



## Plastic Part Marking Algorithm

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<b>Abstract</b>	This document provides a standard for the marking of HP's plastic parts and products, to be used for subsequent decision-making during recycling, reuse, or disposal.
<b>Applicability</b>	The requirements of this standard apply to all plastic parts and products specified by or purchased for HP that are manufactured after 01-Jan-2005. Management of these requirements is mandatory for persons specifying plastic parts and products for use by HP.
<b>Status</b>	APPROVED

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## 1 Introduction

This document provides the requirements for marking HP's plastic parts and products. This marking will be used during subsequent recycling, reuse, or disposal.

## 2 Scope

The requirements of this standard apply to all molded plastic parts used in products specified by or purchased for HP that are manufactured after 01-Jan-2005. This standard does not apply to plastic packaging materials.

This standard specifies uniform requirements for physically marking products and parts made of polymeric (plastic) materials according to internationally recognized standards:

- HP plastic parts and products are to be physically marked in accordance with this standard so they can be identified, separated, and processed for recycling.
- The abbreviated terms included in this standard are consistent with the ISO/DIS 11469 *Plastics - Generic Identification and Marking of Plastic Products* and ISO-1043-1 through ISO-1043-4 *Plastics - Symbols* standards and specify the requirements for generic marking of polymers.

## 3 Marking requirements

If the part size, geometry, and cosmetic and effective function allow, all plastic parts and products must be physically marked with the appropriate symbols or codes (identified in the tables within this standard) to designate the following:

- Basic polymer in the part (Section 4.1)
- Flame retardant material used (Section 4.2)
- Filler or reinforcement used to fabricate the part (Section 4.3)
- Plasticizer used (Section 4.4)
- Recycled content (Section 4.5)

Section 5.0 identifies additional coding and information.

The requirements to be followed used when marking plastic parts and products are included in the following subsections.

### 3.1 Part weight

All parts that weigh 25 grams or more must be physically marked, if adequate space is available and the functionality of the part is not compromised. If adequate space is not available, all suppliers, including original equipment manufacturers (OEMs), contract manufacturers (CMs), and original design



manufacturers (ODMs), must notify HP in writing to determine the recycling impact of the unmarked part.

All manufacturers, including OEMs, CMs, and ODMs, are strongly encouraged to include physical marking, where practical, on all parts weighting less than 25 grams. Where physical marking on parts weighing less than 25 grams is required, this requirement will be noted on applicable drawings or procurement documents.

### **3.2 Character size**

The physical marking code location, size, and process must be specified on the applicable part drawing. The marking process must be compatible with the recycling process. Marking should be placed where it is readily visible to product disassemblers. The preferred character size is 3mm to 5 mm high and with a profile depth of approximately 0.2 mm. On smaller parts where 3mm to 5 mm text is not possible, smaller text can be used. The materials identification text must be no smaller than the part number or identifier that is engraved on the part. If a part number or identifier is present on the part, there should also be adequate room for the plastic (polymer) identification symbols.

### **3.3 Marking legibility**

Physical marking of plastic parts and products must remain legible during the entire part life. On molded plastic parts and products, integrally molded-in marking is preferred, with the provision for future revisions. Production Change Orders should include instructions for updating the marking code whenever material is changed.

### **3.4 Marking method**

The physical marking must be by injection molding, embossing melt imprint, or other legible marking in the surface of the polymer.

### **3.5 Marking location**

Plastic products must be physically marked on an interior surface with the appropriate abbreviated terms.

## **4 Marking identification symbols**

The material identification is to be marked between two angle brackets, as follows:

**>Material ID<**

For example: **>ABS<**

Only capital letters must be used for symbols and abbreviated terms.

### **4.1 Material identification for basic polymers**

The symbols identified in Tables 1 and 2 are the material identification abbreviations for physically identifying plastic parts.

<b>Table 1: Symbol for homopolymeric, copolymers and natural polymers</b>			
<b>Symbol</b>	<b>Material</b>	<b>Symbol</b>	<b>Material</b>
AB	acrylonitrile-butadiene	EVAC	ethylene-(vinyl acetate)
ABAK	acrylonitrile-butadiene-acrylate	EVOH	ethylene-(vinyl alcohol)
ABS	acrylonitrile-butadiene-styrene	FEP	perfluoro(ethylene-propylene)
ACS	acrylonitrile-(chlorinated polyethylene)-styrene	FF	furan-formaldehyde
AEPDS	acrylonitrile-(ethylene-propylene-diene)-styrene	HBV	poly(3-hydroxybutyrate)-co-(3-hydroxyvalerate)
AMMA	acrylonitrile-(methyl methacrylate)	LCP	liquid-crystal polymer
ASA	acrylonitrile-styrene-acrylate	MABS	(methyl methacrylate)-acrylonitrile-butadiene-styrene
CA	cellulose acetate	MBS	(methyl methacrylate)-butadiene-styrene
CAB	cellulose acetate butyrate	MC	methyl cellulose
CAP	cellulose acetate propionate	MF	melamine-formaldehyde
CEF	cellulose formaldehyde	MP	melamine-phenol
CF	cresol-formaldehyde	MSAN	$\alpha$ -methylstyrene-acrylonitrile
CMC	carboxymethyl cellulose	PA	polyamide
CN	cellulose nitrate	PAA	poly(acrylic acid)
COC	cycloolefin copolymer	PAEK	polyaryletherketone
CP	cellulose propionate	PAI	polyamidimide
CTA	cellulose triacetate	PAK	polyacrylate
EAA	ethylene-(acrylic acid)	PAN	polyacrylonitrile
EBAK	ethylene-(butyl acrylate)	PAR	polyarylate
EC	ethyl cellulose	PARA	polyarylamide
EEAK	ethylene-(ethyl acrylate)	PB	polybutene
EMA	ethylene-(methacrylic acid)	PBAK	poly(butyl acrylate)
EP	epoxide	PBD	1,2-polybutadiene

<b>Symbol</b>	<b>Material</b>	<b>Symbol</b>	<b>Material</b>
E/P	ethylene-propylene	PBN	poly(butylene naphthalate)
PBS	poly(butylene succinate)	PEN	poly(ethylene naphthalate)
PBSA	poly(butylene succinate adipate)	PEOX	poly(ethylene oxide)
PBT	poly(butylene terephthalate)	PES	poly(ethylene succinate)
PC	polycarbonate	PESTUR	polyesterurethane
PCCE	poly(cyclohexylene dimethylene cyclohexanedicarboxylate)	PESU	polyethersulfone
PCO	polycycloolefin	PET	poly(ethylene terephthalate)
PCL	polycaprolactone	PEUR	polyetherurethane
PCT	poly(cyclohexylene dimethylene terephthalate)	PF	phenol-formaldehyde resin
PCTFE	polychlorotrifluoroethylene	PFA	perfluoro(alkyl vinyl ether)-tetrafluoroethylene
PDAP	poly(diallyl phthalate)	PHA	polyhydroxyalkanoate
PDCPD	polydicyclopentadiene	PHB	poly(3-hydroxybutyrate)
PE	polyethylene	PI	polyimide
PE-C	polyethylene, chlorinated	PIB	polyisobutylene
PE-HD	polyethylene, high density	PIR	polyisocyanurate
PE-LD	polyethylene, low density	PK	polyketone
PE-LLD	polyethylene, linear low density	PLA	poly(lactic acid)
PE-MD	polyethylene, medium density	PMI	polymethacrylimide
PE-UHMWPE	polyethylene, ultra high molecular weight	PMMA	poly(methyl methacrylate)
PE-VLD	polyethylene, very low density	PMMI	poly( <i>N</i> -methylmethacrylimide)
PEC	polyestercarbonate	PMP	poly(4-methylpent-1-ene)
PEEK	polyetheretherketone	PMS	poly( $\alpha$ -methylstyrene)
PEEST	polyetherester	POM	polyoxymethylene; polyacetal; polyformaldehyde
PEI	polyetherimide	PP	polypropylene



<b>Symbol</b>	<b>Material</b>	<b>Symbol</b>	<b>Material</b>
PEK	polyetherketone	PP-E	polypropylene, expandable;
PP-HI	polypropylene, high impact;	PVF	poly(vinyl fluoride)
PPE	poly(phenylene ether)	PVFM	poly(vinyl formal)
PPOX	poly(propylene oxide)	PVK	poly( <i>N</i> -vinylcarbazole)
PPS	poly(phenylene sulfide)	PVP	poly( <i>N</i> -vinylpyrrolidone)
PPSU	poly(phenylene sulfone)	SAN	styrene-acrylonitrile
PS	polystyrene	SB	styrene-butadiene
PS-E	polystyrene, expandable	SI	silicone
PS-HI	polystyrene, high impact	SMAH	styrene-(maleic anhydride)
PS-S	polystyrene, sulfonated	SMS	styrene- $\alpha$ -methylstyrene
PSU	polysulfone	UF	urea-formaldehyde resin
PTFE	polytetrafluoroethylene	UP	unsaturated polyester
PTT	poly(trimethylene terephthalate)	VCE	(vinyl chloride)-ethylene
PUR	polyurethane	VCEMAK	(vinyl chloride)-ethylene-(methyl acrylate)
PVAC	poly(vinyl acetate)	VCEVAC	(vinyl chloride)-ethylene-(vinyl acetate)
PVAL	poly(vinyl alcohol)	VCKMAK	(vinyl chloride)-(methyl acrylate)
PVB	poly(vinyl butyral)	VCMMA	(vinyl chloride)-(methyl methacrylate)
PVC	poly(vinyl chloride)	VCOAK	(vinyl chloride)-(octyl acrylate)
PVC-C	poly(vinyl chloride), chlorinated;	VCVAC	(vinyl chloride)-(vinyl acetate)
PVC-U	poly(vinyl chloride), unplasticized	VCVDC	(vinyl chloride)-(vinylidene chloride)
PVDC	poly(vinylidene chloride)	VE	vinyl ester
PVDF	poly(vinylidene fluoride)		



#### 4.1.1 Polymer blends

Polymer blends or alloys must be labeled with the appropriate abbreviated terms for the component polymers, with the main component in first place followed by the other components in descending order of their mass fractions, separated by a plus (+) sign. There should be no spaces before or after the plus sign.

For example: **>PC+ABS<** or **>PVC+ABS+SAN<**

Section 6.1 identifies codes to be used to identify commercial blends.

#### 4.1.2 Laminates

Laminates must be physically marked with the appropriate abbreviated terms for the component polymers, separated by a comma. The primary visible material is identified first and the main component, by weight, is identified with an underline.

For example: **>PVC,PUR,ABS<**

#### 4.2 Ignition-resistant (flame retardant) materials

The flame retardant code must be included after the polymeric abbreviation. The term FR, in capital letters without spaces, is also followed by a two-digit code number that states the type of FR material used. The two-digit code must be enclosed in parentheses.

For example: **>PA66-(GF20+MD15)FR(52)<**

All plastics containing flame retardants that have been intentionally added or that exceed 1% by weight must include the flame-retardant code.

Table 3 identifies flame retardant codes.

<b>Table 3: Code numbers for flame retardants</b>	
Code numbers are grouped according to the chemical composition of the flame retardant.	
<b>HALOGONATED COMPOUNDS</b>	
10	aliphatic/alicyclic chlorinated compounds
11	aliphatic/alicyclic chlorinated compounds in combination with antimony compounds
12	aromatic chlorinated compounds
13	aromatic chlorinated compounds in combination with antimony compounds
14	aliphatic/alicyclic brominated compounds
15	aliphatic/alicyclic brominated compounds in combination with antimony compounds
16	aromatic brominated compounds (excluding brominated diphenyl ether and biphenyls)
17	aromatic brominated compounds (excluding brominated diphenyl ether and biphenyls) in combination with antimony compounds
18	polybrominated diphenyl ether
19	polybrominated diphenyl ether in combination with antimony compounds
20	polybrominated biphenyls
21	polybrominated biphenyls in combination with antimony compounds
22	aliphatic/alicyclic chlorinated <u>and</u> brominated compounds
23, 24	not allocated
25	aliphatic fluorinated compounds
26 to 29	not allocated
<b>NITROGEN COMPOUNDS</b>	
30	nitrogen compounds (confined to melamine, melamine cyanurate, urea)
31 to 39	not allocated
<b>ORGANIC PHOSPHORUS COMPOUNDS</b>	
40	Halogen-free organic phosphorus compounds
41	Chlorinated organic phosphorus compounds
42	Brominated organic phosphorus compounds
43 to 49	Not allocated
<b>INORGANIC PHOSPHORUS COMPOUNDS</b>	
50	ammonium orthophosphates
51	ammonium polyphosphates
52	red phosphorus
53 to 59	not allocated
<b>METAL OXIDES, METAL HYDROXIDES, METAL SALTS</b>	
60	aluminum hydroxide
61	magnesium hydroxide

<b>Table 3: Code numbers for flame retardants</b>	
62	antimony (III) oxide
63	alkali-metal antimonate
64	magnesium/calcium carbonate hydrate
65 to 69	not allocated
<b>BORON AND ZINC COMPOUNDS</b>	
70	inorganic boron compounds
71	organic boron compounds
72	zinc borate
73	organic zinc borate
74	not allocated
<b>SILICA COMPOUNDS</b>	
75	inorganic silica compounds
76	organic silica compounds
77 to 79	not allocated
<b>OTHERS</b>	
80	graphite
81 to 89	not allocated
90 to 99	not allocated

### 4.3 Filler and reinforced composition marking

Additional information on filled or reinforced compositions must be marked. The algorithm for marking filler and reinforced composition is indicated in the following sections.

Compositions with a single filler or reinforcing material must include the abbreviated term for the polymer followed by a dash, then the material symbol followed by the form/structure symbol of the additive, followed by the filler's percentage by mass.

For example1: a polycarbonate containing 20% glass fiber is indicated as follows: **>PC-GF20<**

For example2: a high impact polystyrene containing 10% glass fiber is indicated as follows:

**>PS-HI-GF10<**

Compositions with a mixture of fillers or reinforcing materials must include the filler's indicator and percentage within parentheses (curved brackets).

For example3, a polyamide 66 containing a mixture of 15% mineral powder and 20% glass fiber is indicated as follows: **>PA66-(GF20+MD15)<** or **>PA66-(GF+MD)35<**

For example4, a poly(oxymethylene) containing a mixture of 20% glass fiber and 15% Polytetrafluorouethylene is indicated as follows: **>POM-(GF20+PTFE15)<** or **>POM-(GF+PTFE)35<**

There must be no space before or after the plus (+) sign.

Symbols for fillers and reinforcing materials are identified in Table 4.

<b>Symbol</b>	<b>Material (1)</b>	<b>Symbol</b>	<b>Form/Structure</b>
A	aramid	B	beads, spheres, balls
B	boron	C	chips, cuttings
C	carbon	CM	chopped-strand mat
D	alumina trihydrate	D	finest, powders
E	clay	EM	continuous (endless) strand mat
G	glass	F	fibre
K	calcium carbonate	G	ground
L	cellulose	H	whisker
M	mineral	K	knitted fabric
ME	metal (2)	L	layer
N	natural organic (cotton, sisal: hemp: flax: and so forth.)	LF	long fibres
P	mica	M	mat (thick)
Q	silica	N	non-woven (fabric, thin)
S	synthetic organic (finely divided PTFE: polyimides or thermoset resins) (3)	NF	nanofibres
T	talcum	NT	nanotubes
W	wood	P	paper
X	not specified	R	roving
Z	others (not included in this list)	S	flake
		T	twisted or braided fabric, cord, tube
		V	veneer
		W	woven fabric
		X	not specified
		Y	yarn
		Z	others, not included on this list



[1] The materials may be further defined; for example by their chemical symbols or by additional symbols defined in the relevant International Standard.
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[2] In the case of metals (ME), the type(s) of metal must be indicated by its chemical symbol.
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[3] A specific material may be further defined
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#### 4.3.1 Marking for additional materials

Additional information combining more data, such as flame retardants, fillers, and resin characteristics, must be supplied, based upon the appropriate current material specification.

For example, **>PA11-MD30<** describes a material composition of PA= Polyamide, 11= a specific nylon 11 as outlined in Table 1, and MD30, which is mineral powder at 30%.

For example, A nylon 6, 30% glass fiber with red phosphorus flame retardant would be marked as: **>PA6-GF30 FR(52)<**

#### 4.4 Plasticizers

Compositions containing plasticizers must be physically marked with the abbreviated term for the polymer, followed by a hyphen, then the symbol "P" followed by the abbreviated term of the plasticizer in parentheses, as described in ISO 1043-3.

For example, a PVC containing dibutyl phthalate is marked: **>PVC-P(DBP)<**

Supplemental requirements for plasticizers are shown in Table 5.

##### 4.4.1 Supplemental requirements for plasticizers

Table 5 provides uniform symbols for components relating to plasticizers, to form abbreviated terms. It includes typical abbreviated terms that have come into established use.

Requirements:

1. The first appearance of an abbreviated term in a text must be enclosed in parentheses and shall be preceded by the chemical name written in full. For example, Alkylsulfonic acid ester (ASE).
2. Only capital letters shall be used for the symbols.
3. Mixtures of plasticizers are not considered.
4. Unless otherwise indicated, the alkyl groups are *n*-alkyl groups and phthalates are esters of *o*-phthalic acid.
5. No symbol is used in the abbreviated terms to indicate normal (*n*-) linear alcohols. For branched (*iso*) alcohols, the additional symbol *l* is used with one exception: in view of the worldwide usage of the symbol *O* for 2-ethylhexyl (for example in DOA and DOP), this practice is observed in this part of ISO 1043 and the *n*-octyl group is designated *NO* (as in DNOP). Because of this dual usage, the application of the rule specified in Requirement 1 is most important.
6. The symbol *l* designates *iso*-branched groups (for example, DIOP). However, DTDP is sometimes used instead of DITDP because di-*n*-tridecyl phthalate is not a plasticizer: when DTDP is used, the application of the rule specified in 1 (*one*) is most important.
7. For plasticizers based on di-esters of the same alcohol, the first symbol of the abbreviated term is *D*.
8. The letter *P* may be used in place of *F* for "phosphate" in abbreviated terms for plasticizers.



9. Several plasticizers having "iso" names indicating branched groups may consist of several isomers. For this reason, no single IUPAC name can describe the detailed chemical composition of each of these plasticizers.
10. Some plasticizers consisting of esters of more than one alcohol are known by the combined number and letter code, for example, 711A is an alternative common name for heptyl nonyl undecyl adipate (HNUA). The first digit represents the number of carbon atoms in the shortest alkyl group and the second and third digits represent that of the longest alkyl group in the plasticizer: thus 7 denotes heptyl and 11 denotes undecyl. The letter at the end of the code is either A, which denotes adipate, or P, which denotes phthalate.

<b>Abbreviated Term</b>	<b>Common name</b>	<b>IUPAC* equivalent</b>	<b>CAS-RN**</b>
ASE	Alkylsulfonic acid ester	Alkylsulfonates or Alkyl alkanesulfonates	not known
ATBC (or TBAC)	tributyl <i>o</i> -acetyl citrate(or acetyl tributyl citrate)	tributyl <i>o</i> -acetyl citrate	77-90-7
ATEC (or TEAC)	triethyl <i>o</i> -acetyl citrate(or acetyl triethyl citrate)	triethyl <i>o</i> -acetyl citrate	77-89-4
ATEHC	actyltri-(2-ethylhexyl) citrate	tris(2-ethylhexyl)2- actyloxypropane- 1,2,3-tricarboxylate	144-15-0
BAR	butyl- <i>o</i> -acetylricinoleate	Butyl <sup>®</sup> -12- acetoxyoleate	140-04-5
BBP	Benzyl butyl phthalate	same	85-68-7
BCHP	Butyl cyclohexyl phthalat	same	84-64-0
BNP	Butyl nonyl phthalate	same	not known
BOA	Benzyl octyl adipate	benzyl2-ethylhexyl adipate	3089-55-2
BOP	Butyl octyl phthalate	butyl2-ethylhexyl phthalate	85-69-8
BST	Butyl stearate	same	123-95-5
DBA	Dibutyl adipate	same	105-99-7
BEP	di-(2-butoxyethyl) phthalate	bis(2-butoxyethyl) phthalate	117-83-9
DBF	dibutyl fumarate	same	105-75-9
DBM	dibutyl maleate	same	105-76-0



<b>Abbreviated Term</b>	<b>Common name</b>	<b>IUPAC* equivalent</b>	<b>CAS-RN**</b>
DBP	dibutyl phthalate	same	84-74-2
DBS	dibutyl sebacate	same	109-43-3
DBZ	dibutyl azelate	same	2917-73-9
DCHP	dicyclohexyl phthalate	same	84-61-7
DCP	dicapryl phthalate	bis(1-methylheptyl) phthalate	131-15-7
DDP	didecyl phthalate	same	84-77-5
DEGDB	diethylene glycol dibenzoate	oxydiethylene dibenzoate	120-55-8
DEP	diethyl phthalate	same	84-66-2
DHP	diheptyl phthalate	same	3648-21-3
DHXP	dihexyl phthalate	same	84-75-3
DIBA	diisobutyl adipate	same	141-04-8
DIBM	diisobutyl maleate	same	14234-82-3
DIBP	diisobutyl phthalate	same	84-69-5
DIDA	diisobutyl adipate	see 8	27178-16-1
DIDP	diisodecyl phthalate	see 8	26761-40-0
DIHP	diisoheptyl phthalate	as above	41451-28-9
DIHXP	diisohexyl phthalate	same	71850-09-4
DINA	diisononyl adipate	see 8	33703-08-1
DINCH	diisononyl cyclohexanedicarboxylate	diisononyl cyclohexane-1,2-dicarboxylate	166412-78-8
DINP	diisononyl phthalate	see 8	28553-12-0
DIOA	diisooctyl adipate	see 8	1330-86-5
DIOM	diisooctyl maleate	see 8	1330-76-3
DIOP	diisooctyl phthalate	see 8	27554-26-3
DIOS	diisooctyl sebacate	see 8	27214-90-0
DIOZ	diisooctyl azelate	see 8	26544-17-2
DIPP	diisooctyl phthalate	same	605-50-5



<b>Abbreviated Term</b>	<b>Common name</b>	<b>IUPAC* equivalent</b>	<b>CAS-RN**</b>
DMEP	di-(2-methoxyethyl) phthalate	bis(2-methoxyethyl) phthalate	117-82-8
DMP	dimethyl phthalate	same	131-11-3
DMS	dimethyl sebacate	same	106-79-6
DNF	dinonyl fumarate	same	2787-63-5
DMN	dinonyl maleate	same	2787-64-6
DNOP	di- <i>n</i> -octyl phthalate	dioctyl phthalate	117-84-0
DNP	dinonyl phthalate	same	14103-61-8
DNS	dinonyl sebacate	same	4121-16-8
DOA	dioctyl(3) adipate	bis(2-ethylhexyl)3) adipate	103-23-1
DOIP	dioctyl isophthalate	bis(2-ethylhexyl) isophthalate	137-89-3
DOP	dioctyl phthalate	bis(2-ethylhexyl) phthalate	117-81-7
DOS	dioctyl sebacate	bis(2-ethylhexyl) sebacate	122-62-3
DOTP (or DEHT)	dioctyl terephthalate	bis(2-ethylhexyl) terephthalate	6422-86-2
DOZ	dioctyl azelate	bis(2-ethylhexyl) azelate	2064-80-4
DPCF (or DPCF)	diphenyl cresyl phosphate	diphenyl x-tolyl orthophosphate where x demotes <i>o</i> , <i>m</i> , <i>p</i> or mixture	26444-49-5
DPGDB	di- <i>x</i> --propylene glycol dibenzoate	not possible	not known
DPHP	di-(2-propylheptyl) phthalate	bis(2-propylheptyl) benzene-1,2-dicarboxylate	53306-54-0
DPOP (or DPOF)	diphenyl octyl phosphate	2-ethylhexyl diphenyl orthophosphate or octyl diphenyl orthophosphate	1241-94-7
DPP	diphenyl phthalate	same	84-62-8

<b>Abbreviated Term</b>	<b>Common name</b>	<b>IUPAC* equivalent</b>	<b>CAS-RN**</b>
DTDP	diisotridecyl phthalate (see note X)	see 8	27253-26-5
DUP	diundecyl phthalate	same	3648-20-2
ELO	epoxidized linseed oil	not possible	8016-11-3
ESBO	epoxidized soya bean oil	not possible	8013-07-8
GTA	glycerol triacetate	same	102-76-1
HNUA	heptyl nonyl undecyl adipate (=711A)	not possible	Not known
HNUP	heptyl nonyl undecyl phthalate (=711P)	not possible	68515-42-4
HXODA	heptyl octyl decyl adipate (=610A)	not possible	not known
HXODP	heptyl octyl decyl phthalate (=610P)	not possible	68515-51-5
NUA	nonyl undecyl adipate (=911A)	not possible	not known
NUP	nonyl undecyl phthalate (=911P)	not possible	not known
ODA	octyl decyl adipate	decyl octyl adipate	110-29-2
ODP	octyl decyl phthalate	decyl octyl phthalate	68515-52-6
ODTM	<i>n</i> -octyl decyl trimellitate	decyl octyl hydrogen Benzene 1,2,4-tricarboxylate	not known
PO	paraffin oil	not possible	8012-95-1
PPA	poly(propylene adipate)	same	not known
PPS	poly(propylene sebacate)	not possible	not known
SOA	sucrose octa-acetate	sucrose octaacetate	126-14-7
TBAC (or ATBC)	tributyl <i>o</i> -acetylcitrate	same	77-90-7
TBEP	tri-(2-butoxyethyl) phosphate	tris(2-butoxyethyl) orthophosphate	78-51-3
TBP	tributyl phosphate	tributyl orthophosphate	126-73-8
TCEP (or TCEF)	trichloroethyl phosphate	tris(2-chloroethyl)	6145-73-9



<b>Table 5: Plasticizers</b>			
<b>Abbreviated Term</b>	<b>Common name</b>	<b>IUPAC* equivalent</b>	<b>CAS-RN**</b>
		orthophosphate	
TCP (or TCF)	tricresyl phosphate	tri- <i>x</i> -tolyl orthophosphate where <i>x</i> denotes <i>o</i> , <i>m</i> , <i>p</i> or mixture	1330-78-5
TDBPP	tri-(2,3-dibromopropyl) phosphate	tris(2,3-dibromopropyl) orthophosphate	126-72-7
TDCPP	tri-(2,3-dichloropropyl) phosphate	tris(2,3-dichloropropyl) orthophosphate	78-43-3
TEAC (or ATEC)	triethyl <i>o</i> -acetyl citrate	same	77-89-4
THFO	tetrahydrofurfuryl oleate	same	5420-17-7
THTM	triheptyl trimellitate	triheptyl benzene-1,2,4-tricarboxylate	1528-48-9
TIOTM	triisooctyl trimellitate	tris(6-methylheptyl) Benzene-1,2,4-tricarboxylate	27251-75-8
TOP (or TOF)	trioctyl phosphate	tris(2-ethylhexyl) orthophosphate	78-42-2
TOPM	tetraoctyl pyromellitate	tetrakis(2-ethylhexyl) benzene-1,2,4,5-tetracarboxylate	3126-80-5
TOTM	trioctyl trimellitate	tris(2-ethylhexyl) benzene-1,2,4,5-tetracarboxylate	89-04-3
TPP	triphenyl phosphate	triphenyl orthophosphate	115-86-6
TXP (or TXF)	trixyllyl phosphate	tri- <i>x,y</i> -xyllyl orthophosphate, where <i>x</i> and <i>y</i> denotes <i>o</i> , <i>m</i> , <i>p</i> or mixture	25155-23-1

\* IUPAC is the International Union of Pure and Applied Chemicals.

\*\* CAS-RN identifies the Chemical Abstracts Service - Registry Number



#### 4.5 Recycled Content

The symbol “(REC)” is an option (according to ISO 14021:1999) that may be used in addition to the abbreviated term for the basic polymer and the symbols for the indication of special characteristics. The symbol “(REC)” for plastic recyclate shall always be at the last position of the abbreviated term and symbols used for the plastic.

If the percentage recycled content is available and a specific claim of recycling content has to be declared, the capital letters REC may be followed by a number indicating the minimum percentage by mass of the recycling content and the whole enclosed in parentheses, e.g. “(REC85)”.

For examples1, HIPS with recycled content of 85% post consumable content,

**>PS-HI<** When the specific claim regarding recyclate is not intended to be declared

**>PS-HI(REC)<** When the specific claim regarding recyclate is intended to be declared without specifying amount.

**>PS-HI(REC85)<** When the specific claim regarding recyclate is intended to be declared with specific amount.

For examples2, ABS with recycled content of 85% post consumable content, **>ABS(REC85)<**

For examples3, PC containing 20% Glass fiber with recycled content of 50% post consumable content, **>PC-GF20(REC50)<**

## 5 Supplemental identification

Additional identification marking, such as date code, country of origin, part model name, part version, ISO supplemental part marking, and so forth, may be included on the part, upon Divisional discretion. However, no additional information may replace the universal material marking code defined in this standard.

### 5.1 Commercial blends

Table 6 includes marking information for commercial blends

<b>Symbol</b>	<b>Material</b>
ABS+PA	Acrylonitrile-butadiene-styrene+polyamide
ABS+PC	Acrylonitrile-butadiene-styrene+polycarbonate
ABS+PPSU	Acrylonitrile-butadiene-styrene+polyphenylenesulfone
ABS+PTFE	Acrylonitrile-butadiene-styrene+polytetrafluoroethylene
ABS+PVC	Acrylonitrile-butadiene-styrene+poly(vinylchloride)
ABS+SMA	Acrylonitrile-butadiene-styrene+styrenemaleicanhydride
ABS+TPU	Acrylonitrile-butadiene-styrene+thermoplasticpolyurethane



<b>Table 6: Commercial Blends Quick Reference</b>	
<b>Symbol</b>	<b>Material</b>
ASA+PC	Acrylonitrile-styrene-acrylate+polycarbonate
ASA+PMMA	Acrylonitrile-styrene-acrylate+poly(methylmethacrylate)
ASA+PVC	Acrylonitrile-styrene-acrylate+poly(vinylchloride)
PA	Polyamide(amorphous)blend
PA+EMA	Polyamide+ethylenemethacrylicacid(ionomer)
PA+PE	Polyamide+polyethylene
PA+PPE	Polyamide+poly(phenyleneether)
PA+RBR	Polyamide+rubber
PA+SAN	Polyamide+styrene-acrylonitrile
PBT+PET	Poly(butylene terephthalate)+poly(ethylene terephthalate)
PBT+PPE	Poly(butylene terephthalate)+poly(phenyleneether)
PBT+RBR	Poly(butylene terephthalate)+rubber
PC+PBT	Polycarbonate+Poly(butylene terephthalate)
PC+PE	Polycarbonate+polyethylene
PC+PET	Polycarbonate+poly(ethylene terephthalate)
PC+SMA	Polycarbonate+styrene maleic anhydride
PC+TPU	Polycarbonate+thermoplastic polyurethane
PET+PMMA	Poly(ethylene terephthalate)+poly(methylmethacrylate)
PET+PPSU	Poly(ethylene terephthalate)+polyphenylene sulfone
PET+RBR	Poly(ethylene terephthalate)+rubber
POM+PTFE	Polyoxymethylene+polytetrafluoroethylene
POM+RBR	Polyoxymethylene+rubber
PPE+IPS	Poly(phenylene ether)+high impact polystyrene
PPS+PTFE	Poly(phenylene sulfide)+polytetrafluoroethylene
PUR+PIR	Polyurethane+polyisocyanurate
PVC+CPE	Poly(vinyl chloride)+chlorinated polyethylene
PVC+NBR	Poly(vinyl chloride)+nitrile-butadiene rubber
PVC+PMMA	Poly(vinyl chloride)+poly(methylmethacrylate)
PVC+PUR	Poly(vinyl chloride)+polyurethane

<b>Symbol</b>	<b>Material</b>
PVC+PU	Poly(vinylchloride)+polyurethane
SMA+IPS	Styrenemaleicanhydride+highimpactpolystyrene

## 5.2 Indication of special characteristics

The abbreviated terms from ISO 1043-1:1997(E) for basic polymers may be supplemented by up to four symbols (identified in Table 7) to differentiate between or among modifications of the polymer, if desired. The supplementary symbols shall be placed after the abbreviated term of the basic polymer, separated by a hyphen, with no spacing before or after the hyphen. No symbol shall be placed in front of the abbreviated term of the basic polymer.

For example, Polypropylene, block co polymer: >PP-B<

<b>Symbol</b>	<b>Meaning</b>	<b>Symbol</b>	<b>Meaning</b>
<b>A</b>	acid (modified)	<b>L</b>	low
<b>A</b>	adipate	<b>M</b>	medium
<b>A</b>	amorphous; atactic	<b>M</b>	molecular
<b>B</b>	biaxial	<b>N</b>	normal
<b>B</b>	block	<b>N</b>	novolak
<b>B</b>	brominated	<b>O</b>	oriented
<b>C</b>	chlorinated	<b>P</b>	plasticized
<b>C</b>	crystalline; isotatic	<b>P</b>	thermoplastic
<b>D</b>	density	<b>R</b>	raised
<b>E</b>	epoxidized	<b>R</b>	random
<b>E</b>	expanded, expandable	<b>R</b>	resol
<b>F</b>	flexible	<b>R</b>	rigid
<b>F</b>	fluid	<b>S</b>	saturated
<b>F</b>	fluorinated	<b>S</b>	sulfonated
<b>G</b>	glycol	<b>S</b>	syndiotactic
<b>H</b>	high	<b>S</b>	thermosetting
<b>I</b>	impact	<b>T</b>	temperature (resistance)



<b>L</b>	linear	<b>T</b>	toughened
<b>U</b>	ultra	<b>V</b>	very
<b>U</b>	unplasticized	<b>W</b>	weight
<b>U</b>	unsaturated	<b>X</b>	crosslinked; crosslinkable

## 6 References

- ASTM D1600, *Standard Terminology Relating to Abbreviations and Codes for Terms Related to Plastics.*
- ASTM D1972, *Standard Practice for Generic Marking of Plastic Products*
- ISO 1043-1:2011(E) *Plastics - Symbols. Part 1: Basic polymers and their special characteristics.*
- ISO 1043-2:2011(E) *Plastics- Symbols Part 2: Fillers and Reinforcing Materials.*
- ISO 1043-3:2016(E) *Plastics-Symbols and abbreviated terms Part 3 Plasticizers*
- ISO 1043-4:1998 (E) *Plastics-Symbols Part 4 Flame retardants.*
- ISO 11469-2016 (E). *Plastics - Generic Identification and Marking of Plastic Products.*
- SAE J1344. *Marking of Plastics Parts.*



## Revision History:

<b>Revision, Date, Change Number</b>	<b>Brief Description of change</b>
Rev F 26-Aug-2003	Added Organic phosphorus compounds to Table 4.
Rev G 03-Aug-2004	Changed threshold guideline for marking from 3 grams to 25 grams.
Rev H 21-Feb-2005	Reformatted to new template. Text was re-ordered and edited for clarity. Examples were added where needed.
Rev J 21-Mar-2005 DCN 02752	Correction in section 4.2 to change "1000 PPM (0.1%)" to "1% by weight."
Rev J1 29-Mar-2005 DCN 02754	Minor revision change to correct Table 3, "Not Allocated" numbers for Organic Phosphorus Compounds.
01-Aug-2008	Ownership change. No revision change needed.
03-Jan-2012	Ownership change. No revision change needed.
24-June-2015	Company name and ownership change. No revision change needed.
Rev K 15-March-2017	Updates including: <ol style="list-style-type: none"> <li>1) The additional of an option to include plastic recyclate and its content.</li> <li>2) New symbol for polymers, fillers, reinforcing material, plasticizers and special characters.</li> <li>3) Correction of engraving code examples in previous revision</li> <li>4) Correction of internal HP standards website</li> </ol>