



# Stockwell Elastomerics, Inc.

4749 Tolbut Street • Philadelphia, PA 19136 - 1512 USA

(800) 523-0123 • (215) 335-3005 • Fax (215) 335-9433

www.stockwell.com

e-mail: service@stockwell.com

High Performance Elastomeric Components and Materials



## Understanding Dimensional Tolerances for Rubber Components Delivers Closer-Tolerance Results

Unlike rigid machined materials, thermoset molded elastomers do not lend themselves to the same level of tolerancing. Being thermally molded, elastomers are subject to many variables. Temperature, cure time, mold tolerance, mold registration, compound variation, and shrinkage are just some of the factors all molders encounter.

The Rubber Manufacturers Association (RMA) has developed tolerance tables with ranges to provide communications between user and provider across a wide range of industries, from precision aerospace electronic components to open tolerance products for consumer goods. These tolerance designations relate to the variability inherent in processing molded rubber parts and are referred to as **RMA A2 "Precision"** and **RMA A3 "Commercial"** dimensional tolerance designations. There are obviously costs involved as the rubber molder prepares to meet customer requirements at the RMA A2 level. This includes preparations for tooling, extra features, cavity finishes and cavity flow provisions. In processing, very close temperature control and timing of molding cycles may add to the cost of the part.

**The type of rubber material and particularly its durometer hardness will determine if the part will experience substantial size change during its cool down.**

**"A2" Precision Drawing Designation  
Dimensional Tolerance Table for Molded Rubber Products**

Size (Millimeters)					Size (Inches)				
Above		Included			Above		Included		
0	-	10	+/- .16	+/- .20	0	-	.40	+/- .006	+/- .008
10	-	16	.20	.25	.40	-	.63	.008	.010
16	-	25	.25	.32	.63	-	1.00	.010	.013
25	-	40	.32	.40	1.00	-	1.60	.013	.016
40	-	63	.40	.50	1.60	-	2.50	.016	.020
63	-	100	.50	.63	2.50	-	4.00	.020	.025
100	-	160	.63	.80	4.00	-	6.30	.025	.032
160	-	& Over			6.30	-	& Over		
Multiply by .004 .005					Multiply by .004 .005				

**"A3" Commercial Drawing Designation  
Dimensional Tolerance Table for Molded Rubber Products**

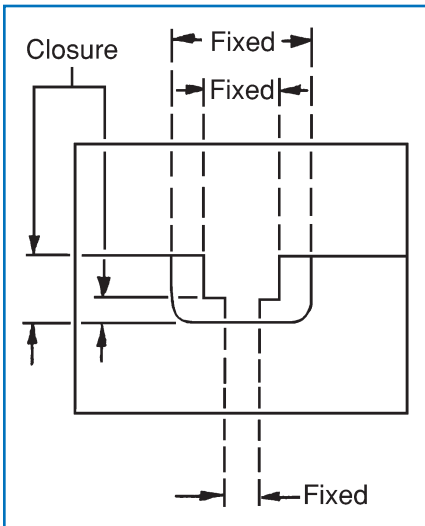
Size (Millimeters)					Size (Inches)				
Above		Included			Above		Included		
0	-	10	+/- .20	+/- .32	0	-	.40	+/- .008	+/- .013
10	-	16	.25	.40	.40	-	.63	.010	.016
16	-	25	.32	.50	.63	-	1.00	.013	.020
25	-	40	.40	.63	1.00	-	1.60	.016	.025
40	-	63	.50	.80	1.60	-	2.50	.020	.032
63	-	100	.63	1.00	2.50	-	4.00	.025	.040
100	-	160	.80	1.25	4.00	-	6.30	.032	.050
160	-	& Over			6.30	-	& Over		
Multiply by .005 .008					Multiply by .005 .008				

- Very soft rubbers (15 to 30 durometer) will be in a 3% to 4% shrink category.
- Firm to almost rigid compounds (65 to 85 durometer) will shrink 1-1/2% to 2% allowing for tighter tolerances.

## General Part Inspection Recommendations

- *Soft parts are best inspected on an optical comparator versus calipers or gauges.*
- *Thin wall parts may be checked on a template or on the hardware itself for fit and function.*

*One critical factor in assuring consistent quality is the number of dimensions the custom molder should track during processing. We at Stockwell Rubber Company recommend two and suggest no more than three.*



● **Basic Closure Dimension:** *This is the dimension across the parting of the plates in the mold. This dimension will always run with somewhat greater variation compared to the fixed dimensions within the cavities. (See Tool Cavity Cross-Section Sketch at left.) The opening and closing of the mold has variations. This is recognized in the RMA tables.*

● **Fixed Cross-Sections:** *Long, relatively thin parts will run with more variation in their length. The dimensioning and tolerance should allow for a little stretch in installation. If the part is too long it will not bunch or compress in place.*

***Often it is practical to machine a prototype cavity to evaluate how well the fit and function of prototype parts suit the application. Changes can be made in dimensions and tolerances when applied to the production cavities. A prototype cavity can be cut in plates suitable for expansion to production cavities. This provides savings in tooling overall.***

*Regarding "A2" tolerancing and tighter, it is desirable that the exact method of measurement be agreed upon, as errors in measurement may be significant in relation to the tolerance.*

***Shrinkage occurs during molding of all rubber components and is a volume effect. Although built into the mold, it will vary depending on the part complexity within the same cavity. It occurs when the part is removed from the heated mold and allowed to cool. The engineering challenge is to cut a steel cavity that will reliably provide acceptably toleranced rubber parts. Given today's close-tolerance thin cross-section designs, your need for precision molded parts has never been more apparent.***

*When applying tolerances the following rules should be kept in mind:*

- *Fixed dimension tolerances apply individually to each fixed dimension by its own size.*
- *Closure dimension tolerances are determined by the largest closure dimension and this single tolerance is used for all other closure dimensions.*
- *Fixed and closure dimensions for a given table do not necessarily go together, and can be split between tables.*
- *Capability studies can be run with a cavity segment to aid our efforts in assigning tolerances for a given material. Please do not hesitate to contact us for assistance!*

***Although mold-cavity dimensions and the actual dimensions of the part will inevitably vary, an experienced custom molder can apply past experience with similar parts and specific material shrink rates to hold specified tolerances. For example, Stockwell Rubber Company applies a proprietary database that combines technical details from previously run components and specific material shrinkage rates to the design of new molds.***

*For help on determining your critical dimensions or to discuss prototype options for your high performance close-tolerance design challenges, just give us a call at (800) 523-0123.*



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