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GENERAL SAFETY

Bungee Cord Hook Speed

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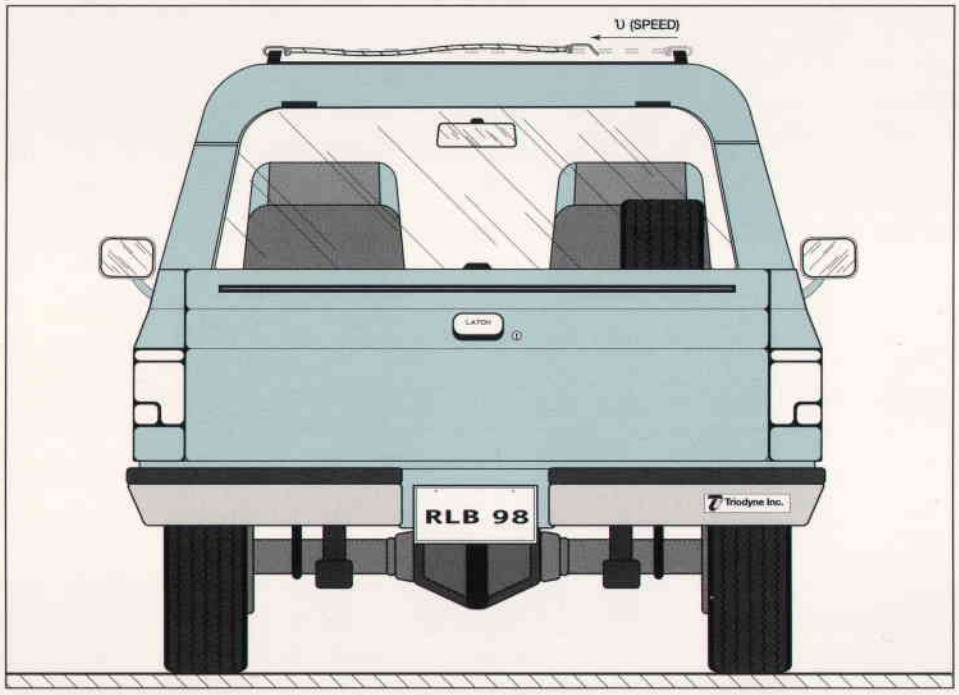

Hook Release Scenario

Hook Speeds

The maximum speed of a bungee cord hook is obtained when one end is released at its maximum elongation and moves to its unstretched length. This speed has been measured and recorded in Table I using equipment described in Reference 1 for various brands of bungee cords with different lengths, diameters and initial elongations.

Speed Prediction

In Reference 1 a first order relationship was developed to relate hook speed to the static mechanical properties of the cord. The resulting formula for hook speed v_h is given by Equation 1;

$$v_h = \sqrt{\frac{2gR}{W_h + (W_c/3)}} \qquad (1$$

where g is the gravitational acceleration (32.2 ft/sec^2), R is the cord's resilience, W_h is the hook weight, and W_c is the cord weight. The resilience R is determined as the area under the Unloading-Deflection curve of the cord. Values of calculated hook speed are shown in Table I for a 100% elongation and, as usual, they are larger than the corresponding measured speeds at 100% elongation; the average error is 11.4%.

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Table I – Maximum Hood Speeds (mph)

BUNGEE CORD Manufactured By	BUNGEE CORD LENGTH x DIAMETER (Inches)	MEASURED SPEEDS ELONGATION			CALCULATED SPEEDS	
		50%	75%	100%	100% Elongation	% Error
BUNGEE INTERNATIONAL MFG. CORP *Manufactured in USA*	40 x 3/8	42.035	58.864	71.630	79.813	11.4%
	36 x 3/8	45.733	60.861	76.533	81.413	6.4%
	30 x 5/16	44.332	59.591	72.527	76.054	4.9%
	24 x 5/16	41.944	56.086	71.107	75.642	6.4%
	18 x 1/4	38.177	49.381	56.537	64.194	13.5%
	13 x 7/32	36.792				
	10 x 5/32	39.811	56.966	66.277	73.242	10.5%
THE LEHIGH GROUP *Manufactured in Phillippines*	36 x 3/8	51.181	71.266			
	30 x 11/32	68.618	95.342			
	24 x 11/32	57.215	82.099			
	20 x 11/32	75.585				
	18 x 11/32	49.794				
	16 x 5/16	48.653				
	13 x 5/16	35.147	52.604			
CAL - HAWK *Manufactured in Taiwan*	32 x 13/32	49.491	67.767	88.213	115.608	31.0%
	24 x 13/32	45.187	63.180	83.407	95.175	14.1%
	18 x 13/32	53.555	79.923			
	12 x 13/32	46.881				
USA PRODUCTS *Manufactured in Malaysia*	36 x 5/16	38.487	56.216	65.638	68.598	4.5%
	24 x 5/16	37.901				
	12 x 5/16	18.289	20.589			
VICTOR PRODUCTS, INC. *Manufactured in China*	24 x 13/32	36.670	56.166			

Note: *Elongations of 75% and 100% were measured using the identical cord used for the 50% elongation.*

Vinyl Jacket Behavior

The behavior of the woven vinyl jacket that encases the bungee cord is very complex under dynamic conditions. It is our hypothesis that this behavior accounts for most of the deviation of the calculated speed from the measured speed. As a preliminary test of this hypothesis, the vinyl jacket was removed from a 24" x 13/32" bungee cord manufactured by Cal-Hawk.

Using 100% elongation, the hook speed was measured at 89.6 mph. The corresponding calculated speed was 92.0 mph. The error is only 2.65%. From Table I we find that an exemplar cord with the vinyl jacket intact had a prediction error of 14.1%. The core of the bungee cord exhibits classic behavior; not the vinyl jacket.

Reference

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General Literature

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