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CROSS-LINKED FOAM SOLUTIONS

Packaging design manual

When designing a package, The following data must be obtained:

1. Sensitivity of the packaged device.
2. Weight of the device.
3. Drop height.
4. Size of the outer box, or other size limitation.
5. The size of the surfaces (flat and firm) of the device in contact with the packaging on all faces of the box.
6. Any special requirements.

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In proper packaging planning, it is important to use a sufficient amount of padding (so that the device won't be hit too hard and exposed to shock). At the same time, excess padding (or if the padding is too stiff), can cause a rebound of the shock being transferred and thus damage the device.

The sensitivity of the device is rated in G (The acceleration of the earth's gravitational force) . It is presented as the "G factor" hereinafter.

If this data is unavailable, it is recommended to use the following Table 1 for guidance.

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Table 1

G factor	Examples	Sensit. level
15 - 25	Altimeter,Gyroscope, Fragile mechanics	Extremely fragile
25 - 40	CT, MRI, X-RAYS	Very fragile
40 - 60	Printers, LCD/Plasma screens	Fragile
60 - 85	TV, CD, stereos	Medium
85 - 115	Furnitures, household electrics	Low
115 +	Electric working tools: Saws, etc.	No sensitivity

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The drop height estimation is based upon the bearing of the device

When there are no special requirements, use Table 2 for guidance.

Table 2

Drop height (Inches)	Method of Carrying	Device weight (Pounds)
42	One person	0 - 11
36	One person	11 - 22
30	One person	22 - 55
24	Two people	55 - 110
18	Light trolley	110 - 275
12	Forklift Truck	275 +

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Drop curves

The drop curves are the results of several drop tests, using devices in several weights & heights, on top of cushions of various thicknesses.

Notice the differences between the curves for the 1st drop and the curves for drops 2-5:

The 1st drop is intended for a single drop, so only a thin cushioning protection layer is required.

When several drops are expected to occur, it is necessary to choose a material (and thickness) that will preserve its damping properties

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How to plan the right cushioning

Upon calculating the device's sensitivity level and drop height, one needs to examine which material the drop curve falls under the device's G factor:

The lower the curve, the better the cushioning protection that will be provided.

The left column of the graph indicates sensitivity of the G- factor required, and by going right on the graph one can evaluate the suitable thickness for the packaging material.

After choosing the point, where the curve meets the G-factor and the drop height requirements, one then goes down to the X axis, which indicates the static loading,

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Whenever the curve is “under” the G factor line – it is suitable for planning:

Moving too much to the left gives over cushioning.

Moving too much to the right gives insufficient cushioning

Based on the static load, the cushion side for each direction of the device can be calculated and then by dividing the objects weight with the required static load, the cushion dimensions in square centimeters are obtained.

In the event that the calculated mounting area is too small, by checking the curves of the other materials, the right damping medium can be found .

If the device has bumps beyond the cushioning layer, there is a need to make sure that enough thickness is used (as it will compress to a max of 60% when dropped).

In the following graphs, imperial units are detailed in brackets.

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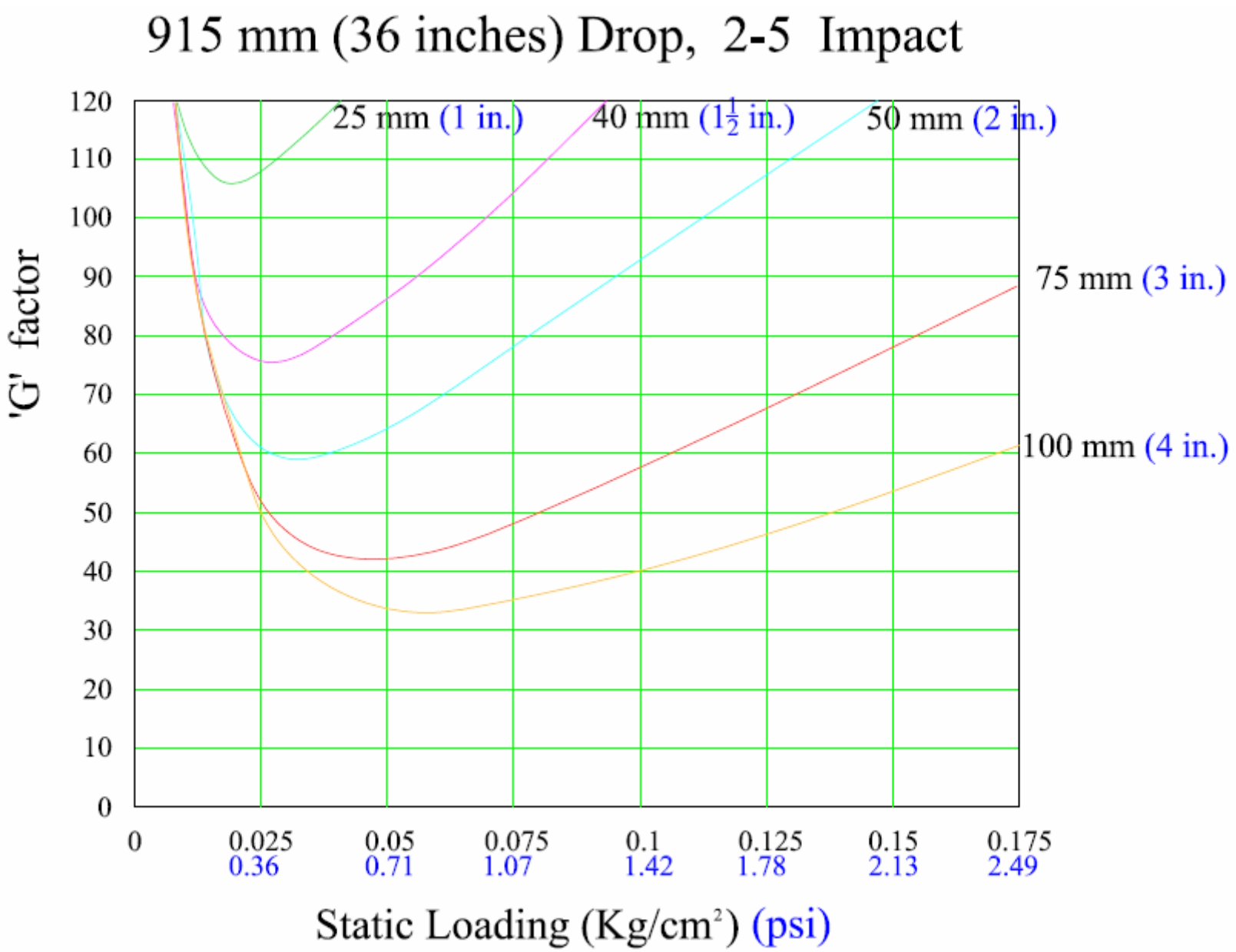
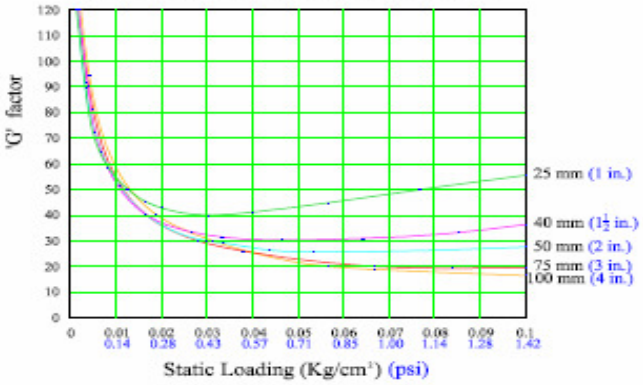
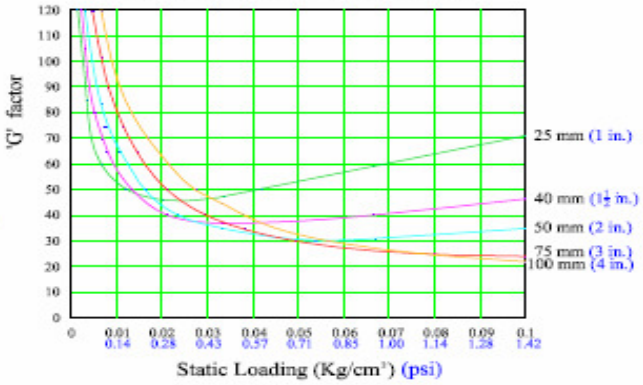

915 mm (36 inches) Drop, 2-5 Impact
'G' factor
120
110
100
90
80
70
60
50
40
30
20
10
0
25 mm (1 in.)
40 mm (1½ in.)
50 mm (2 in.)
75 mm (3 in.)
100 mm (4 in.)
0
0.025
0.36
0.05
0.71
0.075
1.07
0.1
1.42
0.125
1.78
0.15
2.13
0.175
2.49
Static Loading (Kg/cm²) (psi)

Cushioning Curves for GA25 ($1\frac{1}{2}$ pcf) and PA25 ($1\frac{1}{2}$ pcf)

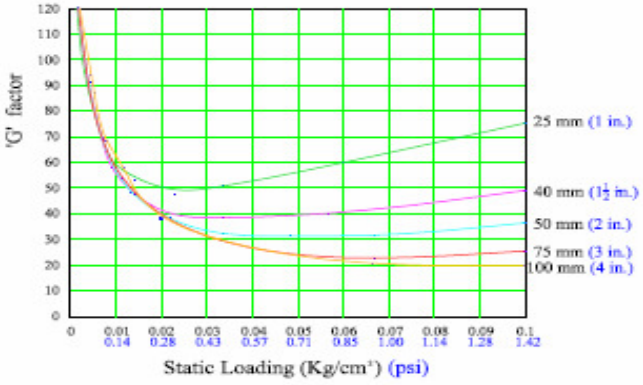
305 mm (12 inches) Drop, 1st Impact



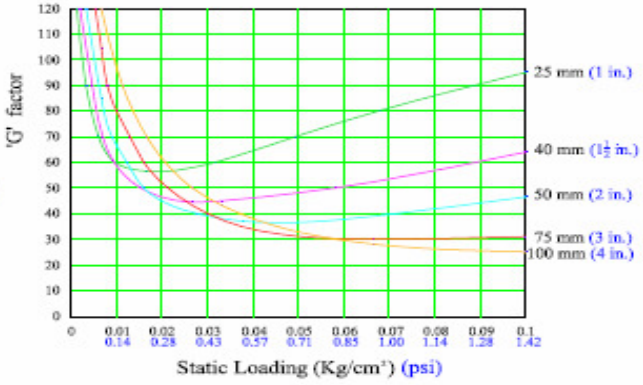
305 mm (12 inches) Drop, 2-5 Impact



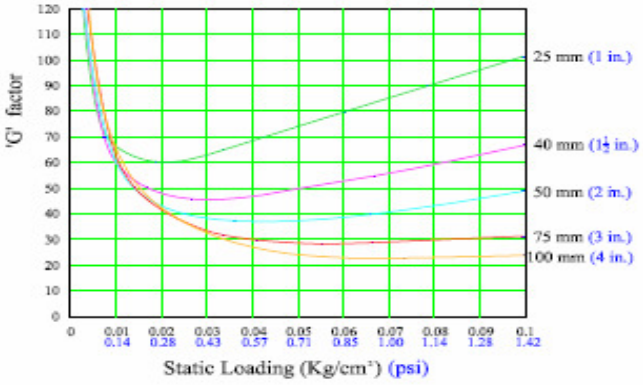
455 mm (18 inches) Drop, 1st Impact



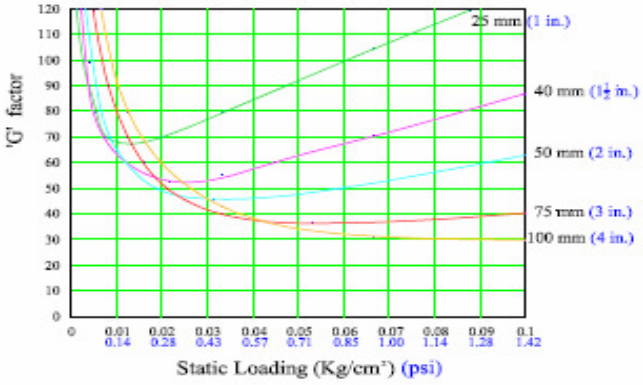
455 mm (18 inches) Drop, 2-5 Impact



610 mm (24 inches) Drop, 1st Impact

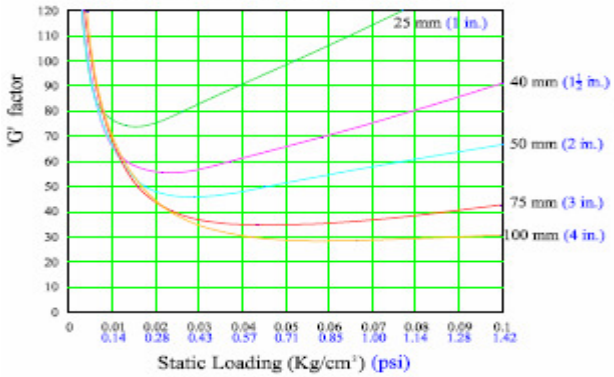


610 mm (24 inches) Drop, 2-5 Impact

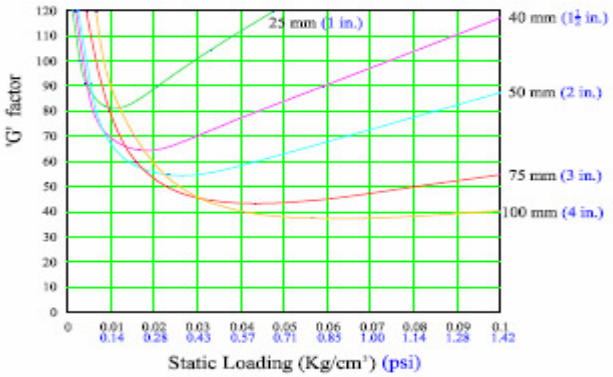


Cushioning Curves for GA25 ($1\frac{1}{2}$ pcf) and PA25 ($1\frac{1}{2}$ pcf)

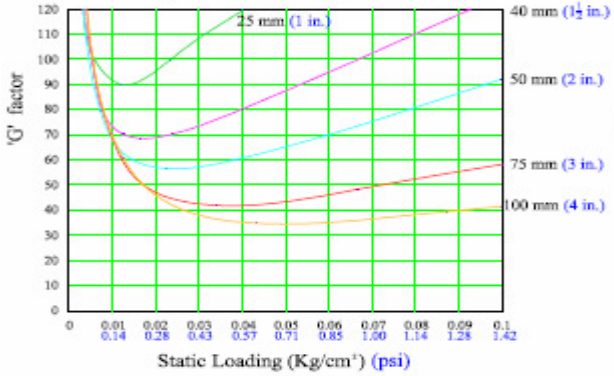
760 mm (30 inches) Drop, 1st Impact



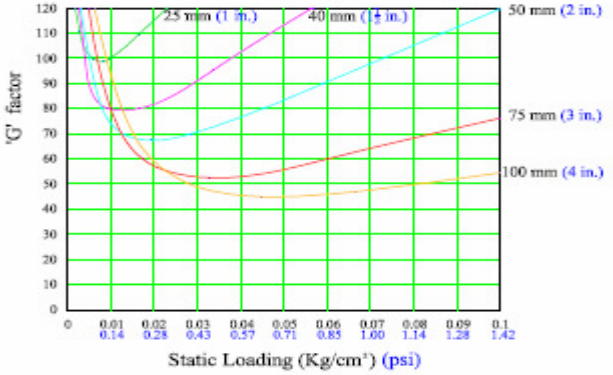
760 mm (30 inches) Drop, 2-5 Impact



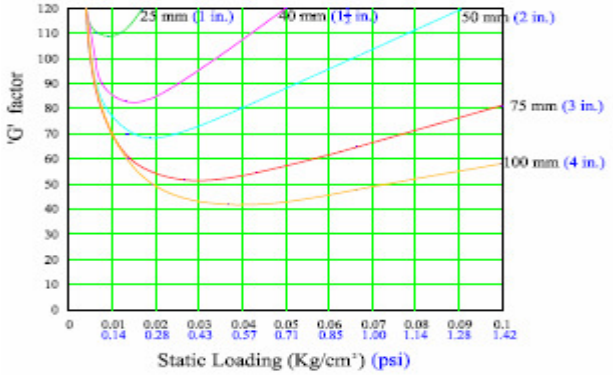
915 mm (36 inches) Drop, 1st Impact



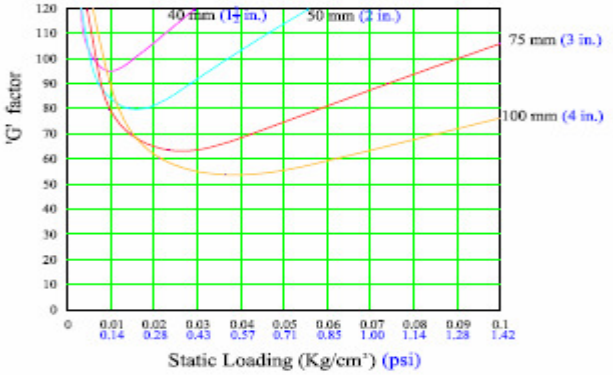
915 mm (36 inches) Drop, 2-5 Impact



1065 mm (42 inches) Drop, 1st Impact

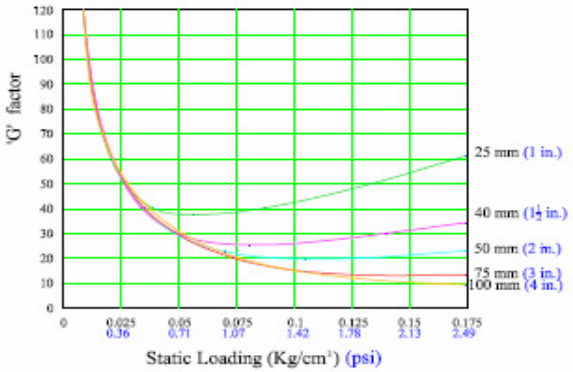


1065 mm (42 inches) Drop, 2-5 Impact

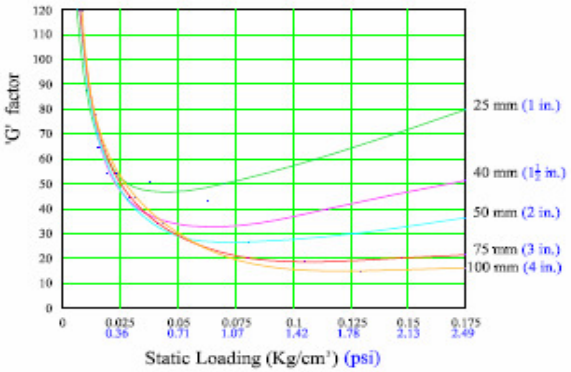


Cushioning Curves for GA40 ($2\frac{1}{2}$ pcf) and PA33 (2 pcf)

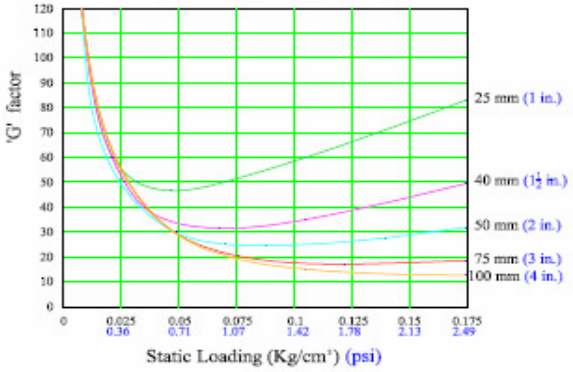
305 mm (12 inches) Drop, 1st Impact



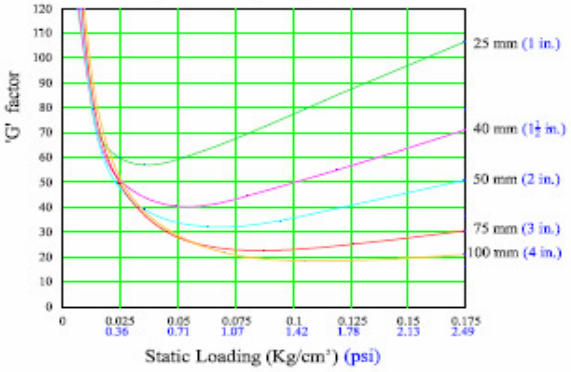
305 mm (12 inches) Drop, 2-5 Impact



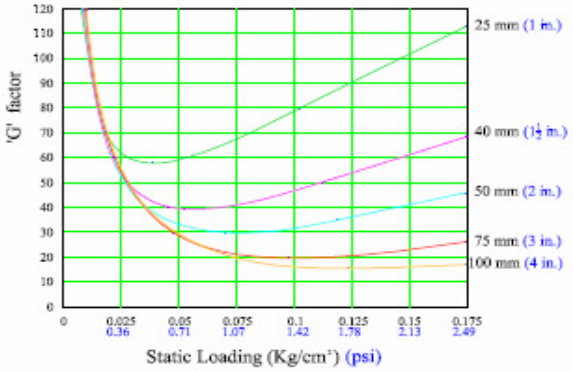
455 mm (18 inches) Drop, 1st Impact



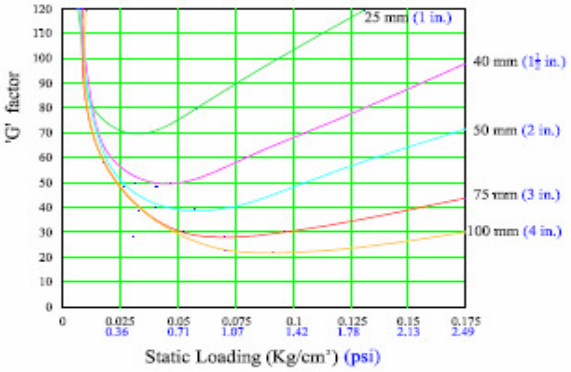
455 mm (18 inches) Drop, 2-5 Impact



610 mm (24 inches) Drop, 1st Impact

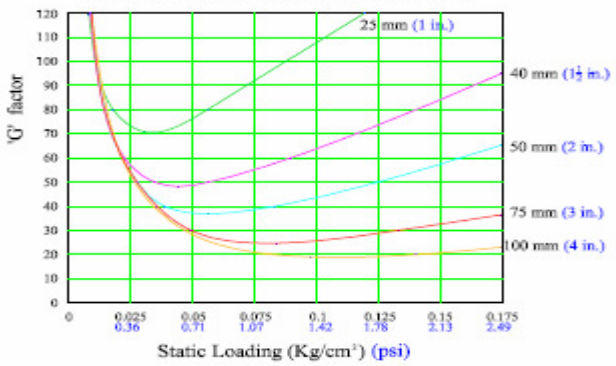


610 mm (24 inches) Drop, 2-5 Impact

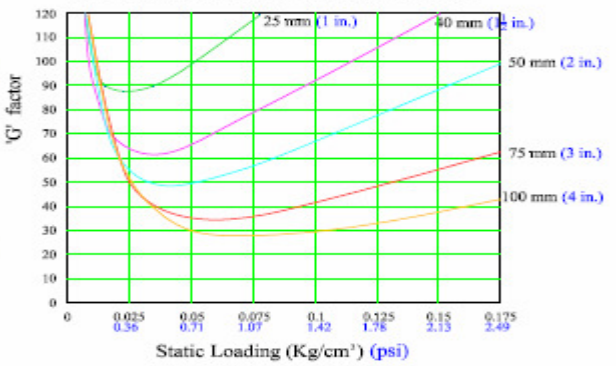


Cushioning Curves for GA40 ($2\frac{1}{2}$ pcf) and PA33 (2 pcf)

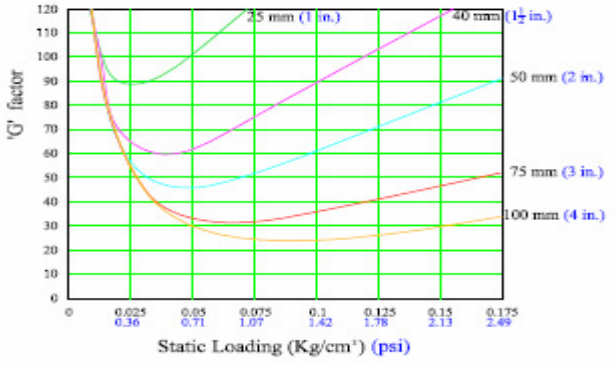
760 mm (30 inches) Drop, 1st Impact



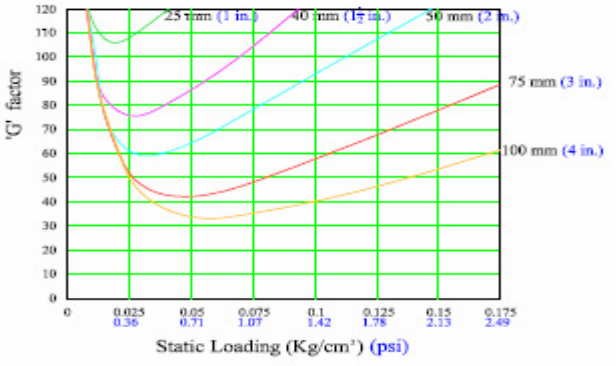
760 mm (30 inches) Drop, 2-5 Impact



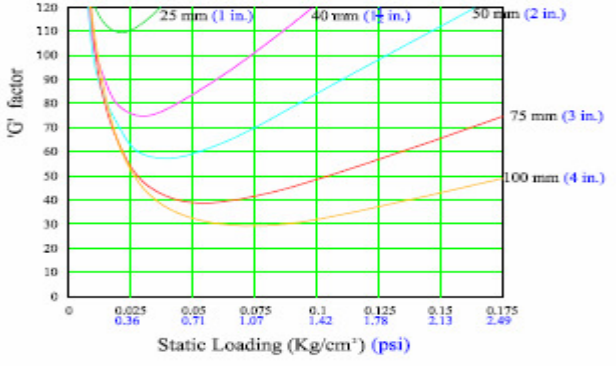
915 mm (36 inches) Drop, 1st Impact



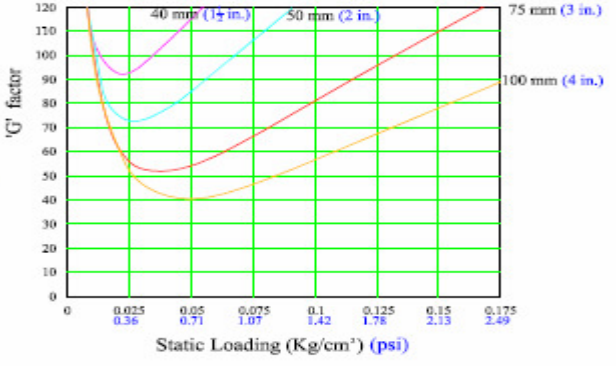
915 mm (36 inches) Drop, 2-5 Impact



1065 mm (42 inches) Drop, 1st Impact

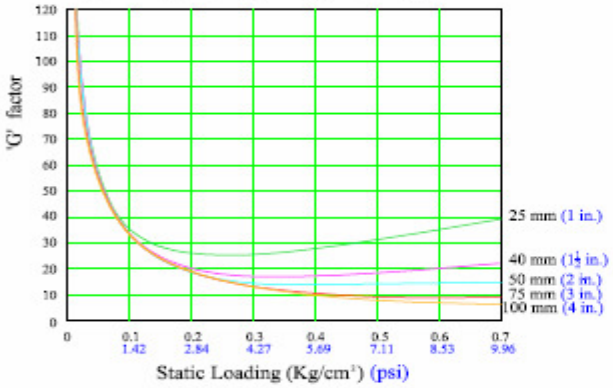


1065 mm (42 inches) Drop, 2-5 Impact

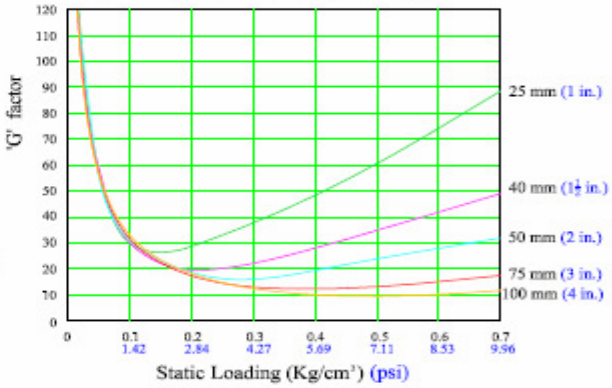


Cushioning Curves for PA60 (4 pcf)

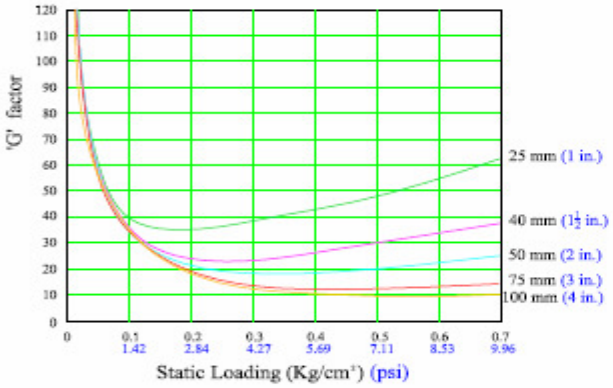
150 mm (6 inches) Drop, 1st Impact



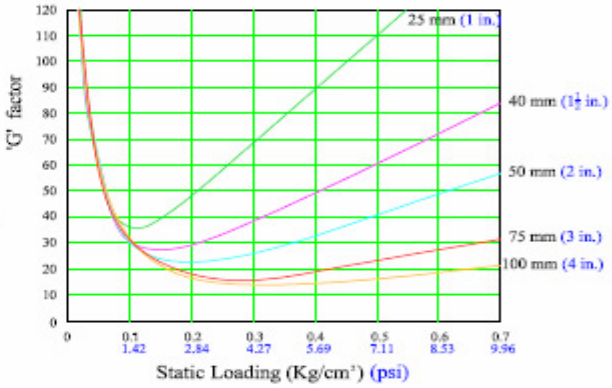
150 mm (6 inches) Drop, 2-5 Impact



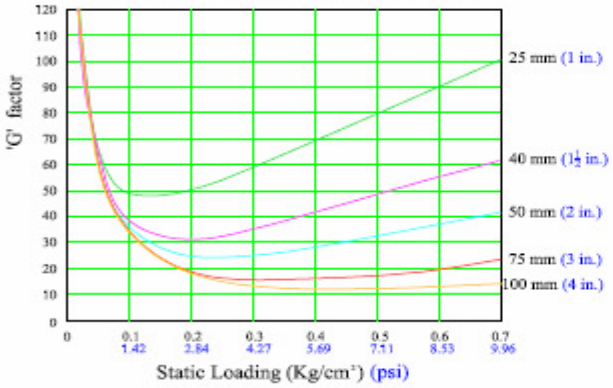
305 mm (12 inches) Drop, 1st Impact



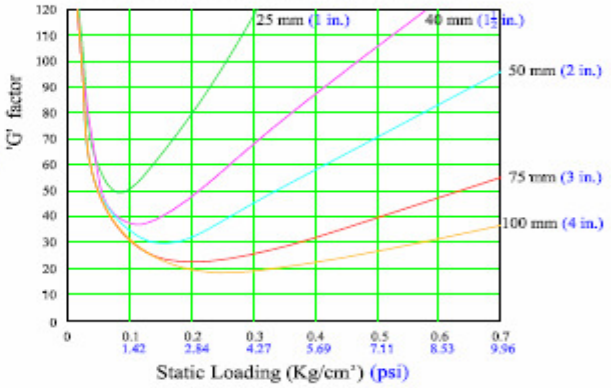
305 mm (12 inches) Drop, 2-5 Impact



455 mm (18 inches) Drop, 1st Impact

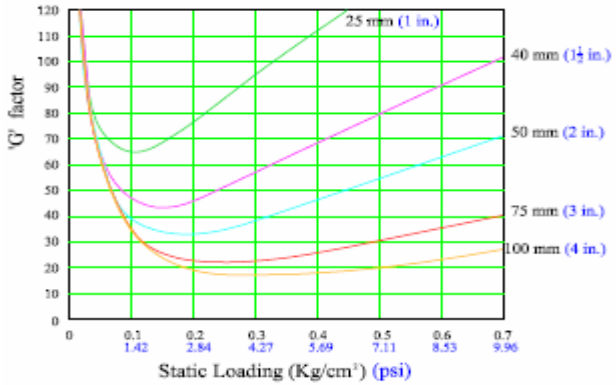


455 mm (18 inches) Drop, 2-5 Impact

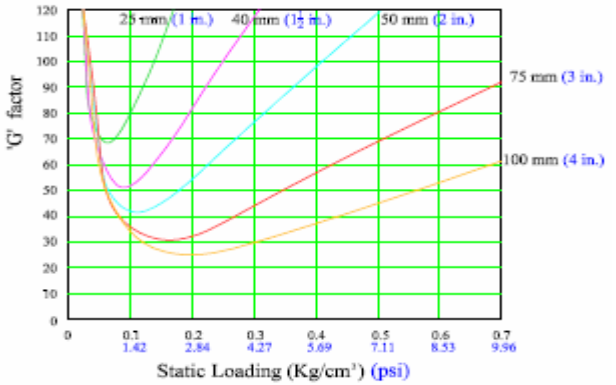


Cushioning Curves for PA60 (4 pcf)

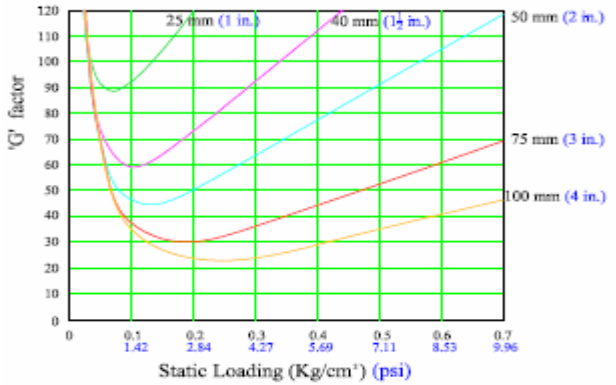
610 mm (24 inches) Drop, 1st Impact



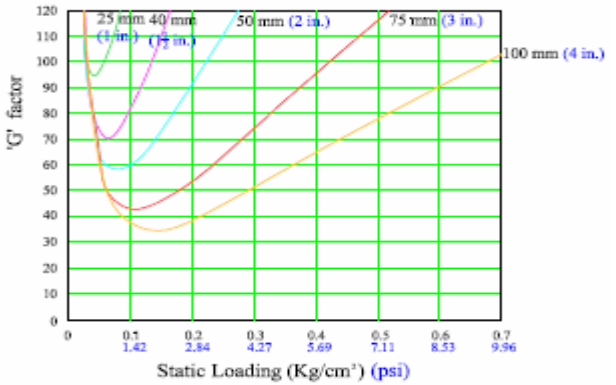
610 mm (24 inches) Drop, 2-5 Impact



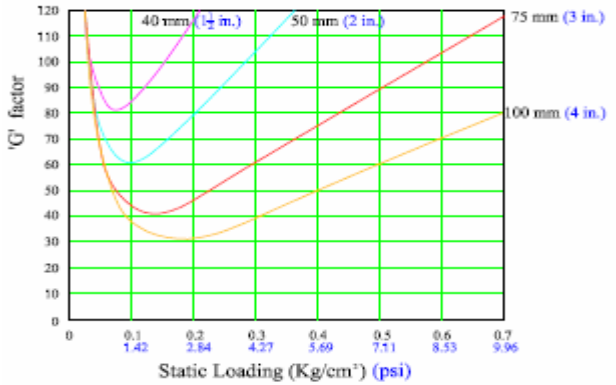
760 mm (30 inches) Drop, 1st Impact



760 mm (30 inches) Drop, 2-5 Impact



915 mm (36 inches) Drop, 1st Impact



915 mm (36 inches) Drop, 2-5 Impact