
Plastics
Tolerances for plastic moulded parts
(thermosetting and thermoplastic)

F : Plastiques - Tolérances applicables aux pièces
moulées en plastiques (thermodurcissables et
thermoplastiques)

French Standard certified by decision of the
Director General of AFNOR on 5 September 1987 to
take effect on 5 November 1987
Supersedes the certified Standard with the same
number, dated September 1985.

Correspondance There is no ISO standard dealing with the same
subject. The German Standard DIN 16 901 on the same
subject is not equivalent.

Analysis This standard supplies tolerances on moulded parts
(compression moulding, injection moulding or
transfer moulding), for plastics (thermoplastic and
thermosetting) with the exception of cellular and
expanded plastics. The tolerances depend on the
value of the dimension in question, the type of
plastic used for moulding the part and the tolerance
class required (standard, reduced, precision, high
precision). These data which are given in numerical
form should be able to be adapted for computer
assisted design (CAD).

Descriptors International Technical Thesaurus : Plastics,
thermosetting resins, thermoplastic resins, plastic
moulding, materials specifications, dimensional
tolerances, tables (data).

Plastics

Tolerances for plastic moulded parts (thermosetting and thermoplastic)

FOREWORD

At the date of publication of this standard there is no standard or draft standard under consideration by the International Organization for Standardization (ISO).

1 SCOPE AND FIELD OF APPLICATION

1.1 This standard applies to tolerances and permissible deviations for plastic mouldings produced by compression moulding, transfer moulding or injection moulding from thermosetting and thermoplastic materials.

It does not apply to cellular or expanded plastics.

1.2 The materials covered by this standard are given in Table 1.

1.3 The tolerance values given in Tables 2 to 13 are only valid for manufacturing tolerances. They apply:

- regardless of deformations connected to the shape of the mouldings
- regardless of flash.

Secondary effects such as post-shrinkage, swelling, post-crystallization or dimensional variations due to the effects of temperature and humidity are not taken into account.

If certain tolerances must be guaranteed after storage or prolonged use, these shall be the subject of an agreement between the manufacturer and the user.

Modifications In relation to the previous edition

- on page 3, Table 1, 2nd column, the meaning of symbol POM for a dimensional tolerance category of 3 has been corrected, read "polyoxymethylene (L < 150 mm) (polyacetal).
- on page 9, paragraph 4.2, 1st line, the symbol of phenolic plastic materials corresponding to the denomination D4 (P42) has been corrected read PF2.
- on page 14, table 15, 3rd column, 1st line, the permissible deviation $\Delta \alpha$ for a length L < 10 has been corrected, read $\pm 1^{\circ} 30'$

Corrections

Table 1

<u>Symbol</u>	<u>Meaning</u>	<u>Dimensional tolerance categories</u> <u>(see tables in section 4)</u>
PA	Polyamides PA 6, PA 66, PA 6/10, PA 11, PA 12 without filler	3
	Amorphous polyamides, with and without filler	4
	Polyamides PA 6, PA 66, PA 6/10, PA 11, PA 12 with filler	4
	Block polyamides (polyether block amide) Shore D Hardness > 50 (1)	3
	Block polyamides (polyether block amide) Shore D Hardness ≤ 50 (1)	5
POM	Polyoxymethylene (L < 150 mm) (polyacetal)	3
	Polyoxymethylene with filler	4
PBTP	Poly(butylene terephthalate) without filler	3
	Poly(butylene terephthalate) with filler	4
PETP	Crystalline poly(ethylene terephthalate)	3
	Amorphous poly(ethylene terephthalate)	4
	Poly(ethylene terephthalate) with filler	4
	Polyester-ether block copolymers without filler Shore D Hardness > 50 (1)	3
	Polyester-ether block copolymers without filler Shore D Hardness ≤ 50 (1)	5
E/VAC	Poly(ethylene/vinyl acetate)	3
PP	Polypropylene with filler	3
	Modified polypropylene PP/EPDM without filler	3
PPO	Unmodified poly(phenyl oxide)	4
	Modified poly(phenyl oxide) without filler	4
	Modified poly(phenyl oxide), reinforced, (glass fibre)	4
PC	Polycarbonate with and without filler	4
ABS	Poly (acrylnitrile/butadiene/styrene with and without filler	4
PF	Phenolic plastic materials PF2 C3	1
	Phenolic plastic materials PF2 A1, PF2 D1, PF2 D3, PF2 D4	2
UP	Unsaturated polyesters (moulding composition)	1
	Preimpregnated (unsaturated polyesters)	2

(1) Shore D Hardness 50 corresponds to Shore A Hardness 93-94

<u>Symbol</u>	<u>Meaning</u>	<u>Dimensional tolerance categories</u> <u>(see tables in section 4)</u>
EP	Epoxy	1
PDAP	Poly(diallyl phthalate) with organic filler	1
MF	Melamine formaldehyde with mineral filler	1
	Melamine formaldehyde with organic or mixed filler	2
PS	Polystyrene with filler	4
	Polystyrene without filler	4
SB	Poly(styrene/butadiene)	4
SAN	Poly(styrene/acrylonitrile) with and without filler	4
PMMA	Poly(methyl methacrylate)	4
PUR	Thermoplastic polyurethane Shore D Hardness > 50 (1)	3
PVC-U	Unplasticized polyvinyl chloride	4
PSU (2)	Polysulphone with or without filler	4
PPS (2)	Poly(phenylene sulphide), reinforced	4
CA	Cellulose acetate	3
CAB	Cellulose acetate butyrate	3
CAP	Cellulose acetate propionate	3
CP	Cellulose propionate	3

(1) Shore D Hardness 50 corresponds to Shore A Hardness 93-94

(2) This symbol is not defined in the Documentation Sheet T 50-050

<u>Symbol</u>	<u>Meaning</u>	<u>Dimensional tolerance categories</u> <u>(see tables in section 4)</u>
PES (1)	Poly(ether sulphone) (without filler)	4
ASA	Poly(acrylonitrile/styrene/acrylate)	4
PUJ	Thermoplastic polyurethane Shore D Hardness \leq 50 (2)	5
PE	Polyethylene without filler	5
PP	Polypropylene without filler	5
PVC-P (3)	Plasticized poly(vinyl chloride) Shore D Hardness $>$ 50 (2)	3
	Plasticized poly(vinyl chloride) Shore D Hardness \leq 50 (2)	5
PPSU	Poly (phenylene sulfone)	4
FEP	Poly perfluoro(ethylene/propylene)	5
PFA (1)	Perfluoro alkoxy copolymer	5
E/TFE	Tetrafluoroethylene/ethylene copolymer without reinforcement	5
	Tetrafluoroethylene/ethylene copolymer with glass fibre reinforcement	3
PTFE (4)	Polytetrafluoroethylene	
PB	Polybutenes	5

(1) This symbol is not defined in the Documentation Sheet T 50-050.

(2) Shore D Hardness 50 corresponds to Shore A Hardness 93-94.

(3) Symbol according to ISO/DIS 1043 part 1.

(4) At the date of publication of this standard there is no data available for classification of dimensional tolerances.

1.4 The dimensions are measured after cooling (at least 48 h after moulding and before any ageing process for acceptance testing or certification).
Reference atmosphere: $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and $50\% \pm 5\%$ relative humidity.

In special cases and by agreement between the parties concerned, the dimensions may be tested after pretreatment (stabilization, moisture regain).

Note: Any special conditions for measuring the dimensions of unfree pieces (e.g. plastic duplicate moulding), may be the subject of an agreement between the parties concerned.

1.5 Tolerances on shape and position of threads and teeth are not specified by this standard. If required, these shall be agreed with the manufacturer in accordance with existing standards.

2 REFERENCES

NF E 04-552 Technical drawings - Geometric tolerancing - General.
Definitions, symbols, marking on drawings.

T 50-050 Symbols for the abbreviated designation of base materials for plastic compounds.

3 DEFINITIONS OF DIMENSIONAL TOLERANCES. GUIDE TO SELECTION

3.1 Tolerance classes

Plastic pieces can be made in accordance with three tolerance classes:

- Standard tolerances: deviation obtained from low level of control of manufacture and equipment.
- Reduced tolerances: deviation obtained from strict control of manufacture and equipment; this tolerance class costs more than the standard class.
- Precision tolerances: deviation obtained from:
 - the use of precision machines
 - expensive tool design

- the use of qualified personnel
- reinforced control of manufacture and equipment with high risks of rejects or sorting.

There is also a fourth class that is used in exceptional cases:

- High precision tolerances: deviation obtained from an extremely expensive design of manufacturing equipment.

Note: When thermoplastics are used, it is possible to achieve even closer tolerances than those in the "high precision" class, by limiting the mass of the pieces to a few decigrams. This requires a special technology and causes problems if abrasive materials have to be used (glass filler).

The use of the standard tolerance class allows the widest application and interchangeability of materials.

3.2 Indications to be marked on the drawing

- The tolerances that apply to untoleranced dimensions on the drawing are standard class tolerances. They do not undergo any special inspection.
- The standard, reduced, precision and high precision tolerances that apply to functional dimensions shall be written in full on the drawing for the dimensions in question.
- If tolerances are required that are narrower than those in this standard, these, after agreement between the parties concerned, shall be indicated in full on the drawing for the dimension(s) in question. If larger tolerances than those in this standard are allowed, these shall also be indicated in full.

Indicate on the drawing of the moulding near the cartridge:

- "general tolerances of class... (to be specified) according to NF T 58-000".
- the value of the injection point and, where applicable, the surface condition of the moulding (in R_a).

Note : Positions of ejectors, mould joints, injection points, reference marks on the moulding

and on the mould and the date stamp shall be specified on the drawings after agreement between the parties concerned.

4 DIMENSIONAL TOLERANCES - Tables of dimensional tolerances for lengths, diameters and radii.

4.1 Category 1.

- Tolerances applicable to phenolic plastic materials PF2 C3 (P12), unsaturated polyesters, epoxydes, diallylphthalates, melanine formols with mineral filler.

Table 2 - Deviations for dimensions not including mould joint

Dimensions mm	Tolerance class		
	standard	reduced	precision
$a \leq 1$	$\pm 0,13$	$\pm 0,06$	$\pm 0,04$
$1 < a \leq 3$	$\pm 0,15$	$\pm 0,07$	$\pm 0,05$
$3 < a \leq 6$	$\pm 0,17$	$\pm 0,08$	$\pm 0,06$
$6 < a \leq 10$	$\pm 0,20$	$\pm 0,09$	$\pm 0,07$
$10 < a \leq 15$	$\pm 0,22$	$\pm 0,10$	$\pm 0,08$
$15 < a \leq 22$	$\pm 0,25$	$\pm 0,11$	$\pm 0,09$
$22 < a \leq 30$	$\pm 0,27$	$\pm 0,13$	$\pm 0,10$
$30 < a \leq 40$	$\pm 0,30$	$\pm 0,15$	$\pm 0,11$
$40 < a \leq 53$	$\pm 0,33$	$\pm 0,17$	$\pm 0,13$
$53 < a \leq 70$	$\pm 0,38$	$\pm 0,20$	$\pm 0,15$
$70 < a \leq 90$	$\pm 0,43$	$\pm 0,24$	$\pm 0,17$
$90 < a \leq 115$	$\pm 0,50$	$\pm 0,29$	$\pm 0,20$
$115 < a \leq 150$	$\pm 0,60$	$\pm 0,35$	$\pm 0,24$
$150 < a \leq 200$	$\pm 0,75$	$\pm 0,44$	$\pm 0,30$
$200 < a \leq 250$	$\pm 0,90$	$\pm 0,55$	$\pm 0,36$
$250 < a \leq 315$	$\pm 1,10$	$\pm 0,60$	$\pm 0,44$
$315 < a \leq 400$	$\pm 1,30$	$\pm 0,85$	$\pm 0,55$
$400 < a \leq 500$	$\pm 1,50$	$\pm 1,00$	$\pm 0,65$
$500 < a \leq 630$	$\pm 1,90$	$\pm 1,20$	$\pm 0,80$
$630 < a \leq 800$	$\pm 2,40$	$\pm 1,50$	$\pm 1,00$
$800 < a \leq 1\ 000$	$\pm 2,90$	$\pm 1,90$	$\pm 1,30$
$1\ 000 < a \leq 1\ 300$	$\pm 3,60$	$\pm 2,40$	$\pm 1,70$
$1\ 300 < a \leq 1\ 600$	$\pm 4,40$	$\pm 3,10$	$\pm 2,20$
$1\ 600 < a \leq 2\ 000$	$\pm 5,40$	$\pm 3,90$	$\pm 2,70$

Table 3 - Deviations for dimensions including the mould joint or slip

Dimensions mm	Tolerance class		
	standard	reduced	precision
$a \leq 1$	$\pm 0,23$	$\pm 0,16$	$\pm 0,14$
$1 < a \leq 3$	$\pm 0,25$	$\pm 0,17$	$\pm 0,15$
$3 < a \leq 6$	$\pm 0,27$	$\pm 0,18$	$\pm 0,16$
$6 < a \leq 10$	$\pm 0,30$	$\pm 0,19$	$\pm 0,17$
$10 < a \leq 15$	$\pm 0,32$	$\pm 0,20$	$\pm 0,18$
$15 < a \leq 22$	$\pm 0,35$	$\pm 0,21$	$\pm 0,19$
$22 < a \leq 30$	$\pm 0,37$	$\pm 0,23$	$\pm 0,20$
$30 < a \leq 40$	$\pm 0,40$	$\pm 0,25$	$\pm 0,21$
$40 < a \leq 53$	$\pm 0,43$	$\pm 0,27$	$\pm 0,23$
$53 < a \leq 70$	$\pm 0,48$	$\pm 0,30$	$\pm 0,25$
$70 < a \leq 90$	$\pm 0,55$	$\pm 0,34$	$\pm 0,27$
$90 < a \leq 115$	$\pm 0,60$	$\pm 0,39$	$\pm 0,30$
$115 < a \leq 150$	$\pm 0,70$	$\pm 0,45$	$\pm 0,34$
$150 < a \leq 200$	$\pm 0,85$	$\pm 0,55$	$\pm 0,40$
$200 < a \leq 250$	$\pm 1,00$	$\pm 0,65$	$\pm 0,46$
$250 < a \leq 315$	$\pm 1,20$	$\pm 0,70$	$\pm 0,55$
$315 < a \leq 400$	$\pm 1,40$	$\pm 0,95$	$\pm 0,65$
$400 < a \leq 500$	$\pm 1,60$	$\pm 1,10$	$\pm 0,75$
$500 < a \leq 630$	$\pm 2,00$	$\pm 1,30$	$\pm 0,90$
$630 < a \leq 800$	$\pm 2,50$	$\pm 1,60$	$\pm 1,10$
$800 < a \leq 1\ 000$	$\pm 3,00$	$\pm 2,00$	$\pm 1,40$
$1\ 000 < a \leq 1\ 300$	$\pm 3,70$	$\pm 2,50$	$\pm 1,80$
$1\ 300 < a \leq 1\ 600$	$\pm 4,50$	$\pm 3,20$	$\pm 2,30$
$1\ 600 < a \leq 2\ 000$	$\pm 5,50$	$\pm 4,00$	$\pm 2,80$

4.2 Category 2.

- Tolerances applicable to preimpregnated phenolic plastic materials
PF2 A1 (P21), PF2 D1 (P31), PF2 D3 (P41), PF2 D4 (P42), melamine formols
with organic or mixed filler.

Table 4 - Deviations for dimensions
not including the mould jointTable 5 - Deviations for dimensions
including the mould joint or slip

Dimensions mm	Tolerance class		
	standard	reduced	precision
$a \leq 1$	$\pm 0,13$	$\pm 0,08$	$\pm 0,06$
$1 < a \leq 3$	$\pm 0,15$	$\pm 0,09$	$\pm 0,07$
$3 < a \leq 6$	$\pm 0,17$	$\pm 0,10$	$\pm 0,08$
$6 < a \leq 10$	$\pm 0,20$	$\pm 0,11$	$\pm 0,09$
$10 < a \leq 15$	$\pm 0,22$	$\pm 0,13$	$\pm 0,10$
$15 < a \leq 22$	$\pm 0,25$	$\pm 0,15$	$\pm 0,11$
$22 < a \leq 30$	$\pm 0,28$	$\pm 0,17$	$\pm 0,13$
$30 < a \leq 40$	$\pm 0,32$	$\pm 0,20$	$\pm 0,15$
$40 < a \leq 53$	$\pm 0,37$	$\pm 0,24$	$\pm 0,17$
$53 < a \leq 70$	$\pm 0,44$	$\pm 0,28$	$\pm 0,20$
$70 < a \leq 90$	$\pm 0,50$	$\pm 0,34$	$\pm 0,24$
$90 < a \leq 115$	$\pm 0,60$	$\pm 0,41$	$\pm 0,29$
$115 < a \leq 150$	$\pm 0,75$	$\pm 0,50$	$\pm 0,35$
$150 < a \leq 200$	$\pm 0,95$	$\pm 0,65$	$\pm 0,45$
$200 < a \leq 250$	$\pm 1,15$	$\pm 0,80$	$\pm 0,55$
$250 < a \leq 315$	$\pm 1,40$	$\pm 1,00$	$\pm 0,70$
$315 < a \leq 400$	$\pm 1,75$	$\pm 1,20$	$\pm 0,85$
$400 < a \leq 500$	$\pm 2,20$	$\pm 1,50$	$\pm 1,00$
$500 < a \leq 630$	$\pm 2,80$	$\pm 1,90$	$\pm 1,20$
$630 < a \leq 800$	$\pm 3,50$	$\pm 2,40$	$\pm 1,50$
$800 < a \leq 1\ 000$	$\pm 4,40$	$\pm 2,90$	$\pm 1,90$
$1\ 000 < a \leq 1\ 300$	$\pm 5,50$	$\pm 3,60$	$\pm 2,40$
$1\ 300 < a \leq 1\ 600$	$\pm 7,00$	$\pm 4,40$	$\pm 3,10$
$1\ 600 < a \leq 2\ 000$	$\pm 9,80$	$\pm 5,40$	$\pm 3,90$

Dimensions mm	Tolerance class		
	standard	reduced	precision
$a \leq 1$	$\pm 0,23$	$\pm 0,18$	$\pm 0,16$
$1 < a \leq 3$	$\pm 0,25$	$\pm 0,19$	$\pm 0,17$
$3 < a \leq 6$	$\pm 0,27$	$\pm 0,20$	$\pm 0,18$
$6 < a \leq 10$	$\pm 0,29$	$\pm 0,21$	$\pm 0,19$
$10 < a \leq 15$	$\pm 0,32$	$\pm 0,23$	$\pm 0,20$
$15 < a \leq 22$	$\pm 0,35$	$\pm 0,25$	$\pm 0,21$
$22 < a \leq 30$	$\pm 0,38$	$\pm 0,27$	$\pm 0,23$
$30 < a \leq 40$	$\pm 0,42$	$\pm 0,30$	$\pm 0,25$
$40 < a \leq 53$	$\pm 0,47$	$\pm 0,34$	$\pm 0,27$
$53 < a \leq 70$	$\pm 0,55$	$\pm 0,38$	$\pm 0,30$
$70 < a \leq 90$	$\pm 0,60$	$\pm 0,44$	$\pm 0,34$
$90 < a \leq 115$	$\pm 0,70$	$\pm 0,50$	$\pm 0,39$
$115 < a \leq 150$	$\pm 0,85$	$\pm 0,60$	$\pm 0,45$
$150 < a \leq 200$	$\pm 1,10$	$\pm 0,75$	$\pm 0,55$
$200 < a \leq 250$	$\pm 1,30$	$\pm 0,90$	$\pm 0,65$
$250 < a \leq 315$	$\pm 1,50$	$\pm 1,10$	$\pm 0,80$
$315 < a \leq 400$	$\pm 1,90$	$\pm 1,30$	$\pm 0,95$
$400 < a \leq 500$	$\pm 2,30$	$\pm 1,60$	$\pm 1,10$
$500 < a \leq 630$	$\pm 2,90$	$\pm 2,00$	$\pm 1,30$
$630 < a \leq 800$	$\pm 3,60$	$\pm 2,50$	$\pm 1,60$
$800 < a \leq 1\ 000$	$\pm 4,50$	$\pm 3,00$	$\pm 2,40$
$1\ 000 < a \leq 1\ 300$	$\pm 5,60$	$\pm 3,70$	$\pm 2,50$
$1\ 300 < a \leq 1\ 600$	$\pm 7,10$	$\pm 4,50$	$\pm 3,20$
$1\ 600 < a \leq 2\ 000$	$\pm 9,90$	$\pm 5,50$	$\pm 4,00$

4.3 Category 3:

- Tolerances applicable to polyamides PA 6, PA 66, PA 6/10, PA 11, PA 12 without filler, block polyamides (polyether block amide) of Shore D Hardness > 50, polyoxymethylene (polyacetals) (L < 150 mm), PBTP without filler, crystalline PETP, block polyester-ether copolymers without filler Shore D Hardness > 50, poly(ethylene/vinyl acetate), E/VAC, polypropylene with filler, modified polypropylene PP/EPDM without filler, thermoplastic polyurethane Shore D Hardness > 50, cellulose acetate, cellulose acetate butyrate, cellulose acetate propionate, cellulose propionate, plasticized poly(vinyl chloride) Shore D Hardness > 50, glass fibre reinforced tetrafluoroethylene/ethylene copolymers.

Table 6 - Deviations for dimensions not including the mould joint

Dimensions mm	Tolerance class		
	standard	reduced	precision
a ≤ 1	± 0,13	± 0,08	± 0,06
1 < a ≤ 3	± 0,15	± 0,09	± 0,07
3 < a ≤ 6	± 0,17	± 0,10	± 0,08
6 < a ≤ 10	± 0,20	± 0,11	± 0,09
10 < a ≤ 15	± 0,22	± 0,13	± 0,10
15 < a ≤ 22	± 0,25	± 0,15	± 0,11
22 < a ≤ 30	± 0,28	± 0,17	± 0,13
30 < a ≤ 40	± 0,32	± 0,20	± 0,15
40 < a ≤ 53	± 0,37	± 0,24	± 0,17
53 < a ≤ 70	± 0,44	± 0,28	± 0,20
70 < a ≤ 90	± 0,50	± 0,34	± 0,24
90 < a ≤ 115	± 0,60	± 0,41	± 0,29
115 < a ≤ 150	± 0,75	± 0,50	± 0,35
150 < a ≤ 200	± 0,95	± 0,65	± 0,45
200 < a ≤ 250	± 1,20	± 0,80	± 0,55
250 < a ≤ 315	± 1,40	± 0,95	± 0,66
315 < a ≤ 400	± 1,80	± 1,20	± 0,82
400 < a ≤ 500	± 2,20	± 1,50	± 1,00
500 < a ≤ 630	± 2,80	± 1,90	± 1,20
630 < a ≤ 800	± 3,50	± 2,40	± 1,50
800 < a ≤ 1 000	± 4,40	± 2,90	± 1,90
1 000 < a ≤ 1 300	± 5,50	± 3,60	± 2,40
1 300 < a ≤ 1 600	± 7,00	± 4,40	± 3,10
1 600 < a ≤ 2 000	± 9,80	± 5,40	± 3,90

Table 7 - Deviations for dimensions including the mould joint or slip

Dimensions mm	Tolerance class		
	standard	reduced	precision
a ≤ 1	± 0,16	± 0,11	± 0,09
1 < a ≤ 3	± 0,18	± 0,12	± 0,10
3 < a ≤ 6	± 0,20	± 0,13	± 0,11
6 < a ≤ 10	± 0,22	± 0,14	± 0,12
10 < a ≤ 15	± 0,25	± 0,16	± 0,13
15 < a ≤ 22	± 0,28	± 0,18	± 0,14
22 < a ≤ 30	± 0,31	± 0,20	± 0,16
30 < a ≤ 40	± 0,35	± 0,23	± 0,18
40 < a ≤ 53	± 0,40	± 0,27	± 0,20
53 < a ≤ 70	± 0,47	± 0,31	± 0,23
70 < a ≤ 90	± 0,55	± 0,37	± 0,27
90 < a ≤ 115	± 0,65	± 0,44	± 0,32
115 < a ≤ 150	± 0,80	± 0,55	± 0,38
150 < a ≤ 200	± 1,00	± 0,70	± 0,48
200 < a ≤ 250	± 1,30	± 0,85	± 0,60
250 < a ≤ 315	± 1,50	± 1,00	± 0,70
315 < a ≤ 400	± 1,90	± 1,30	± 0,85
400 < a ≤ 500	± 2,30	± 1,60	± 1,10
500 < a ≤ 630	± 2,90	± 2,00	± 1,30
630 < a ≤ 800	± 3,60	± 2,50	± 1,60
800 < a ≤ 1 000	± 4,50	± 3,00	± 2,00
1 000 < a ≤ 1 300	± 5,60	± 3,70	± 2,50
1 300 < a ≤ 1 600	± 7,10	± 4,50	± 3,20
1 600 < a ≤ 2 000	± 9,90	± 5,50	± 4,00

4.4 Category 4:

- Tolerances applicable to polyamides PA 6, PA 66, PA 6/10, PA 11, PA 12 with filler, PBTP with filler, PETP with filler, amorphous PETP, modified PPD without filler, unmodified PPD, modified PPD reinforced with glass fibre, polycarbonates with and without filler, ABS with and without filler, amorphous polyamides with and without filler, polyoxymethylene (polyacetals) with filler, polystyrene, poly (styrene/butadiene) SB, Poly(styrene/acrylonitrile) SAN with and without filler, poly(methyl methacrylate) PMMA, unplasticized PVC, PSU with and without filler, reinforced PPS, PES without filler

Table 8 - Deviations for dimensions not including the mould joint

Dimensions mm	Tolerance class		
	standard	reduced	precision.
$a \leq 1$	$\pm 0,13$	$\pm 0,06$	$\pm 0,04$
$1 < a \leq 3$	$\pm 0,15$	$\pm 0,07$	$\pm 0,05$
$3 < a \leq 6$	$\pm 0,17$	$\pm 0,08$	$\pm 0,06$
$6 < a \leq 10$	$\pm 0,20$	$\pm 0,09$	$\pm 0,07$
$10 < a \leq 15$	$\pm 0,22$	$\pm 0,10$	$\pm 0,08$
$15 < a \leq 22$	$\pm 0,25$	$\pm 0,11$	$\pm 0,09$
$22 < a \leq 30$	$\pm 0,27$	$\pm 0,13$	$\pm 0,10$
$30 < a \leq 40$	$\pm 0,30$	$\pm 0,15$	$\pm 0,11$
$40 < a \leq 53$	$\pm 0,35$	$\pm 0,17$	$\pm 0,13$
$53 < a \leq 70$	$\pm 0,38$	$\pm 0,20$	$\pm 0,15$
$70 < a \leq 90$	$\pm 0,43$	$\pm 0,24$	$\pm 0,17$
$90 < a \leq 115$	$\pm 0,50$	$\pm 0,29$	$\pm 0,20$
$115 < a \leq 150$	$\pm 0,60$	$\pm 0,35$	$\pm 0,24$
$150 < a \leq 200$	$\pm 0,75$	$\pm 0,44$	$\pm 0,30$
$200 < a \leq 250$	$\pm 0,90$	$\pm 0,55$	$\pm 0,36$
$250 < a \leq 315$	$\pm 1,10$	$\pm 0,70$	$\pm 0,44$
$315 < a \leq 400$	$\pm 1,30$	$\pm 0,85$	$\pm 0,55$
$400 < a \leq 500$	$\pm 1,50$	$\pm 1,00$	$\pm 0,65$
$500 < a \leq 630$	$\pm 1,90$	$\pm 1,20$	$\pm 0,80$
$630 < a \leq 800$	$\pm 2,40$	$\pm 1,50$	$\pm 1,00$
$800 < a \leq 1\ 000$	$\pm 2,90$	$\pm 1,90$	$\pm 1,25$
$1\ 000 < a \leq 1\ 300$	$\pm 3,60$	$\pm 2,40$	$\pm 1,70$
$1\ 300 < a \leq 1\ 600$	$\pm 4,40$	$\pm 3,10$	$\pm 2,20$
$1\ 600 < a \leq 2\ 000$	$\pm 5,40$	$\pm 3,90$	$\pm 2,70$

Table 9 - Deviations for dimensions including the mould joint or slip

Dimensions mm	Tolerance class		
	standard	reduced	precision
$a \leq 1$	$\pm 0,16$	$\pm 0,09$	$\pm 0,07$
$1 < a \leq 3$	$\pm 0,18$	$\pm 0,10$	$\pm 0,08$
$3 < a \leq 6$	$\pm 0,20$	$\pm 0,11$	$\pm 0,09$
$6 < a \leq 10$	$\pm 0,23$	$\pm 0,12$	$\pm 0,10$
$10 < a \leq 15$	$\pm 0,25$	$\pm 0,13$	$\pm 0,11$
$15 < a \leq 22$	$\pm 0,28$	$\pm 0,14$	$\pm 0,12$
$22 < a \leq 30$	$\pm 0,30$	$\pm 0,16$	$\pm 0,13$
$30 < a \leq 40$	$\pm 0,33$	$\pm 0,18$	$\pm 0,14$
$40 < a \leq 53$	$\pm 0,36$	$\pm 0,20$	$\pm 0,16$
$53 < a \leq 70$	$\pm 0,41$	$\pm 0,23$	$\pm 0,18$
$70 < a \leq 90$	$\pm 0,46$	$\pm 0,27$	$\pm 0,20$
$90 < a \leq 115$	$\pm 0,55$	$\pm 0,32$	$\pm 0,23$
$115 < a \leq 150$	$\pm 0,65$	$\pm 0,38$	$\pm 0,27$
$150 < a \leq 200$	$\pm 0,80$	$\pm 0,47$	$\pm 0,33$
$200 < a \leq 250$	$\pm 0,95$	$\pm 0,60$	$\pm 0,39$
$250 < a \leq 315$	$\pm 1,20$	$\pm 0,75$	$\pm 0,47$
$315 < a \leq 400$	$\pm 1,40$	$\pm 0,90$	$\pm 0,60$
$400 < a \leq 500$	$\pm 1,60$	$\pm 1,10$	$\pm 0,70$
$500 < a \leq 630$	$\pm 2,00$	$\pm 1,30$	$\pm 0,85$
$630 < a \leq 800$	$\pm 2,50$	$\pm 1,60$	$\pm 1,10$
$800 < a \leq 1\ 000$	$\pm 3,00$	$\pm 2,00$	$\pm 1,30$
$1\ 000 < a \leq 1\ 300$	$\pm 3,70$	$\pm 2,50$	$\pm 1,80$
$1\ 300 < a \leq 1\ 600$	$\pm 4,50$	$\pm 3,20$	$\pm 2,30$
$1\ 600 < a \leq 2\ 000$	$\pm 5,50$	$\pm 4,00$	$\pm 2,80$

4.5 Category 5:

- Tolerances applicable to polyester-ether copolymers without filler Shore D Hardness ≤ 50 , block polyamides (polyether block amide) Shore D Hardness ≤ 50 , thermoplastic polyurethanes Shore D Hardness ≤ 50 , polyethylenes without filler, polypropylene without filler, plasticized poly(vinyl chloride) Shore D Hardness ≤ 50 , perfluoro poly(ethylene/propylene), perfluoro alkoxy copolymer, tetrafluoroethylene/ethylene copolymer without reinforcement, polybutenes.

Table 10 - Deviations for dimensions not including the mould joint

Dimensions mm	Tolerance class		
	standard	reduced	precision
$a \leq 1$	$\pm 0,13$	$\pm 0,10$	$\pm 0,08$
$1 < a \leq 3$	$\pm 0,15$	$\pm 0,11$	$\pm 0,09$
$3 < a \leq 6$	$\pm 0,17$	$\pm 0,12$	$\pm 0,10$
$6 < a \leq 10$	$\pm 0,20$	$\pm 0,14$	$\pm 0,11$
$10 < a \leq 15$	$\pm 0,24$	$\pm 0,17$	$\pm 0,13$
$15 < a \leq 22$	$\pm 0,28$	$\pm 0,20$	$\pm 0,15$
$22 < a \leq 30$	$\pm 0,33$	$\pm 0,24$	$\pm 0,17$
$30 < a \leq 40$	$\pm 0,39$	$\pm 0,28$	$\pm 0,20$
$40 < a \leq 53$	$\pm 0,47$	$\pm 0,33$	$\pm 0,24$
$53 < a \leq 70$	$\pm 0,58$	$\pm 0,40$	$\pm 0,28$
$70 < a \leq 90$	$\pm 0,71$	$\pm 0,50$	$\pm 0,34$
$90 < a \leq 120$	$\pm 0,87$	$\pm 0,60$	$\pm 0,41$
$120 < a \leq 160$	$\pm 1,10$	$\pm 0,75$	$\pm 0,50$
$160 < a \leq 200$	$\pm 1,40$	$\pm 0,95$	$\pm 0,60$
$200 < a \leq 250$	$\pm 1,70$	$\pm 1,15$	$\pm 0,80$
$250 < a \leq 315$	$\pm 2,10$	$\pm 1,45$	$\pm 1,00$
$315 < a \leq 400$	$\pm 2,70$	$\pm 1,80$	$\pm 1,20$
$400 < a \leq 500$	$\pm 3,30$	$\pm 2,20$	$\pm 1,50$
$500 < a \leq 630$	$\pm 4,20$	$\pm 2,80$	$\pm 1,90$
$630 < a \leq 800$	$\pm 5,20$	$\pm 3,50$	$\pm 2,40$
$800 < a \leq 1\ 000$	$\pm 6,50$	$\pm 4,40$	$\pm 2,90$
$1\ 000 < a \leq 1\ 300$	$\pm 8,00$	$\pm 5,50$	$\pm 3,60$
$1\ 300 < a \leq 1\ 600$	$\pm 9,00$	$\pm 7,00$	$\pm 4,40$
$1\ 600 < a \leq 2\ 000$	$\pm 11,80$	$\pm 8,50$	$\pm 5,40$

Table 11 - Deviations for dimensions including the mould joint or slip

Dimensions mm	Tolerance class		
	standard	reduced	precision
$a \leq 1$	$\pm 0,23$	$\pm 0,20$	$\pm 0,18$
$1 < a \leq 3$	$\pm 0,25$	$\pm 0,21$	$\pm 0,19$
$3 < a \leq 6$	$\pm 0,27$	$\pm 0,22$	$\pm 0,20$
$6 < a \leq 10$	$\pm 0,30$	$\pm 0,24$	$\pm 0,21$
$10 < a \leq 15$	$\pm 0,34$	$\pm 0,27$	$\pm 0,23$
$15 < a \leq 22$	$\pm 0,38$	$\pm 0,30$	$\pm 0,25$
$22 < a \leq 30$	$\pm 0,43$	$\pm 0,34$	$\pm 0,27$
$30 < a \leq 40$	$\pm 0,49$	$\pm 0,38$	$\pm 0,30$
$40 < a \leq 53$	$\pm 0,57$	$\pm 0,43$	$\pm 0,34$
$53 < a \leq 70$	$\pm 0,68$	$\pm 0,50$	$\pm 0,38$
$70 < a \leq 90$	$\pm 0,81$	$\pm 0,60$	$\pm 0,44$
$90 < a \leq 120$	$\pm 0,97$	$\pm 0,70$	$\pm 0,55$
$120 < a \leq 160$	$\pm 1,20$	$\pm 0,85$	$\pm 0,60$
$160 < a \leq 200$	$\pm 1,50$	$\pm 1,05$	$\pm 0,70$
$200 < a \leq 250$	$\pm 1,80$	$\pm 1,25$	$\pm 0,90$
$250 < a \leq 315$	$\pm 2,20$	$\pm 1,55$	$\pm 1,10$
$315 < a \leq 400$	$\pm 2,80$	$\pm 1,90$	$\pm 1,30$
$400 < a \leq 500$	$\pm 3,40$	$\pm 2,30$	$\pm 1,60$
$500 < a \leq 630$	$\pm 4,30$	$\pm 2,90$	$\pm 2,00$
$630 < a \leq 800$	$\pm 5,30$	$\pm 3,60$	$\pm 2,50$
$800 < a \leq 1\ 000$	$\pm 6,60$	$\pm 4,50$	$\pm 3,00$
$1\ 000 < a \leq 1\ 300$	$\pm 8,10$	$\pm 5,60$	$\pm 3,70$
$1\ 300 < a \leq 1\ 600$	$\pm 9,90$	$\pm 7,10$	$\pm 4,50$
$1\ 600 < a \leq 2\ 000$	$\pm 11,90$	$\pm 8,60$	$\pm 5,50$

4.6 Tolerances applicable to high precision thermosetting and thermo-plastic mouldings

Table 12 - Deviations for dimensions not including the mould joint

Dimensions mm	Tolerances	Dimensions mm	Tolerances
$a \leq 1$	$\pm 0,025$	$15 < a \leq 22$	$\pm 0,06$
$1 < a \leq 3$	$\pm 0,03$	$22 < a \leq 30$	$\pm 0,07$
$3 < a \leq 6$	$\pm 0,035$	$30 < a \leq 40$	$\pm 0,08$
$6 < a \leq 10$	$\pm 0,04$	$40 < a \leq 55$	$\pm 0,09$
$10 < a \leq 15$	$\pm 0,05$	$55 < a \leq 70$	$\pm 0,10$

Table 13 - Deviations for dimensions including the mould joint or slip

Dimensions mm	Tolerances	Dimensions mm	Tolerances
$a \leq 1$	$\pm 0,05$	$15 < a \leq 22$	$\pm 0,11$
$1 < a \leq 3$	$\pm 0,06$	$22 < a \leq 30$	$\pm 0,12$
$3 < a \leq 6$	$\pm 0,07$	$30 < a \leq 40$	$\pm 0,13$
$6 < a \leq 10$	$\pm 0,08$	$40 < a \leq 55$	—
$10 < a \leq 15$	$\pm 0,10$	$55 < a \leq 70$	—

4.7 Fillets, bevels and joint radius up to 2 mm

Standard class: $\pm 25\%$ of the nominal value, deviation rounded up to 1/10.

Table 14

Nominal dimension mm	Deviation mm
0,3 (1)	$\pm 0,10$
0,5	$\pm 0,20$
1	$\pm 0,30$
1,5	$\pm 0,40$
2	$\pm 0,50$
To be avoided	

4.8 Dimensioned angle

The deviation $\Delta \alpha$ on the angles is measured taking the large side as a reference base.

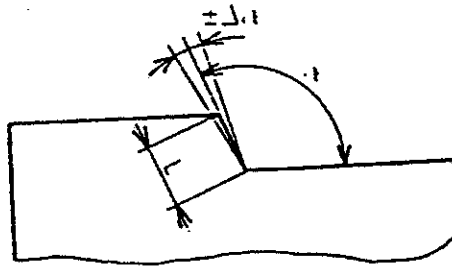


Figure 1

Table 15 - Permissible deviation $\Delta \alpha$

L	Standard class	Reduced class	Precision class
≤ 10	$\pm 3^\circ$	$\pm 1^\circ 30'$	$\pm 1^\circ$
$10 < L \leq 50$	$\pm 2^\circ$	$\pm 50'$	$\pm 30'$
$50 < L \leq 120$	$\pm 1^\circ$	$\pm 25'$	$\pm 20'$
> 120	$\pm 30'$	$\pm 15'$	$\pm 10'$

5 TOLERANCES ON SHAPE AND POSITION (for the marking of tolerances on shape and position, see NF E 04-552)

5.1 Draft

Standard class: 0 to 1⁰

Unless specified otherwise on the drawing:

- for male or external parts, the draft is a minus variation to the dimension indicated. The tolerance only applies to the largest part.
- for female or internal parts, the draft is extra to the dimension indicated. The tolerance only applies to the smallest part.

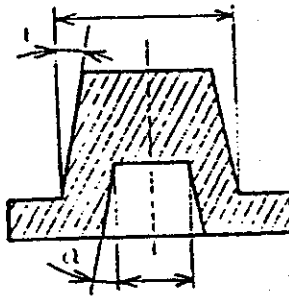


Figure 2

5.2 Tolerances on circularity (ovalization) and parallelism, tolerances on concentricity (offset) and flatness

The deviations depend on the type of material, the percentage and type of filler (mineral or glass fibres). The tolerances on these parameters of shape and position are expressed by a maximum deviation. The value of this deviation corresponds to half a tolerance interval which means that the value indicated in the tables should be taken but without the signs.

Example: Permissible ovalization on a moulding of diameter 35 mm made of PA 66 without filler: in the standard class according to Table 6, the deviation is 0.32 mm.

5.3 Perpendicularity

Tolerance on an element's perpendicularity with regard to a reference, not taking account of the draft, in the standard class: less than $\pm 15'$.

5.4 Level of ejector marks

In accordance with the note to paragraph 3.2, the permissible hollow or relief shall be determined, on agreement between the parties concerned, within the range 0.05 to 0.30 mm in the standard class.

5.5 Displacement due to parts of the mould

Unless otherwise specified on the drawing, the moulding dimension considered is the overall dimension Y (figures 3 to 5).

- Displacement between two moving parts

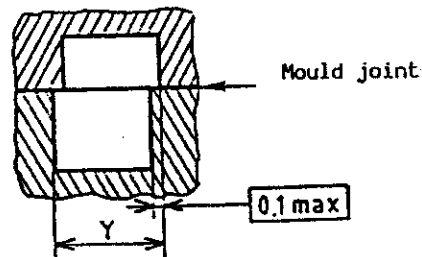


Figure 3

- Displacement between fixed parts

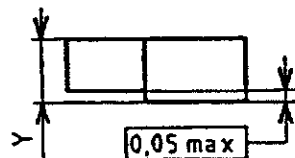


Figure 4

- Connection

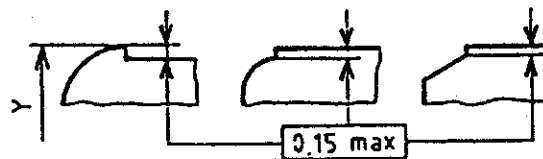


Figure 5

5.6 Shrink marks for thermoplastics (1)

Depending on the thickness ratio B/A , for the standard class:

- ratio ~ 1 : $X = 0.10$ mm max.
- ratio ~ 2 : $X = 0.20$ mm max.
- ratio > 2 : $X = 0.30$ mm max.

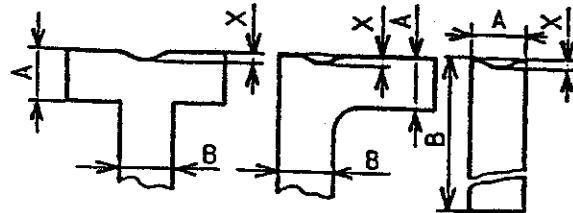


Figure 6

(1) There is no data available on thermosetting plastics at the date of publication of this standard. Anyone able to supply such information is asked to contact Afnor.

6 TOLERANCES ON FINISH

6.1 Flash

The flash on the mould joint and on the ejector marks, for the standard tolerance class, shall not protrude more than 0.3 mm.

Wear bead on the mould joint (thermosetting plastics); for standard class: 0.3 mm max.

6.2 Injection point

For the standard class: value of protrusion or hollow depending on the method of elimination selected, in the absence of any supplementary accuracy on the drawing :

Table 16

	Method of elimination		
	ground	cut	broken
Thermosetting material	$\pm 0,20$	+ 0,6 + 0	+ 1,5 - 0,3
Thermoplastic material	-	$\pm 0,20$	+ 1 - 0,5