The Society of the Plastics Industry's
Machinery Component Manufacturers Division

Recommended Dimensional Guidelines for Single Barrels

The following recommendations for single bore barrels for extrusion/injection machinery have been prepared as a guide to manufacturers and processors. These recommendations have been developed over many years and provide working tolerances that produce effective performance with economy of manufacture.

Lengths, Depths & Widths

The following tolerances apply to most linear dimensions of a screw including, but not limited to the overall length of the screw, the flighted surface and the drive. The tolerances increase with the linear dimension involved.

I. Most linear dimensions

English Measurement		**Metric Measurement**	
To 12"	± .010"	To 300mm	± .25mm
12"-60"	± .030"	300mm-1500mm	± .75mm
60"-120"	± .045"	1500mm-3000mm	± 1.00mm
120"-200"	± .060"	3000mm-5000mm	± 2.25mm
over 200"	± .090"	over 5000mm	± 2.25mm

II. Counterbore Depths or Pilot Lengths

English Measurement		**Metric Measurement**	
All sizes	± .005"	All sizes	± .125mm

Diameters

I. Bores (including counterbores)

English Measurement		
To 1½"	dia. (<60" long)	+ .001" - .000"
1½"-3"	dia. (>60" long)	+ .002" - .000"
3-5½"	dia. (<120" long)	+ .002" - .000"
3-5½"	dia. (>120" long)	+ .0025" - .000"
5½-8"	dia. (<180" long)	+ .0025" - .000"
5½-8"	dia. (>180" long)	+ .003" - .000"
8-12½"	dia. (<180" long)	+ .003" - .000"
8-12½"	dia. (>180" long)	+ .004" - .000"
Metric Measurement		
0-38mm	dia. (<1500mm long)	+ .025mm - .000mm
3-75mm	dia. (<1500mm long)	+ .050mm - .000mm
25-75mm	dia. (>1500mm long)	+ .038mm - .000mm
75-140mm	dia. (<3000mm long)	+ .051mm - .000mm
75-140mm	dia. (>3000mm long)	+ .063mm - .000mm
140-200mm	dia. (<4500mm long)	+ .063mm - .000mm
140-200mm	dia. (>4500mm long)	+ .076mm - .000mm
200-315mm	dia. (<4500mm long)	+ .076mm - .000mm
200-315mm	dia. (<4500mm long)	+ .102mm - .000mm

II. Outside diameters except pilots

English Measurement		**Metric Measurement**	
All sizes and lengths	± .005"	All sizes and lengths	± .102mm

III. Pilot diameters

English Measurement		**Metric Measurement**	
All sizes	± .001"	All sizes	± .038mm

Concentricity of Diameters

Concentricity between all inside and outside diameters should be held within .002" TIR or .051mm TIR within one bore diameter of each end. Concentric diameter dimensions further inside of one bore diameter from the ends should be avoided and/or specially tolerated when required.

Straightness

Straightness is generally specified for the bore of the barrel and is measured by TIR.

English Measurement		
1-3"	bore diameter (<= 24 l/d)	.008" TIR
1-3"	bore diameter (>= 24 l/d)	.010" TIR
3-5½"	bore diameter (<= 24 l/d)	.010" TIR
3-5½"	bore diameter (>= 24 l/d)	.012" TIR
5½-8"	bore diameter (<= 24 l/d)	.012" TIR
5½-8"	bore diameter (>= 24 l/d)	.015" TIR
8-12½"	bore diameter (<= 24 l/d)	.014" TIR
8-12½"	bore diameter (>= 24 l/d)	.016" TIR
Metric Measurement		
25-75mm	bore diameter (<= 24 l/d)	.203mm TIR
25-75mm	bore diameter (>= 24 l/d)	.254mm TIR
75-140mm	bore diameter (<= 24 l/d)	.254mm TIR
75-140mm	bore diameter (>= 24 l/d)	.305mm TIR
140-200mm	bore diameter (<= 24 l/d)	.305mm TIR
140-200mm	bore diameter (>= 24 l/d)	.380mm TIR
200-315mm	bore diameter (<= 24 l/d)	.355mm TIR
200-315mm	bore diameter (>= 24 l/d)	.406mm TIR

To prevent short "kinks" to which the screw could not conform, any two successive measurements taken less than twice the bore diameter apart should have no more than 1/2 the total allowable TIR.

Bar Test

A second way to check both straightness and bore size is by using a precision ground test bar. This method is detailed in the appendix 1.

Finish

The following surface finishes apply unless specified otherwise.

Outer diameters	125 RMS
Counterbores	32 RMS
Pilots	32 RMS
Cylinder bores	8-32 RMS
Feed ports	125 RMS
Vent ports*	32 RMS

*Required within 1/4" of cylinder bore.

The bore shall be free from visual surface defects in the bore over its entire length.

Parallelism & Perpendicularity

Parallel surfaces can be determined by TIR and all dimensions meeting the concentricity recommendations are acceptable.

Perpendicular surfaces to the cylinder bore can be tested by placing the barrel on a surface plate and indicating with an adjustable height table indicator or with a precision square. All mating surfaces should be perpendicular as follows:

	English Measurement	**Metric Measurement**
Pilots and counterbores	.0015" TIR	.038mm TIR
Flanges	.001 TIR per 10" of dia.	.038mm TIR per 250mm of dia.

Threads

The variation in threads used is too broad to be addressed in these recommendations. It is suggested that whenever thread selection is possible that either ANSI or ISO standards are adhered to for ease of measurement and compatibility.

Flange Attachments

Barrel flanges may be affixed in accordance with the procedures in Figures 1-6 shown in the appendix depending on the resultant thrust from internal pressure and other design factors. These procedures apply for flanges at either end of the barrel.

Venting

The following warning label should be affixed to a vented extruder or injection barrel supplied without a venting plug.

Warning: This vented injection/extrusion barrel was designed for operation with the vent OPEN ONLY. Operation of this machine with the vent plugged or otherwise closed off may result in serious injury to persons in the vicinity. Check with your supervisor if this vent is intentionally or unintentionally plugged.

Downsizing Injection Barrels

When downsizing (reducing the barrel/screw bore size and resultant shot capacity) an injection molding machine must have the pressure capability reduced or be redesigned for the new resultant pressure. This is necessary to reduce the screw thrust pressure in proportion to the reduction in area of the bore to prevent the barrel from being over pressurized. All units that are downsized should be equipped with a warning label on the barrel where it can be easily seen.

Barrel Construction

Bimetallic Centrifugally Cast and Hot Isostatically Pressed Barrels

The inlay thickness is to be 1/16" (1.6mm) nominal,with a 1/8" (3.2mm) maximum and 1/32" (0.8mm) minimum.

Hardness standards are those of the manufacturer and are based on the arithmetic means of five hardness measurements taken at random points along the bore. The hardness values vary greatly with the type of inlay. The inlay should have a 100% metallurgical bond at all points determined by ultrasonic techniques.

Nitrided Barrels or Other Single Metal Barrels

Depending on the material used in the outer tube and the bore hardening method, both the hardness and depth of hardness will vary. As a result, the hardness standards are those of the manufacturer.

Sleeved Barrels (New)

All sleeves should be inserted by either shrink fit or press fit with no less than the interference required to maintain the stress levels applying to all barrels detailed in the appendix. In all cases a minimum interference of .001" (.025mm) diametral shrunk per inch of diameter should be used.

Hardness standards are those of the manufacturer and vary with the material and hardening method selected for the sleeve.

Sleeved Barrels (Relined)

The liner material should have a co-efficient of thermal expansion within + 30% of the base (outer tube) material from room temperature through to maximum expected operating temperature.

All internal sleeves should blend to any remaining bore with no visible lip and with no more than the following mismatch in TIR.

English Measurement		**Metric Measurement**	
To 2"	bore dia. .001"	To 50mm	bore dia. .025mm
2-3 1/2"	bore dia. .002"	50-90mm	bore dia. .051mm
> 3 1/2"	bore dia. .003"	>90mm	bore dia. .076mm

In the case of injection barrels, relining of the discharge end should extend a minimum of 2" (50mm) past the maximum backward travel of the rear edge of the check ring on the non-return valve.

Appendix 1

Barrel/Test-bar/Screw Clearance

Criteria

Clearance specified in the two tables below are based upon a minimum of .001 inch to a maximum of .0015 inch per inch of diameter between the barrel inside diameter and the screw flight outside diameter. The test-bar outside diameters are sized to the midway point between the screw flight outside diameter and the barrel inside diameter. The lengths of the test-bars specified are based on approximately 15 to 20 times the nominal screw/barrel diameter. All table dimensions are based on the parameters established in the first sentence of this criteria.

English Measurements

Nominal Diameter	Specified Barrel I.D. Size	Specified Diameter Test Bar	Specified Screw O.D. Size	Test Bar Length	Barrel/ Test Bar Diametral Clearance	Barrel/ Screw Diametral Clearance
1-1/8"	1.125 +.001/-.000	1.1235/1.1230	1.1225/1.1220	22"	.0015/.003	.0025/.004
1-1/4"	1.250 +.001/-.000	1.2485/1.2480	1.2475/1.2465	24"	.0015/.003	.0025/.0045
1-1/2"	1.500 +.001/-.000	1.4985/1.4980	1.497/1.496	26"	.0015/.003	.003/.005
1-3/4"	1.750 +.001/-.000	1.7480/1.7475	1.7465/1.7455	30"	.002/.0035	.0035/.0055
2"	2.000 +.001/-.000	1.9980/1.9975	1.996/1.995	36"	.002/.0035	.004/.006
2-1/4"	2.250 +.001/-.000	2.2480/2.2475	2.246/2.245	38"	.002/.0035	.004/.006
2-1/2"	2.500 +.001/-.000	2.4975/2.4970	2.495/2.494	42"	.0025/.004	.005/.007
2-3/4"	2.750 +.001/-.000	2.7475/2.7470	2.745/2.744	46"	.0025/.004	.005/.007
3"	3.000 +.001/-.000	2.9970/2.9965	2.994/2.993	50"	.003/.0045	.006/.008
3-1/4"	3.250 +.002/-.000	3.2465/3.2460	3.2435/3.2425	56"	.0035/.006	.0065/.0095
3-1/2"	3.500 +.002/-.000	3.4965/3.4960	3.493/3.492	60"	.0035/.006	.007/.010
3-3/4"	3.750 +.002/-.000	3.7465/3.7460	3.743/3.742	62"	.0035/.006	.007/.010
4"	4.000 +.002/-.000	3.9960/3.9955	3.992/3.991	68"	.004/.0065	.008/.011
4-1/4"	4.250 +.002/-.000	4.2460/4.2455	4.242/4.241	72"	.004/.0065	.008/.011
4-1/2"	4.500 +.002/-.000	4.4960/4.4955	4.491/4.490	76"	.004/.0065	.009/.012
4-3/4"	4.750 +.002/-.000	4.7455/4.7450	4.741/4.740	82"	.0045/.007	.009/.012
5-1/4"	5.250 +.002/-.000	5.2445/5.2440	5.240/5.238	90"	.0055/.008	.010/.014
6"	6.000 +.002/-.000	5.994/5.9935	5.988/5.986	96"	.006/.0085	.012/.016
8"	8.000 +.002/-.000	7.993/7.992	7.984/7.982	108"	.007/.011	.016/.021

Metric Measurements

Nominal Diameter	Specified Barrel I.D. Size	Specified Diameter Test Bar	Specified Screw O.D. Size	Test Bar Length	Barrel/ Test Bar Diametral Clearance	Barrel/ Screw Diametral Clearance
30MM	1.181 +.001/-.000	1.1795/1.1790	1.1785/1.1780	22"	.0015/.003	.0025/.004
35MM	1.378 +.001/-.000	1.3765/1.3760	1.3750/1.3745	24"	.0015/.003	.003/.0045
38MM	1.496 +.001/-.000	1.4945/1.4940	1.493/1.492	26"	.0015/.003	.003/.005
40MM	1.575 +.001/-.000	1.5735/1.5730	1.572/1.571	28"	.0015/.003	.003/.005
50MM	1.969 +.001/-.000	1.9670/1.9665	1.965/1.964	36"	.002/.0035	.004/.006
60MM	2.362 +.001/-.000	2.3595/2.3590	2.357/2.356	38"	.0025/.004	.005/.007
65MM	2.559 +.001/-.000	2.5565/2.5560	2.554/2.553	42"	.0025/.004	.005/.007
70MM	2.756 +.001/-.000	2.7535/2.7530	2.751/2.750	46"	.0025/.004	.005/.07
75MM	2.953 +.001/-.000	2.9500/2.9495	2.947/2.946	50"	.003/.0045	.006/.008
80MM	3.150 +.001/-.000	3.1465/3.1460	3.1435/3.1425	56"	.0035/.005	.0065/.008
90MM	3.543 +.002/-.000	3.5395/3.5390	3.536/3.535	60"	.0035/.006	.007/.010
100MM	3.937 +.002/-.000	3.9330/3.9325	3.929/3.928	68"	.004/.0065	.008/.011
105MM	4.134 +.002/-.000	4.1300/4.1295	4.126/4.125	72"	.004/.0065	.008/.011
115MM	4.528 +.002/-.000	4.5240/4.5235	4.519/4.518	76"	.004/.0065	.009/.012
120MM	4.724 +.002/-.000	4.7195/4.7190	4.715/4.714	82"	.0045/.007	.009/.012
135MM	5.315 +.002/-.000	5.3095/5.3090	5.305/5.303	90"	.0055/.008	.010/.014
150MM	5.906 +.002/-.000	5.900/5.8995	5.894/5.892	96"	.006/.0085	.012/.016

Appendix 3

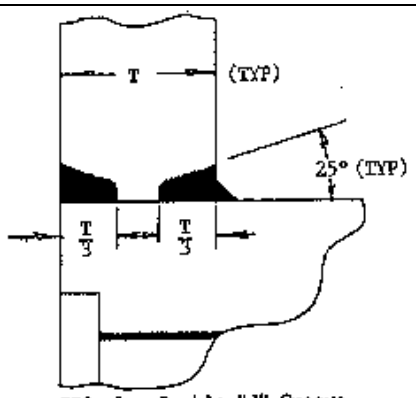

FIG. 1 - Double "J" Groove with Fillet

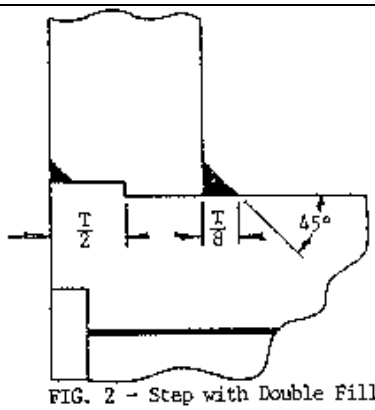

FIG. 2 - Step with Double Fillet

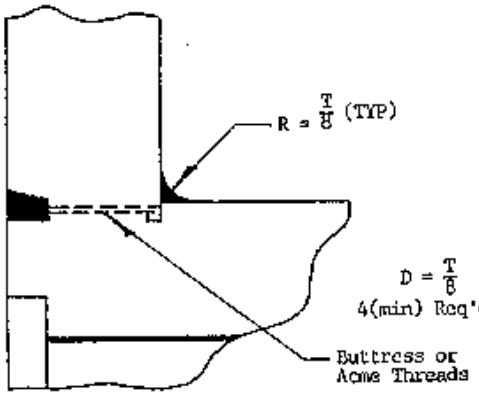

FIG. 3 - Threaded with Double Seal Weld

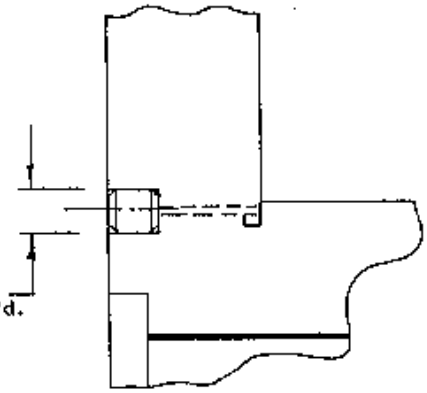

FIG. 4 - Threaded with Dutchman

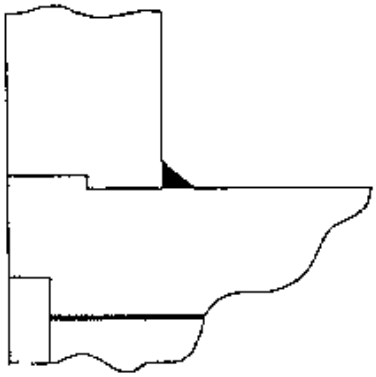

FIG. 5 - Step with Single Fillet

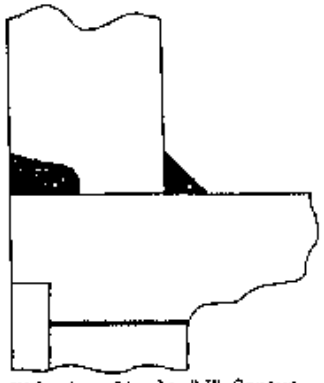

FIG. 6 - Single "J" Groove with Fillet