



## Standard Practice for Molding and Machining Tolerances for PTFE Resin Parts<sup>1</sup>

This standard is issued under the fixed designation D 3297; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This practice defines tolerances applicable to parts molded and free sintered from PTFE resins and to machined parts produced from basic shapes of compression-molded or ram-extruded resins.

1.2 The values stated in SI units are to be regarded as the standard.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

D 618 Method for Conditioning Plastics and Electrical Insulating Materials for Testing<sup>2</sup>

D 883 Definition of Terms Relating to Plastics<sup>3</sup>

D 1898 Recommended Practice for Sampling of Plastics<sup>4</sup>

E 177 Recommended Practice for Use of the Terms Precision and Accuracy as Applied to Measurement of a Property of a Material<sup>2,5</sup>

#### 2.2 Military Standard:<sup>6</sup>

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes

### 3. Terminology

3.1 *General*—Definitions of terms applying to this practice appear in Definitions D 883.

### 4. Summary of Practice

4.1 This practice provides minimum practical dimensional tolerances for PTFE parts that are molded and free-sintered or machined from stock shapes. Dimensional values are most reproducible when the parts are measured at a stabilized temperature between 22 and 25°C (72 and 77°F) using agreed upon measuring equipment and procedures.

### 5. Significance and Use

5.1 The tolerances are applicable to conventional measuring equipment under controlled environmental condi-

tions. Because parts of PTFE resin deform easily, care must be taken during the measuring process. In certain instances, considering cross-section to diameter, the part must be supported without distortion by a suitable fixture while being measured. Measuring procedures, gages, and fixtures should be agreed upon between purchaser and seller.

### 6. Interferences

6.1 Stabilized temperatures of molded or machined parts at time of measurement shall be between 22 and 25°C (72 and 77°F). Difficulty is experienced between 18 and 21°C (64 and 70°F) due to a critical transition zone characteristic of PTFE resins. Figure 1 illustrates this effect.

### 7. Conditioning

7.1 Condition the parts at the established inspection temperature for a minimum of 24 h. A shorter period of conditioning may result in erroneous measurements.

7.2 The maintenance of constant relative humidity is not required unless, in filled materials, the filler may be affected by moisture absorption. In this case, the Standard Laboratory Atmosphere of 50 ± 5 % relative humidity shall apply.

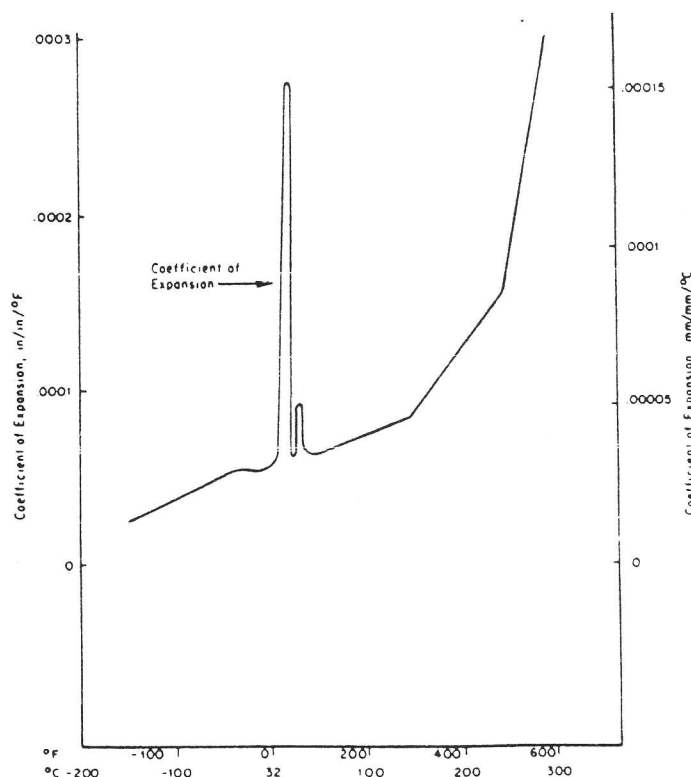


FIG. 1 Thermal Expansion of PTFE Resin

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D-20 on Plastics, and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials (Section D20.15.12).

Current edition approved June 24, 1988. Published August 1988. Originally published as D 3297 - 74. Last previous edition D 3297 - 74 (1980)<sup>(1)</sup>.

<sup>2</sup> Annual Book of ASTM Standards, Vols 08.01, 10.01 and 10.02.

<sup>3</sup> Annual Book of ASTM Standards, Vols 08.01 and 08.04.

<sup>4</sup> Annual Book of ASTM Standards, Vol 08.02.

<sup>5</sup> Annual Book of ASTM Standards, Vols 04.01 and 14.02.

<sup>6</sup> Available from Naval Publications and Forms Center, 5801 Tabor Ave., Philadelphia, PA 19120. Attn: NPFC 105.

**TABLE 1 Tolerances for Molded Parts of PTFE Resins**

Molded Part		Tolerances
<b>Rings:</b>		
Diameter	0.010 mm/mm	0.010 in./in.
Wall	0.10 mm	0.004 in.
Height (maximum)	0.100 mm/mm (min 0.38 mm)	0.100 in./in. (min 0.015 in.)
Concentricity (OD to ID)	0.008	0.008
Parallelism wall—greater than 2.54 mm (0.100 in.)	0.010 mm/mm diameter	0.010 in./in. diameter
<b>Solid Round:</b>		
Diameter	0.010 mm/mm	0.010 in./in.
Height	0.100 mm/mm min 0.38 mm, min 0.254 mm	0.100 in./in. min 0.015 in., min 0.010 in.
Parallelism	0.20 mm/mm of diameter	0.008 in./in. of diameter
<b>Solid other than round:</b>		
Lengths	0.01 mm/mm	0.010 in./in.
Height (mold direction)	0.100 mm/mm min 0.38 mm, min 0.254 mm	0.100 in./in. min 0.015 in., min 0.010 in.
Parallelism	0.20 mm/mm of length	0.008 in./in. of length
<b>General:</b>		
Corners	0.25 mm min radius	0.010 in. min radius
Finish	3.25 $\mu$ m min	128 $\mu$ m min
<b>Steps:</b>		
Draft angle	4° max	4° max
Radius or fillet, or both	0.25 mm min radius	0.010 in. min radius

**TABLE 2 Tolerances for Machined Parts of PTFE Resins**

Machining Operation	Tolerance	
<b>Turning/boring:</b>		
All dimensions (OD, ID, and lengths) up to 25.4 mm (1 in.)	±38 μm	±0.0015 in.
For each additional inch of dimension (OD, ID and length) add a further tolerance of	±25 μm	±0.001 in.
ID tolerance based on a length to diameter ratio no greater than	...	1.5 to 1.0
Concentricity—Total indicator reading (TIR) for relation of OD to ID angles	±150 μm	0.006 in.
	±8.7 rad	±½°
<b>Drilling/reaming:</b>		
Reaming of PTFE parts is not generally recommended due to build-up of frictional heat in tool.		
Diameter of drilled hole tolerance based on a length to a diameter ratio not to exceed 5.0 to 1.0.		
Location and depth of drilled hole	±38 μm	±0.015 in.
<b>Milling:</b>		
All dimensions	±0.005 mm/mm	±0.005 in./in.
Angles	±8.7 rad	±½°
<b>Sawing:</b>		
All dimensions	±1.524 mm	±0.060 in.
<b>Grinding:</b>		
Face or flat grinding is usually not performed on PTFE parts, but where this process is required tolerances are to be agreed upon between the purchaser and the seller.	−0.000 mm	−0.000 in.
<b>Centerless grinding:</b>		
Dimensions up to ¼ in.	±12.7 μm	±0.0005 in.
Dimensions from ½ in. to 1 in.	±25.4 μm	±0.001 in.
For each additional inch or part of inch add a further tolerance of	±12.7 μm	±0.0005 in.
<b>Finish:</b>		
When specifying surface finish on machined PTFE parts, the method of measurement must also be specified. Even when surface measurement instruments are properly used, root mean square (rms), surface finish reading will range ±50 % and tolerances should be specified.		
When performance is a function of finish, inspection techniques should be agreed upon between the purchaser and the seller. It should be pointed out that, since a polymer that undergoes plastic flow and material transfer is being considered, the surface finish, itself, is not as critical as it is for metals.		

## 8. Procedure

8.1 Molded part configurations and tolerances shall be as shown in Table 1.

8.2 Machined part tolerances for customarily used machining methods shall be as shown in Table 2.

*The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.*