Tolerance Guidelines

In profile design, function is the over-riding criterion, especially with regard to tolerances, which become critical only where profile features must mate with other parts at cutouts or recesses, or where a mating component must move within the profile.

An assembly may involve snap fits, loose lateral lay-on assemblies, tight or loose longitudinal slide assemblies or lateral slide assemblies. When assembly requirements cannot be adequately described by a set of tolerances, extruders usually will guarantee assembly function instead of specific dimensions.

Thermoplastics vary in degree of tolerance control that can be achieved with equivalent dies and fixtures. Rigid plastics hold closer tolerances than flexible materials. Allowance must be made also for thermal expansion and contraction.

For rigid vinyl, standard tolerances for wall-thicknesses are ± 8% over a range of wall thicknesses. Tolerance ranges for rigid vinyl and various other thermoplastic materials are given in Table 1.

	Rigid Vinyl (RPVC)	Poly-styrene	ABS Poly-Carbonate Acrylic Butyrate PETG	Poly-Propylene	Flexible Vinyl (FPVC)	Poly-ethylene
Wall Thickness (%, ±)	8	8	8	8	10	10
Angles (deg. ±)	2	2	3	3	5	5
Profile Dimension (inches, ±)						
To 1/8	0.007	0.007	0.010	0.010	0.010	0.012
1/8 to ½	0.010	0.012	0.020	0.015	0.015	0.025
½ to 1	0.015	0.017	0.025	0.020	0.020	0.030
1 to 1 ½	0.020	0.025	0.027	0.027	0.030	0.035
1 ½ to 2	0.025	0.030	0.035	0.035	0.035	0.040
2 to 3	0.030	0.035	0.037	0.037	0.040	0.045
3 to 4	0.045	0.050	0.050	0.050	0.065	0.065
4 to 5	0.060	0.065	0.065	0.065	0.093	0.093
5 to 7	0.075	0.093	0.093	0.093	0.125	0.125
7 to 10	0.093	0.125	0.125	0.125	0.150	0.150

Table 1: Tolerance Guide for Plastics Profile Extrusions

Fully streamlined dies and special fixtures such as vacuum calibrators can hold tighter tolerances then the standards in Table 1. These special tools are generally several thousands of dollars and should only be used if tight tolerances are necessary.

Secondary Operations: Special shape configurations such as angles and notches can be cut in line with tolerances held to ± 0.010 in some cases, but generally ± 0.030 to ± 0.050 by automated electronic control of punches and saws. Remember to consider tolerance stacks, I.E. the first hole is ± 0.010 while the second hole is the first hole tolerance, plus ± 0.010. Tolerance determinations should be based on end-use function of the profile. Tighter tolerances can be maintained in secondary operations but this is an added cost.

When designing a part and requesting quotes, please keep this one general rule of thumb in mind: The tighter the required tolerances, the higher the tooling costs will be. Tighter tolerances also command longer startup times and more scrap generation. These are all costs figured into the final cost of the part.

Helpful Design Hints

Successful design of any profile extrusion depends on a great number of factors. There are, however, just a few that should be considered in the beginning phases of your design process. After the basic design is roughly determined, we can review your concept and suggest additional ideas to maximize processability, dimensional control and part performance. Material selection can greatly alter the overall performance and cost of the final product. It is at this stage that these factors must be addressed.

Tolerances that are extremely tight are one of the major contributing factors in cost escalation. It is best to consider which specific areas of the part need to be maintained as "critical" and how tight they must be for the intended use. Mating parts and dimensional stacking problems must also be considered at this stage.

Overall wall thickness in the cross-sectional area should be as consistent as possible. Failure to observe this basic rule leads to increased tooling costs, reduced production efficiencies, reduced tolerance control, and bowing and twisting of the parts.

Sink marks or depressed areas generally occur opposite the opposing leg or rib of a profile extrusion. The greater the wall variation, the greater the depth of the sink marks. To compensate for these sink marks, feature lines can be added to help hide this inherent process condition. Again, this is an added cost. If surface appearance is not critical, be sure to indicate that.

Profiles that require hollow sections require special tooling and sizing considerations. Hollow areas that are required to maintain consistent wall thickness are still preferable to unbalanced walls. Projections inside the hollow section while allowed, cannot be controlled, therefore cannot be dimensioned.