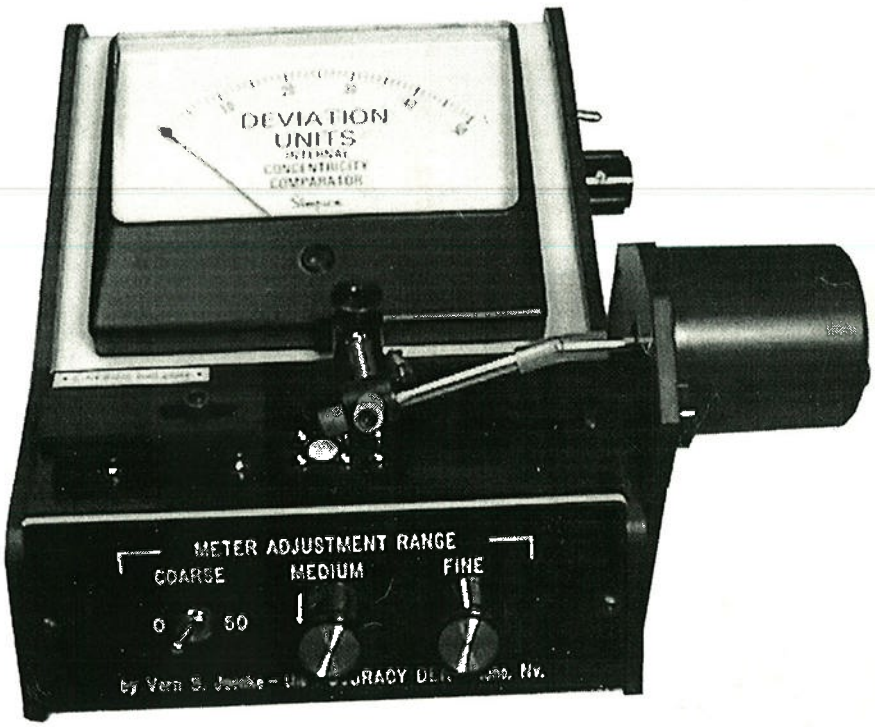
the ACCURACY DEN *I.C.C. UNIT

*(Internal Concentricity Comparator)
Ultrasonic Metal-Mass Detector



"The Vern Juenke Machine"

Expressing the promise of accuracy in the bullet's flight

Vern S. Juenke K7MUP
FFL # 9-88-016-01-E4-02516

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05940

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the ACCURACY DEN

(GUNSMITHING SINCE 1946)
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BASIC DESCRIPTION

(Will test bullets from .22 cal. 50 gr. to .375 cal. and cases from .22 Hornet to .375 H&H)

The Accuracy Den I.C.C. unit utilizes a special ultrasonic metal mass detector. It is equipped with a motor drive to eliminate the boredom of rotating the test piece by hand. The typical time involved to test 100 bullets is about 12 minutes. You do find variations even in the best custom bullets! The time required to test cases is about the same.

The I.C.C. unit is a one of a kind instrument. It uses the standard 115 VAC 50/60 Cycle line voltage plug-in wall transformer power supply. It is regulated down to 90 VAC. This unit was designed and built by myself and is not a production unit. It has the ability to find and eliminate several more variables in the quest for that one hole group.

Deluxe: (Taut Band 4 1/2" meter). With Carbide ball plate: $639.00. This includes shipping by parcel post, priority to all 50 states.

This I.C.C. unit is guaranteed for 60 days against defects in materials and workmanship.

I reserve the right to make any changes in design or appearance, depending on parts availability, in the I.C.C. unit without incurring any exchange or updating liabilities.

Some owners of this unit to date:

Omark Industries
Nosler Bullets
Swing Rifle Co. (England)
Stu Harvey
Walt Berger
Gaillard Barrels
Dr. Palmisano
Larry Scharnhorst
Skip Talbot
Dupont Co.
J.C. Braconi (France)
Dick Wright
Bill Shehane
Army Rifle Team
Griffin and Howe
Randolph Constantine
Kenny Jarrett
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Martin Menke (Germany)
John St. Alban (Australia)
Clay Spencer
Gerry Masker
Philip Sauer
Bill Crosby
Jan Behrman (England)
U.S. Secret Service
Ken Glanzer
David Tooley
Greg McGee
Sinclair Int.
David Miller Co.
L. E. Willson Inc.
Richard Beebe (Redding Dies)
Olin (Winchester) (3)
Hornady (2)
Federal Cartridge Co.
Norma
Bob Brackney
Chris Van Niekerk (Africa)
Ken Glanzer
Remington
David Billingurst (Australia)
Lapua
Don Geraci
Bruce Carrigan
Krieger Barrels
Marine Rifle Team (2)
Gerry Geske

ENTER, THE I.C.C. TESTER

There have been several case wall thickness testers available over the years. All of them of mechanical design. A long probe must be inserted into the case mouth to get back to the critical area where you want to check. The case is then rotated by hand. You watch the dial indicator as it gives you a jumpy reading as it tries to follow the rough inside of the case wall. It takes almost a minute to test a case.

With the I.C.C. Tester, it only takes about seven seconds to look at a case or bullet with a smooth motor driven readout. No other tester will look inside a finished bullet and tell you the jacket quality that was used in its construction. The electronic I.C.C. Tester will look at the copper jacket and ignore the lead core. It will, however, look at a void between the core and jacket. This is due to the unit's detector field geometry and its frequency of operation.

The movement on the "Deviation Units" needle moves more than 10-20 times the amount that a mechanical dial indicator needle moves for the same thickness variation.

To get the best results out of my I.C.C. Tester as you must know, all of the accepted case preparation and load development procedures must be followed.

BASIC OPERATING INSTRUCTIONS FOR the ACCURACY DEN I.C.C.

Plug the transformer connector into the right side of the unit. Plug the transformer into a 115-vac outlet. Above the transformer connector, is the Power On-Off switch with the Drive Motor Speed control on the left. Move the small bat handle of the Power switch to the up position. The Deviation Units Meter needle will go up scale past "50". Rotate the aluminum knob of the Motor Speed control in a clockwise direction. This will cause the test piece Drive Motor to rotate. Maximum speed will be at a full clockwise position. If you set the black line of the Motor Speed control at a 12 o'clock position, the speed will be about right for 6mm bullets. Run the motor speed slower for smaller bullets, and faster for larger cases etc. The best speed of rotation will be where you get maximum meter needle deflection. You can turn the unit Power switch off without changing the motor speed setting, once established.

To operate the unit, lift the spring loaded motor drive shaft up with the small projecting shaft. If you lift the shaft high enough, it will stay in an upright locked position for cleaning or to be at rest. Place the bullet or case over the steel balls and adjust the black plastic stop to the desired position. You can slide the stop right or left without adjusting the tension screw. Do not tighten this slide tension screw with any tool. FINGER TIGHT ONLY! When the drive motor is running, it will cause the test piece to move to the left against the stop. Test all flat base bullets with the stop set all the way to the right.

To adjust the meter needle position, set the "METER ADJUSTMENT RANGE" "FINE" control to the center of it's range with the white line at 12 o'clock. If the meter needle is below "0". Rotate the "MEDIUM" control so that the needle reads about 25 or center scale. A clockwise rotation of the control moves the needle toward "50". A counter-clockwise rotation moves the needle toward "0". If the needle still reads "O" with the "MEDIUM" control rotated fully clockwise, switch the "COARSE" switch from the "O" to the "50" position and re-adjust the "MEDIUM" control to the near 25 scale position. Adjust the motor to your desired speed. Set the "FINE" control to keep the needle within the "0" to "50" range. Observe the number of deviation units. This gives you the figure of merit of the piece being tested. The less the number of deviation units, the more uniform the wall thickness of the case is, or the balance and quality of the bullet.

PLEASE NOTE:
The clear meter cover can get a static charge on it due to handling or rubbing it. This causes the needle to hang up. Dampen a paper towel with water and rub the meter cover carefully in one direction only, until the needle returns to "0".

Before testing any bullets or cases, let the unit warm up for about 30 minutes with a bullet or case in place. Adjust the meter to read about 25 on the scale and readjust to 25 as required for the 30 minute period. Don't run the drive motor during this period. No damage can occur to the unit if the above procedure isn't followed. The needle will just drift slightly to start with.

OPERATING TIPS AND FACTS

- *The items to be tested and the ball surfaces at the detector and rubber friction drive should be kept clean. Use alcohol or lacquer thinner on a Q Tip. Do not get any lacquer thinner on any other parts of the unit. Clean with a little soap and water on a soft cloth only.*

- *The best time to check cases is after firing but before sizing. However, useable information can be taken on unfired cases.*

- *Set the plastic stop so that the left-hand pair of balls contacts the case just forward of the expansion ring.*

- *The right-hand pair of balls are slightly higher than the center pair so that the longer cases will be supported on a longer base line.*

- *Use the center and left pair for checking bullets.*

- *Bullet ogive run-out can be tested by adjusting the stop so that the ogive rests on the center balls and the base or body rests on the left-hand balls.*

- *The I.C.C. unit will also detect out of round bullets and cases.*

- *As the case is viewed from 12 O'clock, a down-scale reading indicates a thicker wall. An upscale reading indicates a thinner wall.*

- *Smaller diameter bullets and cases show a greater sensitivity to the I.C.C. because the piece under test is closer to the detector head.*

- *In the checking of bullets, the detector is more sensitive to copper than lead.*

- *The unit will test bullets from .22 cal. to .375 H & H diameter cases.*

- *Boat-tail to body concentricity can be checked by running the boat-tail on the left pair of balls, and the body on the center pair of balls.*

THINGS TO LOOK FOR WHEN CHECKING BULLETS

Good jackets alone do not make a good bullet. Extreme care and uniform procedures when seating the cores is important. Assume a good quality jacket is used and a uniform core has been seated. The next requirement is to form the bullet. This requires just the right amount of the proper lubricant.

When the bullet is formed without enough lubricant, it can end up slightly larger in diameter and with a bigger pressure ring on the base. It can also end up shorter in overall length than a better lubed bullet.

These conditions can be detected with the I.C.C. unit. The bullet that is larger in diameter will zero at a different point on the meter scale. A bullet that is longer or shorter in length will also come to zero at a different spot on the meter scale.

While these bullets may still give small deviation readings, one from the low end of the scale should not be mixed with bullets from the high end of the scale.

Establish an average bullet for center scale settings and use it to zero the meter on center scale (25 setting).

Remember to let the I.C.C. unit and any bullets to be tested stabilize for at least an hour in the same room.

Do not handle the bullets to be tested for too long, as your body heat could change the meter zero.

NOTE:

Re-zero to 25 every 5 or 10 minutes using your "average" bullet.
This may be required due to changes in temperature or in case the settings get changed accidentally.

HOW TO ESTABLISH REJECT LIMITS

No case or bullet is perfect. They all show some deviation units on the meter. The question is what is good enough, and what is bad.

Some bench rest rifles are more tolerant to case variations than others. Generally, the better the rifle is built, the tighter it will group with variations in cases. This assumes the rifle also has a top quality barrel and chamber. Even so, the rifle will shoot smaller groups if all components of the ammo are as identical as possible.

The main reason for testing wall thickness variations in cases at the head area is to prevent the cases from stretching on firing at the thin area. This will cause the head to go out of square on contacting the bolt face and cause fliers due to uneven thrust on the bolt. 10 to 15 deviation units should be a satisfactory limit. The cases should be checked after firing the first time so that all of the voids and dents are fire formed out. Basically, test a batch of cases and reject the ones that really look worse than the average.

Test the bullets right out of the box. Good bullets should run less than 5 deviation units. Custom bullets will have a lower deviation rate than factory production bullets. Here again, set your own level of rejection. 8 to 10 deviation units should be a good reject level based on the average of the box.

On boat-tail bullets, run the boat-tails on the left support balls. This will check boat-tail to body run-out. If the boat-tail deviation is more than the body only deviation, it means the boat-tail is not concentric to the body. Deviation run-out on bullets can mean several things. Any deviation means an out of balance bullet. When checking a bullet, the I.C.C. sees the following defects:
1) Jacket thickness variations.
2) Uneven jacket folds in the ogive.
3) Basic bullet out of round.
4) Voids between core and jacket.
Any or all of the above defects can be taken as one as far as bullet quality and balance is concerned.

Make sure the I.C.C. unit and the cases or bullets to be checked have stabilized to room temperature for an hour before testing. Temperature has an effect on meter zero or drift. To test this, put a bullet or case in the unit and adjust to zero and motor speed as needed. Note the meter needle position. Take the bullet or case out of the unit and hold it in your hand for a minute or so. Put it back in the unit and note the change in the meter position. The temperature change has increased the diameter of the bullet or case and the I.C.C. sees this dimension change as a zero shift on the meter.

THE REAL PHILOSOPHY BEHIND BULLET CHECKING

Many shooters believe that shooting bullets to test their quality is the only way to go. Sure, if you shoot a good group, the bullets that you shot were good. The problem is, Unless you check all of the bullets 100%, you never know when a bullet will come along with an out of tolerance jacket. This can happen with any bullet maker, custom or factory. The reason is simple. Bullet makers cannot check the jackets 100% before they make their bullets. A small percentage of bullets will be made from not so good jackets. They could turn up any time and really ruin your day at a match.

You can check 100 Bullets in about 12 minutes with my I.C.C. tester. A small price to pay to know exactly what you are shooting.

DEVIATION UNITS

5 or less (these are gems)
6-10 (these are good)
11-15 (these are fair)
16-20 (these will not shoot as good as the above)
21 and above (these will not group to bench rest standards)

Vern S. Juenke

THE I.C.C. CALIBRATION FACTS

The I.C.C. unit cannot be calibrated in "inches" because of many reasons. It really doesn't matter because it was really intended for the consumer shooter rather than the bullet maker. I have never talked to a bullet maker that would admit that all of his jackets were not near perfect.

The consumer shooter only wants to know what is good and what is not so good. It doesn't matter what the unit is calibrated in. It could be in inches, deviation units, apples or oranges. He can't change it anyway so it doesn't make any difference.

The detector head of the I.C.C. unit emits an ultrasonic field. The strength of this field varies by the square of the distance away from the field. The ball spacing that the bullet or case rests on during testing remains the same for 22 caliber bullets or .375 H & H cases. The 22 caliber bullet, being of a smaller diameter sets lower between the support balls so it is closer to the detector head. This is the most sensitive position. This will show maximum Deviation units on the meter for a given jacket wall variation. The .375 H & H case, on the other hand, being larger in diameter, will rest further away from the detector. This will show less Deviation units on the meter for the same wall thickness variation. So the sensitivity varies by the square of the distance that the case or bullet rests above the detector.

The sensitivity of the readings vary also due to variations in the thickness of the jacket or case walls. To explain this, lets cut a .17 MACH IV case off just behind the neck-shoulder junction. Using a ball-mic. we measure the wall thickness at .010 inches on the thin side and .011 on the thick side. This is a variation of .001. This is a ratio of 10% from the thin side to the thick side. Put this on the I. C.C. and run it , you will get a meter reading of about 40 Deviation units. If the wall thickness was .020 on the thin side and .021 on the thick side with the same .001 difference the ratio would be 5% and would give a reading of about 20 Deviation units. Going the other way, if the wall thickness was .005 on the thin side and .006 on the thick side, still using the .001 variation, it would be a 20% ratio and the meter would read about 80 Deviation units.

Now lets slide a lead core into the first example with the .010 wall. (The head would have to be cut off ahead of the solid web to simulate a bullet jacket). The meter adjustment controls would have to be readjusted to balance out the lead core in the detector head field. The detector is slightly more sensitive to copper alloys than to lead. This is why we can look at finished jacketed bullets. This combination would yield a reading of about 60% of the reading without the core, or about 24 Deviation units. If you would have marked the case at 12 o'clock with a pen, at the thick section before you put the core in, the mark would be in the same 12 o'clock position but yield a smaller Deviation unit reading.

This is why we can't calibrate in inches because there are too many variables involved. The speed that the drive motor runs also effects the sensitivity. This doesn't make the unit any less valuable in checking any one type of bullet or case against another of the same type. Thus we call it the "Internal Concentricity Comparator (I.C.C.). The unit is also limited when looking into much thicker case or jacket walls than are generally found in popular match cases or bullets. This would include the .50 cal. bullets and cases.

Vern S. Juenke

Cartridge case wall thickness variations per .001 inch, versus meter deviation units.

This is an average value.
Thinner walls give more deviation per .001 inch.
Thicker walls give less deviation per .001 inch

Smaller cases normally have thinner walls.

Larger cases normally have thicker walls.

Case	Deviation units per .001 inch
.218 BEE	70
.221, .222, .223, ETC.	10
.30 AMER., 6 PPC, ETC.	4
.308, .22/250, .30/06. ETC.	3
7MM, .300 H&H, ETC.	2

The reason for the above decrease in sensitivity as the case gets larger is because .001 inch is equal to a smaller percentage of the total case wall thickness. Also, as the case gets bigger it rests further away from the detector head.

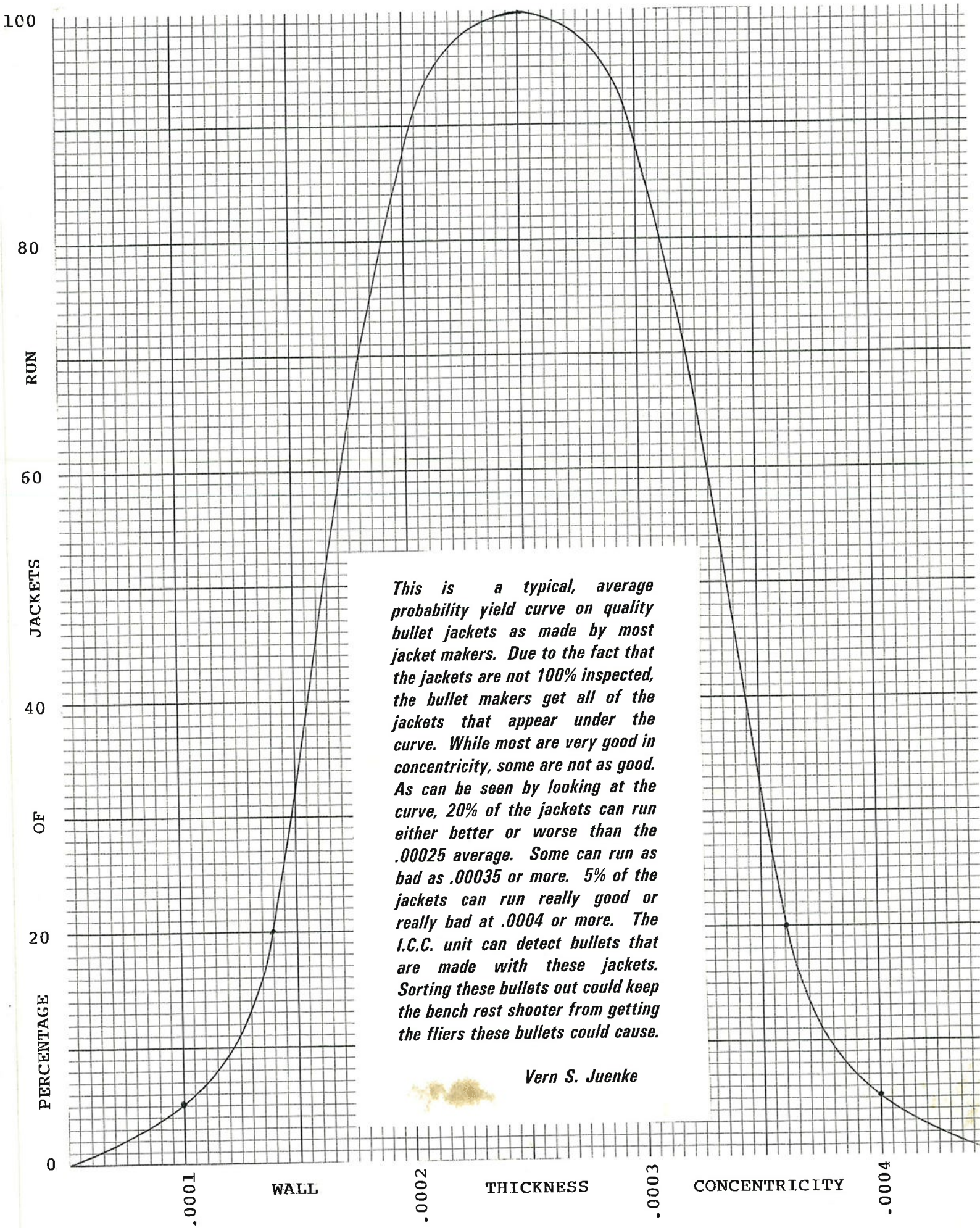
Due to the fact that the I.C.C. unit also reads out of round on the outside, the cases to be tested should be fired to fill out all of the surface variations, Test before any sizing is done. Position the case so that the left hand set of balls contacts the case in beyond the fired expansion ring. That would be about .5 inch from the case head surface.

HOW TO SELECT AND USE THE "TEST" BULLET.

The "test" bullet should be a good one with low deviation units. You should have one in all of the different caliber's that you are testing. You use it to set the center scale point on the meter (25). Let the drive motor run and adjust the needle to center on 25. Check this point about every 10 minutes. Set the motor speed control to obtain the same deviation units on the test bullet by adjusting the motor faster or slower, as desired.

If you stop testing for a long time period without a bullet over the detector head and the meter needle goes off scale, the Ultra Sonic transistor that drives the test field at the white dot is running without a load and it warms up slightly. This does not harm the transistor, but the zero point could drift slightly at the 25 point when you continue testing. I recommend putting the test bullet back in position so the meter needle stays at the 25 point and doesn't go off scale when you stop or delay testing. If you change the stop or move it, you may have to re-zero to 25 with the test bullet.

When you test a batch of bullets they will all come to a meter scale reading at a different point (See page 5 for an explanation why this occurs). When you select your test bullet, you should select one that averages a near center scale reading.



This is a typical, average probability yield curve on quality bullet jackets as made by most jacket makers. Due to the fact that the jackets are not 100% inspected, the bullet makers get all of the jackets that appear under the curve. While most are very good in concentricity, some are not as good. As can be seen by looking at the curve, 20% of the jackets can run either better or worse than the .00025 average. Some can run as bad as .00035 or more. 5% of the jackets can run really good or really bad at .0004 or more. The I.C.C. unit can detect bullets that are made with these jackets. Sorting these bullets out could keep the bench rest shooter from getting the fliers these bullets could cause.

Vern S. Juenke