Bow Report

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LimbSaver DeadZone DZ-32

TABLE 1: LIMBSAVER DEADZONE DZ-32

COMPARATIVE TEST DATA

Comparative data from the static and dynamic tests of the LimbSaver DeadZone DZ-32

CABLE CLEARANCE: 1/2 Inch
MASS WEIGHT: 4 lbs. 12 oz.
CAM SYSTEM: H.E.A.T. Cam & 1/2

PEAK DRAW FORCE Pounds:	60	65	70
DRAW LENGTH (AMO) Inches:	30	30	30
HOLDING FORCE AT DRAW LENGTH Pounds:	21.8	21.2	19.2
BRACE HEIGHT (Inches):	7⅜	7¼	7⅛
LETOFF PERCENT:	63.7	64.4	72.6
STORED ENERGY Feet per pound:	82.85	91.43	99.32
STORED ENERGY/POUNDS OF DRAW FORCE Foot Lbs./Lbs.:	1.381	1.407	1.419
STATIC HYSTERESIS Foot/Lbs.:	3.44	3.74	3.71
% STORED ENERGY:	4.16	4.09	3.74
AVG. VIRTUAL MASS in Grains:	104.2	99.8	102.5
RATING VELOCITY (Feet Per Second)			
60 LBS./30 IN./540 GR.:			240.2
60 LBS./30 IN./360 GR.:			286.1

The DeadZone DZ-32 is the culmination of considerable research and development effort on the part of Steve Sims and his group to create a compound bow that would wed many of the advantages of his proprietary NAVCOM vibration-control material with some unique concepts of archery bow design plus others of proven worth. Reduction of shock, vibration, and noise were primary goals along with high performance, durability, and overall quality. All of this combined to make a noteworthy task for an organization bringing out its first bow. My review of the DZ-32 supports the premise that they succeeded exceptionally well.

The handle on which the DeadZone is built is machined from a billet of 6061-T6 aluminum alloy. The upper and lower risers are essentially trussed beams with the majority of

FIGURE 1: LIMBSAVER DEADZONE DZ-32

FORCE-DRAW CURVES

A comparison of force-draw curves derived for levels of 60, 65, and 70 pounds peak draw force. **(DRAW LENGTH=30 INCHES AMO)**

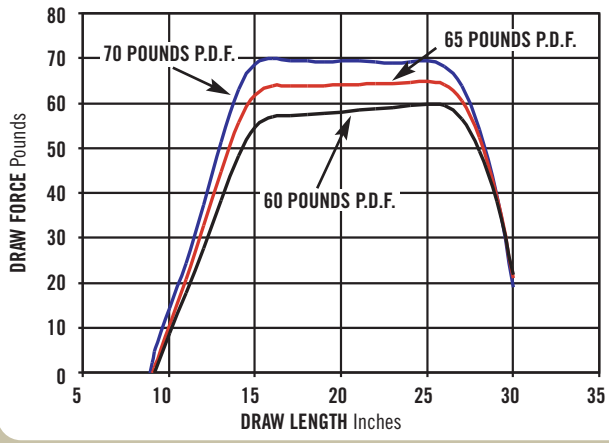


FIGURE 2: LIMBSAVER DEADZONE DZ-32

ARROW VELOCITY VS ARROW WEIGHT

Initial arrow velocity plotted versus arrow weight for the three draw weights taken from the values given in Table 2. **(DRAW LENGTH=30 INCHES AMO)**

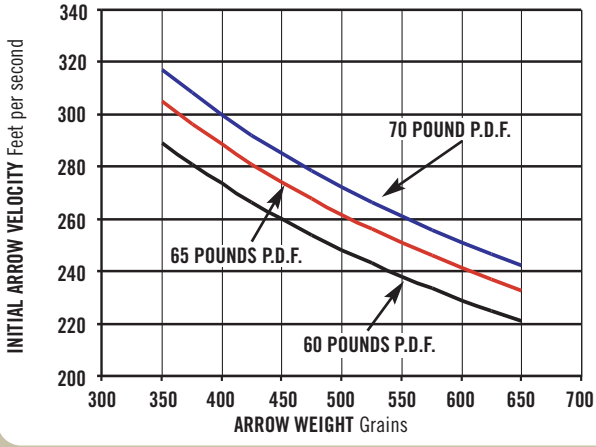
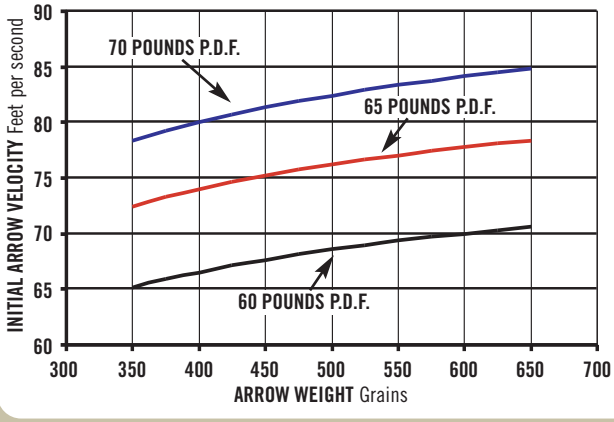


FIGURE 3: LIMBSAVER DEADZONE DZ-32

INITIAL KINETIC ENERGY CURVE

Initial kinetic energy plotted versus arrow weight for draw weights of 60, 65, and 70 pounds. **(DRAW LENGTH=30 INCHES)**



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the connecting cross members featuring an I-shaped cross-section wherever functionality permitted. Lightening holes are added at the junctions of the cross struts and the tension and compression members to effect optimum weight reduction. The risers' external corners are beveled with convex cuts that add eye appeal to the handle. The risers' outer ends are held to the same thickness as the rest of the riser as they extend into the limb pockets and are sandwiched between the extended flanges of the pocket structure. There is a groove milled into the end of each riser to provide clearance for the limb adjustment bolt as it moves with respect to the riser when the draw weight is adjusted.

Measured from a straight line connecting the centerlines of the limb pivots, the DeadZone handle is reflexed about 1⅝ inches. The sight window has a usable length of over 9 inches and is cut past center ¾ inch. Two holes, tapped 5/16-24 UNF and spaced ½ inch apart, are provided for mounting a cushion plunger or arrow rest. These holes are centered ¾ inch above the shelf. The standard two-hole (tapped 10-24 UNC) pattern for attaching a sight or other accessory is incorporated in bosses on the cross struts on the upper riser. The shelf is drilled laterally with five blind holes for weight reduction. The add-on grip is a one-piece, sculptured section of laminated hardwood that slips in place from the rear and is secured by a through-bolt let into the outer surface. A stainless-steel bushing is threaded into the back of the lower riser just below the grip section to mount a stabilizer or other accessory.

The method by which the limb pockets are attached to the risers and, in fact, the design of the limb pockets themselves deserves special attention. The DeadZone was designed to take

TABLE 2: LIMBSAVER DEADZONE DZ-32

BOW EFFICIENCY %
Tabulations of initial arrow velocity and bow or dynamic efficiency for a wide range of arrow weight for the three draw weights tested.

ARROW WEIGHT (Grains)		350	375	400	425	450	475	500	525	550	575	600	625	650
PEAK DRAW FORCE (Lbs.)	DRAW LG. (Inches)													
60	30	78.6	79.5	80.3	81.0	81.7	82.2	82.8	83.3	83.7	84.1	84.5	84.9	85.2
65	30	79.3	80.1	80.9	81.6	82.3	82.8	83.4	83.9	84.3	84.7	85.1	85.4	85.8
70	30	78.9	79.8	80.6	81.3	81.9	82.5	83.0	83.5	83.9	84.3	84.7	85.1	85.4

ARROW VELOCITY
Feet per second.

ARROW WEIGHT (Grains)		350	375	400	425	450	475	500	525	550	575	600	625	650
PEAK DRAW FORCE (Lbs.)	DRAW LG. (Inches)													
60	30	289.5	281.2	273.7	266.7	260.2	254.1	248.5	243.2	238.3	233.6	226.2	225.0	221.1
65	30	305.4	296.6	288.6	281.2	274.3	268.0	262.0	256.4	251.5	246.3	241.6	217.2	233.1
70	30	317.5	308.4	300.1	292.4	285.3	278.7	272.5	266.7	261.2	256.1	251.3	246.7	242.4

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advantage of all proven shock-dissipating concepts to reach the epitome of smoothness, quietness, and vibration-free operation. The use of parallel limbs with opposing action to minimize the effect of hand shock was a foregone conclusion. Reducing limb length and mass is another requisite, and keeping limb travel to a minimum adds a third desirable effect. The DeadZone limb system utilizes all three concepts in an innovative manner that deserves commentary.

The limb pocket is machined from a 6061-T6 aluminum extrusion. The pocket is identical on both ends of the bow. The limb adjustment feature is incorporated entirely within the structure of the pocket and does not involve the limb in any way. The limb is free-floating in the pocket, positioned by insulating components so there is no contact with the aluminum alloy pocket, thus reducing noise and vibration. It bends on a composition fulcrum that is centered 3½ inches from the limb butt, which is held in the base of the limb pocket, but is isolated from the pocket by a composition half-round component that permits some rotation of the limb. The spacing between the two support points on the limb is then roughly 3½ inches, and the limb butt flexes over this length, which is actually longer than the remaining working section of the limb. In this manner the bending of the limb under load is distributed between the two lengths of the limb rather than being confined primarily to the outboard portion beyond the limb pocket, but inboard of the tip reinforcement. Judicious selection of limb thickness can result in reducing limb travel as well as limb unit stress. Each limb mounts a LimbSaver unit on the face side.

The limb pocket locking method, which consists of squeezing the ends of the risers between the two projecting flanges of the limb pockets, actually performs two functions. It locks the limb adjustment bolts against accidental rotation and also insures positive alignment of the limb pockets to the handle. The manner in which the limbs are retained in the limb pockets and the design of the pockets eliminates the need for any slot in the butt of the limbs. The limbs are 1½ inches wide and 12 inches long with the principal working section confined to the inner 6 inches of length. They are machined from blanks of Gordon Power-Tuff and ground to final dimensions.

The cam system used on the DeadZone is a hybrid design that consists of a lower power cam and an upper control wheel. The two are quite alike in shape having similar outside tracks but varying greatly with regard to internal construction and function. The power cam is a three-track arrangement while the control wheel has only two tracks. On the power cam, the large track (bow-hand side) carries the

shooting string, the inner track carries the buss cable, and the third track is for the control cable. The large track on the control wheel reels out the shooting string while the second track carries the opposite end of the control cable. The buss cable is yoked on the upper end and is anchored on tiny sheaves on the outer extremities of the axle.

The DeadZone uses two cam sizes to cover the draw length range from 25 to 30 inches. The short draw cam covers 25, 26, and 27 inches draw length, and the long draw cam is used for 28, 29, and 30 inches. Draw length changes within the ranges are accomplished by adjusting bowstring and cable length and by rotating the cams. The cam sets have two anchor positions available for anchoring the bowstring. This feature allows for a ½-inch adjustment in the bowstring effective length.

The axle-to-axle length (32 plus or minus ⅛ inch) is the controlling dimension for tune. The bottom or power cam has two scribed marks, one on either side of the control cable, that indicate proper tune. Maintaining the position of the power cable within the scribed lines assures optimum performance when the axle-to-axle length is within tolerance. Timing of the cams is judged by having the bowstring contact the flat sections on both cams simultaneously when the bow is at full draw.

The cable guard rod, a ⅜-inch round composite section, fits into a drilled hole in the upper riser just above the arrow pass. It is retained by a metal bridge that is recessed into the sight window and held in place by two socket-head screws that thread into the riser. The cable slide is machined from Teflon to provide smooth operation under all weather conditions. The cable guard carries two cable guard dampeners, one forward and one aft of the cable slide.

The bowstring and cables are made by Winner's Choice, widely recognized for the exceptional quality of its products. The string is 55⅛ inches in length made from BCY's 8125 material, while the cables are 452X material from the same source. The bowstring carries two string leeches and two sets of string weights encapsulated in shrink tubing. Each of the cables has a pair of cable leeches installed to reduce noise and vibration.

The shelf has an integrated strip of Sims NAVCOM installed on the forward end. This strip spans the shelf and extends nearly two inches up the sight window to cushion any contact from a wayward arrow and the upper riser.

The test bow was equipped with a LimbSaver fall-away arrow rest plus the Arrow Pad and Arrow Holder that augment it. This rest has a Teflon-lined arrow cradle plus two NAVCOM dampening elements to reduce noise and vibration.

The handle and limbs of the DeadZone are finished in the high-definition G1 camouflage. The bow is offered in draw weights of 50, 60, and 70 pounds.

The Tests

The bow I had for testing was rated at 70 pounds peak draw force rather than the 60-pound category that I usually test. The draw length was set for 30 inches so at least one specification fell into place. This caused a little head-scratching on my part because there wasn't time to wait for a replacement. Ultimately I decided to test this bow at 60, 65, and 70 pounds and then determine what I could do with the results. After running all three force-draw curves and comparing them, I decided that there was a reasonable solution to obtaining comparable performance values so that this bow could be judged against its peers that have gone before. I would correct the 60-pound test data to reflect the difference between the performance with the bow set at peak draw weight and one backed off by 10 pounds. Having values of SE/PDF and dynamic efficiency to work with makes this adjustment quite reasonable. More details about this approach when we cover the performance results.

All testing was done using the fall-away arrow rest for the dynamic format. Static tests are conducted using a force-draw machine equipped with a Mark 10 digital force gauge capable of reading to the nearest 0.1 pound. Force readings are taken at one-inch increments from brace height to just beyond the test draw length in order to define the valley and back wall of the force-draw curve. The area under the force-draw curve is integrated by elemental summation and then converted to foot-pounds to obtain the energy that is stored when the bow is drawn from brace height to full draw. Other pertinent measurements are also taken with the bow at brace height and at full draw. Comparative data from the static tests are tabulated in the first nine lines of **TABLE 1**.

FIGURE 1 presents the force-draw curves that were developed during the three static tests. Observe that there is a great similarity between the three curves except for one characteristic. As draw weight is reduced, the dwell section of the curves falls away from the peak draw level up to maximum of 3 pounds for the

maximum recommended draw weight reduction. It's only 1 pound for a 5-pound reduction, but 3 pounds for a 10-pound reduction. The ration of stored energy to peak draw force (SE/PDF) is 1.419 at 70 pounds PDF, 1.407 at 65 pounds, and 1.381 at 60 pounds. It was the basic similarity among these curves that suggested to me the method for correcting the performance data from the low setting on the 70-pound bow to the high setting on a 60-pound bow. Needless to say, these are excellent curves for storing energy.

Brace height measured 7⅛ inches with the peak draw force set at 70 pounds. It increased to 7¼ inches when the draw weight was reduced to 65 pounds and to 7⅜ inches when it was further reduced to 60 pounds. The location of the bottom of the v alley showed a similar relationship. It occurred at 30⅜ inches at 70 pounds, 30⅝ inches at 65 pounds , and when the dr aw weight was set at 60 pounds moved out to 30⅞ inches. This means that when tested at exactly 30 inches draw length, the holding weight and the letoff are affected. The following table lists the differences:

PEAK DRAW FORCE (Lbs.)	DRAW LENGTH (Inches)	DRAW FORCE HOLD at 30"	% LETOFF	FORCE HOLD at Bottom of Valley	% LETOFF
70	30	20.1 lbs.	72.6	18.2 lbs.	74
65	30	19.7 lbs.	67.4	21.2 lbs.	74.6
60	30	17.2 lbs.	63.7	21.8 lbs.	74.2

Static hysteresis is a measure of the energy lost to friction in the system as determined under static conditions. It is not directly related to dynamic performance but it does tell us something about how a bow will act when it is shot. In general, static hysteresis will range from about 4 to 11 percent of stored energy. The DeadZone DZ-32 exhibited a commendable pattern with this characteristic, achieving values that ranged from 3.74 percent of stored energy at 70 pounds, through 4.09 percent at 65 pounds, to 4.16 percent at 60 pounds.

dard F1544-04 governs the testing procedure for determining the Rating Velocities for archery bows. This standard employs the average initial velocity of five shots of each of the two test arrows for this determination. The initial velocity is taken from a chronograph positioned three feet downrange from the back of the bow at the arrow pass. The method I use for these Bow Reports predates Standard F1544-04. It uses the initial average velocities of seven test arrows, each shot and chronographed a minimum of five times to establish a theoretically correct curve of arrow velocity (a performance profile) for the bow. The Rating Velocities are selected from this curve by calculation. The procedure includes the F 1544-04 test method, hence both values are available.

Dynamic tests are conducted using a shooting machine equipped with a Gator Jaws release aid. Arrow velocity is measured by a double chronograph arrangement employing a Custom Chronograph Model 1000 instrument as the standard device. This chronograph is located 3 feet downrange from the back of the bow at the arrow pass. The checking chronograph was a Custom Chronograph Speed Tach. It is positioned immediately adjacent to the standard instrument. Seven test arrows ranging in weight from about 360 to 650 grains in approximate 50-grain increments, are each shot and chronographed a minimum of five times to establish credible average velocities. The average velocity values are used to determine a theoretically correct curve of virtual mass using linear regression. From this curve the velocity for any desired weight of arrow can be determined. With the weight of the arrow and the initial velocity, the initial kinetic energy of the arrow may be calculated. The dynamic efficiency of the bow and arrow combination is determined by expressing the kinetic energy of the arrow as a percentage of the stored energy of the bow.

TABLE 2 presents tabulations of initial arrow velocity and corresponding dynamic efficiency for a wider range of arrow weight. Observe that with an arrow weight of 400 grains the DeadZone achieves a dynamic efficiency of over 80 per cent over the entire range of adjustable draw weight. With the heaviest arrow tested (650 grains) it topped 85 per cent. Very few bows reach this level of efficiency. **FIGURE 2** presents a plot of the three curves of initial arrow velocity taken from the values given in **TABLE 2**.

The Rating Velocity is a parameter established by ATA to permit comparing the performance of various bows. It is defined as the initial velocities of 360-grain and 540-grain arrows shot from a bow set at 60 pounds peak draw force and 30 inches ATA draw length. ASTM Standard F1544-04 governs the testing procedure for determining the Rating Velocities for archery bows. This standard employs the average initial velocity of five shots of each of the two test arrows for this determination. The initial velocity is taken from a chronograph positioned three feet downrange from the back of the bow at the arrow pass. The method I use for these Bow Reports predates Standard F1544-04. It uses the initial average velocities of seven test arrows, each shot and chronographed a minimum of five times to establish a theoretically correct curve of arrow velocity (a performance profile) for the bow. The Rating Velocities are selected from this curve by calculation. The procedure includes the F 1544-04 test method, hence both values are available.

Remember that this evaluation is generally made on a 60-pound bow set at its peak draw weight. In this instance it was made on a 70-pound bow set at the 60-pound level. It is generally considered that bows operate at their optimum performance level when they are set at their maximum rated poundage. This isn't always the case, but I have found it to be true most of the time. In order to be completely fair to the DeadZone, after studying the test results I have conceived a method to correct the data for this bow to reflect that discrepancy. This technique would not be applicable to all bows, but because of the similarity of the force-draw curves and the commonality of the dynamic efficiency factors for the DeadZone, I have a great deal of confidence in using it here. It consists in adjusting the stored energy under the 60-pound force-draw curve by a factor that will correct it for the loss of energy caused by geometrical change to the curve from backing off from the peak draw force.

Since the normal procedure for the Bow Report includes the standard method for F 1544-04, I usually present both values, but this time I will provide the corrected Rating Velocities based on the Bow Report method as well. You may take them or leave them based on your appraisal of my correction technique, but I feel that they are fairly accurate.

RATING VELOCITY—FPS

METHOD	360 Gr.	540 Gr.
ASTM F 1544-04	286.0	290.0
Bow Report	286.1	240.2
Bow Report CORRECTED	290.0	243.5

Kinetic energy is the energy possessed by a mass in motion. As applied to archery, it is the energy that the arrow possesses after it is launched by the bow and is speeding toward the target. Kinetic energy is important to bowhunters because it is a measure of the penetration potential of the arrow.

Credible test work has demonstrated that there is a linear relationship between kinetic energy and penetration potential. I use the term "penetration potential" because the actual penetration is also a function of the medium being penetrated and the physical characteristics of the arrow. Initial kinetic energy is calculated from the weight of the arrow and the initial velocity of the arrow determined as it passes through the chronograph.

It is important to recognize that an arrow loses velocity, and, hence, kinetic energy as it progresses downrange. The longer the range, the more kinetic energy is lost by the arrow. Lighter-weight arrows lose kinetic energy at a higher rate than heavier arrows. **FIGURE 3** presents curves of initial kinetic energy plotted versus arrow weight for the three test conditions.

From a performance standpoint the DeadZone DZ-32 should make no apologies to anyone. It can hold its head up in any company. I've read comments that accuse it of being "ugly." My reaction is, "Compared to what?" I think that it's just different. The design is well-conceived and functional—and it works!

General Commentary

At 30 inches draw length, the included string angle measured 73.5 degrees. I believe that the great majority of archers will conclude that the DeadZone is best shot with a release aid. All of the hand shooting that I did during testing was done that way.

One of the characteristics that I note during testing with the shooting machine is the ability of the bow to repeat the chronographed arrow velocity and the point of impact with a given arrow. This bow fared well in that regard. I had to shift impact points on the target frequently to avoid blowing through the target as impact after impact penetrated the same spot. My shooting machine holds the bow loosely on a horizontal rod where it is held in position by an elastic band. Canting is determined by eye rather than by gauge. This is where the effect of minimized hand shock is quite evident.

During hand shooting I paid particular attention to the noise level. The DeadZone is reputed to be dead quiet upon release. I shot arrows that weighed between 360 and 450 grains with the full complement of vibration- and noise-reducing equipment in place, plus the addition of a 4 ½-inch S-Coil stabilizer. The only noise I could distinguish by ear was the impact of the arrow in the target. I'll have to support the "quiet" claim.

One small offering by LimbSaver that I found to be very effective is the self-adhesive arrow pad that is intended to deaden the sound of the fall-away rest impacting the shelf. This device does the best job of anything I have tried for this purpose.

With the limb retention and adjusting concept on the DeadZone, it is possible to relax the limbs for maintenance without the need for a bow press. Obviously this is a real plus when you encounter a problem in the field and need to change a string or cable.

I think that the LimbSaver team deserves a distinct "thumbs up" for its efforts in the design and production of the DeadZone bow. The company motto is "Products That Work"—in my opinion this one does! BW

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