



1900 SW 44th Ave.
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Impact HVHZ large
missile versus small
Product: missile impact

Large missile versus small missile:

Large missile testing according to TAS 201/202/203 exceeds the forces experienced in small missile testing. Units over 30 ft in height are required to have small missile impact testing in HVHZ zones. Small missile testing requires 10 8mm missiles fired at 80 ft/sec. Below is an engineered analysis of small versus large missile damage to glass based on transferred kinetic energy and impulse.

Velocity (in ft/sec)

Large missile = 50 ft/sec
Small missile = 80 ft/sec

Mass: (in lbm)

Large missile = 9 lbm;
Small missile = .04 lbm/missile*10 missiles = .4 lbm;

Kinetic Energy Comparison: $\frac{1}{2} * m * v^2$:

Large missile = $\frac{1}{2} * 9 * 50^2 = 11,250 \text{ ft}^2\text{-lbm/sec}^2$
Small missile = $\frac{1}{2} * .4 * 80^2 = 1,280 \text{ ft}^2\text{-lbm/sec}^2$

Area (in²):

Large missile 2 x 4 ($A_{\text{large}} = 1 \frac{3}{4}'' \times 3 \frac{3}{4}'' = 6.56 \text{ in}^2 = A_{\text{large}}$)
Small Missile 8 mm diameter = ($A_{\text{small}} = \pi * (8\text{mm} * 1\text{in}/25.4\text{mm})^2 * 10 \text{ balls} = 3.12 \text{ in}^2 = A_{\text{small}}$)

Comparing impulses: $M_{\text{large}} A_{\text{large}} V_{\text{large}}^2 / M_{\text{small}} A_{\text{small}} V_{\text{small}}^2$ (where a larger impulse indicates greater concentrated force)

Large Missile = $(.9 \text{ lbm}) * (6.56 \text{ in}^2) * (50\text{ft/sec})^2 = 14,760 \text{ lbm-in}^2\text{ft}^2/\text{sec}^2 = I_{\text{large}}$
Small Missile = $(.4 \text{ lbm}) * (3.12 \text{ in}^2) * (80\text{ft/sec})^2 = 7987.2 \text{ lbm-in}^2\text{ft}^2/\text{sec}^2 = I_{\text{small}}$

The large missile impact impulse is nearly twice that of the small missile impulse. Additionally, there is less control of the small missiles to focus their impact, further reducing the small missile effect. Furthermore, with almost 10 times the kinetic energy of a small missile test, the large missile test has a much more concentrated affect and larger chance of puncturing the glass.

Thanks,

Sincerely,

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