

**Plastic Letters - Combination ALL Mount**

The following data was calculated in May 2004, and reaffirmed 2012, using Gemini's Formed plastic letters, thermoformed out of CAB (Cellulose Acetate Butyrate). Testing and Calculations done and confirmed by David Schmitt, VP Operations, BSME, MMSE.

**Assumptions and facts:**

Numbers are based on a wind force of 144 mph - this equals 82.7 lb/sq. ft.  
 Samples used for testing were Helvetica (a common style)  
 Mounting hardware for the letters was a Combination All mount (stud through pad) with an injection molded plastic block used to receive the threaded stud.

Max. depth of the letters was as follows:

12" UC	1-1/2" deep
18" UC	2" deep
24" UC	2-1/2" deep
36" UC	3" deep

Tensile strength at break for CAB (Cellulose Acetate Butyrate) is 1800 psi  
 Tensile strength of Chemcaulk Silicone Adhesive is 350 psi  
 Thread area for shear of a 10-24 plastic block is 0.048 sq. in.  
 Average face area of a sign letter is .6 x height squared

The following numbers are the result of actual tests, and theoretical information, gathered from the manufacturers of the component parts.  
 This chart is designed to show how much force our mounting hardware will withstand, when used on a standard letter.

Letter Height	144 wind Face Load lbs. Force	144 wind Side Load lbs. Force	Block Shear Strength lbs force	Silicone/Pad Shear Stren. lbs. Force
12"	50 lbs.	11 lbs.	346	3360
18"	112 lbs.	22 lbs.	518	14700
24"	198 lbs.	36 lbs.	518	14700
36"	447 lbs.	65 lbs.	691	19600

Ex: A 24" letter will have 36 lbs. of force pushing on the letter's side, with 144 mph winds.  
 A 24" letter will have 198 lbs. of force pushing on the letter's face, with 144 mph winds.  
 This 24" letter's hardware (threaded block) will not fail until the force equals 518 lbs. of force.  
 This 24" letter's pad with silicone will not fail until the force equals 14,700 lbs. of force

**Gemini Letter Data**

Letter Height	Face Area Square in.	Side Area Square in.	Pads/letter	Pad Area Sq. in. ea.	Total Pad Area Sq.in.	Plastic Block Thread Area	Total Block Thread area
12"	86.4	18	4	2.4	9.6	0.048	0.192
18"	194.4	36	6	7	42	0.048	0.288
24"	345.6	60	6	7	42	0.048	0.288
36"	777.6	108	8	7	56	0.048	0.384

**Assumptions and Facts**

The point of failure will be the Aluminum screws in shear, at the minor thread diameter.  
 144 mph wind speed is equal to 82.7 lb./sq.ft. (0.574 lbs./sq.in.)  
 Tensile strength at break for 3003 Aluminum is 16,000 psi.  
 Minor thread area in shear of a 10-24 Aluminum Screw is .015 sq.in. at 2 threads depth.  
 Therefore, each screw has a holding force in shear of 240 pounds.  
 Average face area of a sign letter is .6 x height squared.  
 Maximum depth of letters is 1.0" at 6" high, 1.5" at 12" high, 2.0" at 18" high, 2.5" at 24" high, and 3.0" at 36" high.