the samples, the material being sampled, the sampling instrument and containers selected for sampling from adventitious contamination.

B-1.4 To draw a representative sample, the contents of each container selected for sampling shah be mixed as thoroughly as possible by suitable means

B-1.5 The sample shall be placed in suitable, clean, dry, air-tight sheet metal, glass containers or any other suitable container on which the material has no action.

B-1.6 Each sample container shall be sealed air-tight with a stopper after filling and marked with full details of sampling, the date of sampling and the month and year of manufacture of the material.

B-2 SCALE OF SAMPLING

B-2.1 Lot

All the containers in a single consignment of the material drawn from a single batch of manufacture shall constitute a lot. If a consignment is declared or known to consist of different batches of manufacture, the batches shall be marked separately and the groups of containers in each batch shall constitute separate lots.

B-2.2 A number of containers, consisting 10 percent of the containers in a lot but not less than 3 containers in any case, shall be selected at random from a lot for the purpose of drawing samples for test (*see* IS 4905).

B-3 TEST SAMPLES AND REFEREE SAMPLE

B-3.1 Preparation

To prepare a set of test samples, draw with an appropriate sampling instrument, from freshly opened containers which have been selected for sampling, an equal number of scoopfuls of material from any point at least 75 mm below the surface and 75 mm above the bottom of large containers, and from any point at least 25 mm below the surface and 25 mm above the bottom of small containers. The sample prepared by mixing the portions from each container shall be not less than eight times the quantity which is estimated to be required for carrying out all the tests. Divide this composite sample into the required number of reduced samples. Each set of these reduced samples shall constitute the test sample.

B-3.2 Three sets of test samples, each not less than twice the quantity required for the purpose of testing, representative of each selected container (*see* **B-3.1**) shall be transferred immediately to thoroughly dried containers, which shall be sealed air-tight with an appropriate stopper. These containers shall be marked with all the particulars of sampling given under **B-1.6**. One set of the test samples shall be sent to the purchaser and one to the supplier.

B-3.3 Referee Sample

The third set of the test samples, bearing the seals of the purchaser and the supplier shall constitute the referee sample, to be used in case of dispute between the purchaser and the supplier. It shall be kept at a place agreed to between the purchaser and the supplier.

B-4 TEST FOR ACCEPTANCE

B-4.1 Examination and Tests

The purchaser may examine and test separately samples from each of the lots (*see* **B-2.1**) for compliance with the requirements of the standard, or he may prepare for the purpose of such examination, a composite sample representing the whole of the consignment, by mixing the test samples.