# IMPLEMENT INSPECTOR'S HANDBOOK

## Volume 1


**PREPARED BY THE EQUIPMENT AND FACILITIES SPECIFICATIONS SUBCOMMITTEE OF THE NATIONAL OFFICIALS COMMITTEE OF USA TRACK AND FIELD**

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This manual is part of the USATF National Officials Monograph Series on how to officiate. Each monograph covers the various techniques for each officiating assignment. These monographs are intended for more in depth understanding of each job. They are intended for both the novice and seasoned official. They cover the real details of the job and how it should be preformed. They summarize various techniques to accomplish the job. These monographs can be copied and used for officials training only.

# INDEX



**Dedication:**

This manual is dedicated to Dr. James Sabatelle of the Metropolitan Association, Carl Strombom and Norm Morrison of the Pacific Association, and Red Meade of the Southern California Association. Jim and Carl were original members of the committee and Norm was one of the original W&M people along with Red Meade on the West Coast. Red was the original manufacturer of the Trackmaster system. Jim was a contributor to the original version of this manual. All were dedicated to helping improve the proficiency of the Implement Inspector in the United States.

# 1 INTRODUCTION

This manual was prepared for Implement Inspectors by the Equipment and Facilities Specifications Subcommittee (EFSS) of the National Officials Committee (NOC) of USA Track and Field (USATF) for the use, education and training of Inspectors of Implements. As such, it is copyrighted for the use of USATF members. Additional copies are available by downloading them directly from http://www.usatf.org/groups/officials/resources/field-events/. Comments and recommendations are welcome and can be sent to Bob Springer, 10063 Arrowsmith Ave. S., Seattle, WA 98178 or via e-mail at bobspringer2@comcast.net. It is the first known publication of how to do the job of an Implement Inspector.

In addition to this manual there is available a free newsletter for Implement Inspectors across the country, published by the subcommittee in February and September. To get on the mailing list write to the same address or e-mail your request.

The only other inspection manual that we are aware of is "Prontuario di Verifica Attrezzature e Attrezzi", which is maintained and published by the Federazione Italiana di Athletica Leggera, Italy. It is a comprehensive technical manual, with a detailed section on implement inspection.

Implement inspection starts, at its core, with the rules of competition which define dimensional limits, minimum mass limits, shape, fit and finish of the throwing implements. It is both a science and an art. The science aspect includes understanding the technical definition of the implements, having measurement equipment that is appropriate for the task, and knowing how to make all the required measurements. The "art" aspect of inspection deals with the gray areas that are not addressed by the rules of competition, and adjusting the rigor of inspection to be commensurate with the level of competition that is being supported.

Although the specifications for implements are published in the various rule books of the various governing bodies for track and field, the method of weighing and measuring implements is not specified in any of them. The Inspector of Implements should be able to say that any implement passes because it met every requirement of the rules governing the meet. Simply weighing an implement does not approve it for use in competition. It must meet all the measurement standards.

This Handbook is intended as a "how to" manual for the novice Inspector of Implements as well as a guide to the seasoned veteran. It spells out the science of inspection, and makes inroads into the art of inspection. It is an attempt to get more uniformity in the methods used to certify implements and in the measurement techniques being used throughout the United States. This Handbook also spotlights numerous tools that are available for the inspection and repair of implements; the list is not comprehensive, but rather is intended to provide ideas about setting up a new inspection suite, or upgrading an existing one.

# 2 HOW TO BECOME A CERTIFIED OFFICIAL

At the present time, USA Track & Field is the major US certifier of officials for track and field. As the national governing body for Athletics in the United States, which includes the sports of Track and Field, Race Walking, Cross Country and Long Distance Running, it is affiliated with

the IAAF (International Association of Athletic Federations) which governs the sport worldwide. It is likewise the representative for track and field, race walking and the marathon to the United States Olympic Committee.

There are four levels of USATF officials – Apprentice, Association, National and Master. Each has its own qualification requirements. The new official begins at the Apprentice level after attending an officiating clinic and taking the Apprentice-level rules test. Each Association sets the requirements for their local area. Some Associations require officiating at a certain number of meets as a trainee before joining. Others only require completion of a test on the rules. Contact your local association to obtain their requirements. You can get their address from the USATF Website at www.USATF.org or by writing the author at the address shown above. At the present time USATF is the only organization which is certifying W&M officials for USATF, NCAA, IAAF, WMA (World Masters Athletics) and high schools in the U.S.

# 3 PRE-MEET REQUIREMENTS

## 3.1 FACILITIES

A room at least 20 feet by 20 feet, with a 9 foot ceiling if handling javelins, and preferably twice that size with a lock and key and limited access is recommended. Good lighting is required, preferably over the measurement area. Rooms smaller than this will provide problems checking the javelin and storing implements until competition time. This is particularly true for meets greater than two days. Consider segregating the check-in and pick-up area from the measurement and storage areas. It should be located near the field and preferably near the athlete entry gate. Ensure there are adequate signs and announcements about its location. If the measurements are performed on the field or outside, ensure that the wind does not interfere with the weight measurements. See Appendix A.

In a pinch, a 10' x 10' or larger tent can be used, but this notably restricts inspection and storage room. Tent sidewalls are a must to keep wind, rain and sunshine off the inspection equipment. If inclement weather is expected, then anchors for the tent legs are required.

In a meet where records are expected, consider an additional location near that event to enable a quick recheck of the implement during the competition. Otherwise, request from meet management an expeditious means of transporting the implement, like a golf cart.

## 3.2 EQUIPMENT

The most common implement inspection kits include the Trackmaster(TM), UCS Implement Certification unit, Gill Implement Certification Kit and Polanik Measuring set. However, some meets may find them cost prohibitive as these now retail from about $1500 for a high school kit to $3700. There are specialty tools to measure individual implements like the javelin or hammer; this manual will describe several that are available. Also, with access to shop facilities, custom inspection tools can be designed and made.

The TRACKMASTER(TM) equipment is no longer manufactured. The Gill Implement Certification Kits can be purchased from Gill Athletics, 601 Mercury Drive, Champaign, IL 61822 (web page www.gillathletics.com). These kits are available for order online and range from a high school kit for about $1500, to an NCAA kit for $3800. Some scales can be purchased separately. The UCS kit is available for $4000 and is sold by UCS Spirit, 511

Hoffman Road, Lincolnton, NC 28092, (web site www.ucsspirit.com). Since some of the suppliers change their sources for scales, it is not possible to specify the factory tolerances for them.

Measuring equipment must be handled with care, maintained, calibrated, adjusted and properly stored in order to do the best job. The misuse of equipment is usually the biggest problem and is the result of lack of knowledge or training. Misuse leads to damage which results in inaccuracies even when a competent person is using it. Uncalibrated scales also contribute significantly to false rejections or false certifications of implements.

NOTE: All measurement equipment should be checked at least annually against known standards. The standards should be traceable to any national metrology institute, such as the National Institute of Standards and Technology (NIST). This is particularly true for scales and calipers. In turn, the calipers can be used to check the measurement templates in the TRACKMASTER(TM), UCS, Gill or other certification kits. Calibration can be performed by a local accredited scale store, accredited calibration laboratory (like Davis Instruments, Mettler-Toledo or Simco), county Weights and Measures unit, or state Department of Agriculture.

When a kit is first purchased, ensure that all implement measuring devices are measured and marked correctly. The scale should be calibrated, and adjusted if required, immediately after purchase since its factory calibration will probably not be valid in your geographical area. Each year check that the gauges have not been damaged through use or enlarged. Standards, if you own any, should not be used for routine checks. Any standard must be handled with care and protected so it is not damaged. Never force implements into the templates as this will wear the sides making them less accurate. Some templates will arrive from the manufacturer either undersized or oversized for their intended measurements. Take this into account and allow for it if there is a close measurement.

The following is a list of needed equipment for setting up a Weigh-In room:

**Recommended Personal Equipment:**

Steel Measuring Tapes: 3 meter tape for implement measuring. Center point tape for manual javelin profile measurement.

Marking Pens: It is preferable to use paint, particularly on the shot where markings are easily worn off. Mark all implements the same way with the same color, same location and same mark. If it is more than a one day meet, change the color and the mark each day. Make it distinctive. Paint sticks are easier to use and are available in your local hardware store, stationery store or hobby shop (Michaels, Joann's and www.markingpendepot.com). Spray paint can also be used but usually takes longer to dry and is not as easy to use. Fluorescent colors stand out more. Broad Line Deco Color Opaque Waterproof Markers or nail polish also works well. Sharpie pens work well in many cases, and are available in several colors; as a minimum, use a black and silver Sharpie, as the latter stands out well on dark implements. Sharpies are also available in retracting/self-sealing pens which can be easily deployed with one hand.

Colored electrical or duct tape may be used on the hammer wires and weight handles,

particularly in wet conditions, and can be more durable than paint. The brighter colors (red, yellow, orange, white, pink, lime green) are preferred over the darker colors, and should be varied from meet to meet.

Adhesive Tape or Painter's Tape: For labeling equipment and laying out javelin measuring tape; also for marking an implement with the reason for its disqualification.

Masking Tape or Duct Tape: For erecting signs and schedules.

Implement Check-In Sheets: A two-page, carbonless (NCR) form should be used for implement check-in. The top sheet is kept at the W&M station at all times, and can also be used to sign-out returned implements at the end of the event. The copy is sent into the field along with the certified implements, which lets the event judge know exactly how many implements were checked in and which implements did not pass; it can also be used to sign-out returned implements.

There are many formats of check-in sheets in use. Two examples are provided in Appendix B. Otherwise, custom sheets can be easily designed on a PC. Reproducing the check-in sheets on to NCR forms can be done at many office supply stores. Be generous when estimating the number of sheets that will be needed, particularly for Youth or Masters meets.

The use of labels on implements is strongly discouraged. Labels can change the "feel" of an implement in an athlete's hands, and the label adhesive is sometimes difficult to remove, even with solvents.

Small Carpenter's Square: Used to test the overall hammer length.

Paperwork: Have a current meet schedule so it is known which implements to inspect first and when to take them out to the field. The officials assignment list and meet syllabus are also useful.

Implement Inspection Signs: Paper or laminated signs to indicate location of Weigh-Ins.

Implement Specification Tables: Complete tables of specifications for all implements from this manual in plastic covers for ready reference. See Tables 1-7.

Age Group Tables: Age tables are particularly useful in Youth and Masters meets. These should be available at the check-in desk to ensure the athletes are submitting the correct implements, and also in the staging area when allocating meet implements to particular events. Tables are in the Appendix C.

Implement Check-in and Impound Forms: See examples in Appendix B.

Level: Used to level scale location.

Calculator: For use in calculating percentages for javelin measurements.

Caliper: Used to measure the hammer wire diameter and the various points on the javelin.

Consider an electronic one, and keep an extra battery in the box. If it has at least 3 ½ inch jaws, it can be used to measure the discus, weight and shot as well as the javelin profile. Manual (Vernier) calipers are less expensive than digital calipers, but learn to read the Vernier scale beforehand.

Handbook: Keep a copy of this handbook in a folder. Note: included in the back are the implement specification tables for all implements in case the individual sheets get misplaced.

Straight Edge: At least 50 centimeters long as a check of the javelin taper or to measure the taper when used with a 0.20 mm feeler gauge.

Javelin Measuring Gauge: You can make your own out of wood or even tape on the edge of the table. See Figures 22 and 23 in the Appendix for examples of ones that were made in three pieces so they could be easily transported. Both are color coded so that the javelin can be easily measured. The one in Figure 22 allows you to do multiple javelins at once for everything but the balance. The dimensions are:

| | |
|---|---|
| Overall Length: | 9 ft / 2.73 m |
| Overall Width: | 6" / 15 cm for all 5 |
| Each Piece: | 3 ft / 0.91 m |

It uses three 3' pieces of 1"x6" lumber with pieces of shelf hanger as sides so the javelins don't roll off. All marks were engraved into the wood before it was painted for accuracy. The three boards can be held together by hinges or pins to assure constant length.. Alternatively, the javelin board can be laid out on a paper or cloth template that can be rolled up and taped to a table or the floor. Finally, use a hinge or other sharp edge to place at the balance point. The original one shown in Fig. 23 in the Appendix was only set up for the only three javelins at that time. You also can mount rulers along the board to do the overall and midpoint measurement for the contour or simply use a string or wire to get their approximate location by measuring to the center of gravity from either end and then halving the measurement by folding the string back on itself.

Notebook: To do any needed calculations and to record calibration procedure.

Rulebooks: A current rulebook, for the type and level of meet that is being officiated, is required, even if it's just the implement section. The specifications vary slightly between some rulebooks. However, the rulebooks are slowly converging on the IAAF specifications. They can be purchased and/or downloaded from the following institutions:

(1) National Federation of State High School Associations
P.O. Box 360
Indianapolis, IN 46206
800-776-3462
www.nfhs.org (general site) and www.nfhs.com (on-line store)
Published in 3 volumes at $10.00 each for Rules, Officials and Case Book, plus shipping charges. The Rule book and Case book are annual and the Officials book is published every two years. Order via the on-line store, phone or mail.

(2) National Collegiate Athletic Association

P.O. Box 6222
Indianapolis, Indiana 46206-6222
317-917-6222
www.ncaa.org and www.ncaa.com

Cost is $7.80 plus shipping charges. Order at www.ncaapublications.com (go to the **Publications**, **Playing Rules** page). The rule book is published once every two years and is also available as a PDF download on the same web page.
Rules interpretations and case book are downloadable at www.ncaa.org.

(3) USA Track and Field
132 E. Washington Street, #800
Indianapolis, IN 46204
317-261-0500
www.usatf.org and http://www.usatf.org/groups/Officials

Cost is $15.00 ($13.50 for USATF members) annually plus shipping charges. You can order by phone or find the on-line ordering links at:
http://www.usatf.org/About/Competition-Rules.aspx . A PDF download is also available on this page.

(4) International Association of Athletics Federations (IAAF)
17, rue Princesse Florestine
BP 359
MC 98007 Monaco
377-93-10-8888
www.iaaf.org

Cost is $10 from IAAF and is published every two years. You can order from the web site; cost includes mailing. Also available for download at the same web site.

(5) World Masters Athletics (WMA)
http://www.world-masters-athletics.org.

The rules are available as downloads only at this web site. This includes separate PDF files for the rules of competition and the technical appendices.

(6) State activities association handbook: The name and content of this publication will vary by state, but it is the top-level high school sports and activities mandate for any state. This usually includes a statement as to what rules or rulebook is to be used, and any rules exceptions for that particular state. An example of the latter may the requirement to use rubber-tipped javelins. This should be downloadable from the state association's web site.

(7) High school league handbook: This handbook will frequently contain useful meet management information for running regular season high school meets, including the preferred order of events, and the procedures for the throws events (prelims/finals or 4 throws).

(8) Special Olympics
http://resources.specialolympics.org/athletics.aspx

(9) International Paralympic Committee
http://www.paralympic.org/athletics/rules-and-regulations/rules

(10) Wheelchair & Ambulatory Sports, USA
http://www.wasusa.org/athleticstrackfield.htm

(11) Deaflympics
http://www.deaflympics.com/sports.asp?at

Other Miscellaneous Equipment:

- Wet and Dry Towels for cleaning implements and hands
- Hand goop or cleaner
- Implement Cart, hand truck, wheelbarrow or wagon for transporting implements
- Containers or crates for segregating unmeasured, approved and impounded implements. A minimum of one per implement type per sex and preferably four for larger meets will be required, i.e., two for check-in and two for measured implements of each type or age group. Masters championship meets may need one per age group or flight. In addition, one and possibly two containers for impounded implements of all types will be required. Very robust dairy crates are available from http://www.containerstore.com. Also, steel ammo crates are available from military surplus stores.
- Soft drink plastic trays work well for storing javelins lying down.
- Camera for documenting the more unusual or bizarre disqualifications that are found.
- Application forms for records.
- Clip boards – at least two more than the number of events
- Curtain rings, or similar, for holding shots and hammer heads in place.
- Scissors
- Box knife for removing tape from hammer wires and handles

Tool bag for repairing implements (optional):

- coarse and fine files for deburring a discus rim or a shot
- adjustable pliers, needle-nose pliers, Vise-Grips and adjustable wrenches for removing/installing hammer wires, disassembling/reassembling indoor weights and bending/flattening discus center plates.
- adjustable spanner wrenches of several sizes to remove/replace the plugs on shots and hammers (also will need small hex keys for the set screw – see next item). Some snap ring pliers are robust enough to use for this purpose, such as those from Knipex.
- Several sizes of slotted screw drivers, Phillips drivers (thru #4) and hex wrenches (English & metric) to disassemble a discus and some indoor weights. Fold-up sets offer the best range of sizes for the cost. Two of each set is best, as some discus hubs freeze up over time and require the same size tool on both sides to break the fasteners free of the hub. The #4 Phillips is a common size for discus fasteners, but is not typically found in fold-up tool sets – a good alternative is a 3/8" drive #4 Phillips bit with a 3/8" drive stubby handle.
- chain grip for holding shot or hammer while removing plug (Vise Grip model 20R works well)
- dead-blow hammer or rubber mallet for tapping stubborn discus plates together
- small pick or awl set for cleaning out the fasteners on discuses, hammers and shots

prior to implement disassembly or plug removal.
- Polanik swivel wrenches for removing Polanik hammer and weight swivels
- penetrating oil or liquid wrench to help loosen stubborn bolts
- lead pellets and scoop for adding weight to shots
- Loctite or plumber compound for indoor weight swivel pins
- Superglue for javelin grip cord
- 3/8" and larger washers for adding weight to an indoor throwing weight
- Drywall sanding screens for taking rust off shots or discus rims, and smoothing rough surfaces on indoor shots.
- PVC tubes of various sizes and tube cutter for adjusting the length of indoor weights.
- spare set screws for securing hammer swivels (English & metric)
- lubricating oil for hammer swivel bearings

**Equipment provided by Meet Management and the Hosting Site:**

Tables: Three to four tables which are at least 6 feet in length. One would be used for the scale and measuring templates, one for the hammer and/or javelin measurements, one for implement repair, and one for implement check in. Ensure there is plenty of room, particularly if javelins will be handled. A solid table is preferable to a folding table. A couple of chairs are always useful.

Implement inspection kit, plus any required separate tools (e.g., hammer stretcher, throwing weight length gauge)

## 3.3 WEIGHING SCALES

An unmaintained scale arguably provides the largest source of error in W&M. To lessen the error, the following precautions should be observed:

1. When properly set up, the scale must be level. Some scales include an integral bubble level. For those that don't, a small torpedo level, or similar, should be used to set the scale level.
2. Most tables will bend as weight is placed on them. To ensure the scale does not get tilted by the table when an implement is being weighed, the scale should be placed either in the middle of the table, or directly over one of the legs.
3. Most electronic scales require 10-15 minutes time to warm up. Sensitive scales may require 20-30 minutes of warm up time.
4. Check your scale for sensitivity to off-center loads. Some scales use a large weighing pan with a separate load cell under each corner. If they are properly designed, it won't matter where on the pan you place the implement – the indicated weight will be the same. You can easily check this by placing a shot in several locations on the pan; if the result is the same at all locations, your scale is not sensitive to placement. However, if the measured weights vary by location, then you should carefully scribe an X in the center and always place the implement at that location.
5. Lower the implement on the scale; don't drop it.
6. A scale should be calibrated by an accredited organization once a year, or more often if experience indicates the scale will drift during that period. A scale should be calibrated

prior to any "big deal'' meet. A scale should be calibrated whenever it has been accidentally dropped, or an implement has been dropped on the scale.

7. Any newly-purchased scale, particularly a sensitive one, should be calibrated (and adjusted, if required) in the general geographic area of where it will be used. Do not rely on the factory adjustment – latitude, altitude and even the makeup of the earth in your location affect the apparent local gravity. For example, a newly-purchased scale, with claimed accuracy of 2 g, can easily indicate 10-20 g, or more, too high at full range. This is a result of its factory adjustment in a different part of the world. However, after adjustment in your locale, it should produce results close to its factory specifications.
8. A scale that is moved geographically a significant distance in the north-south direction will experience a measurement error due to the earth's spin. For example, a scale with a 5 gram resolution, that is moved from Seattle to Eugene, will produce an error of one division for a 35 lb weight. A scale with a 2 gram resolution, that is moved between the same two locations, will produce an error of one division for a 16 lb shot. In these cases, a recalibration may be recommended, depending on what implements will be weighed.
9. When using a double pan balance, place the weights on the left and implements on the right. Test this by moving the ounce slide to the 1 ounce position and see which way the balance moves, i.e. it takes one ounce of weight on the side containing the implements to rebalance the scale to zero. Note some scales have a plus and minus designation to indicate overweight and underweight respectively.
10. For more information about weighing scales, their calibration and their pitfalls, please see EFSS Newsletters 20-2, 21-1 and 21-2 at http://www.usatf.org/groups/officials/newsletters/.

The ideal tolerance of the weighing scale is one part in 10,000 (100 mg or 0.1 g per one kilogram) or better. This meets the National Institute of Standards and Technology Class Field Standards for weights (NIST Class F). See tables below for the full spectrum of weights of interest for field events implements. (Note: Throughout this manual, the terms "tolerance" and "accuracy" are used interchangeably although scientifically these terms have slightly different meanings. Also, most scales' actual accuracy is not equal to their minimum resolution.) However, a tolerance of one part in 10,000 is quite expensive, usually costing in excess of $1000 for such an electronic scale.

If a scale of NIST Class F tolerance is too expensive, a double-pan balance or electronic scale capable of measuring to at least one part in 5,000 is preferred. One in 5,000 means the scale's tolerance is 1/5000 of the range of the scale. For example, a 1:5,000 scale, which has a 20 kg weighing range, would have a claimed accuracy of 4 grams.

But the use of any scale is better than the use of none. For example, the older TRACKMASTER(TM) units have a tolerance of approximately one part in 2,000, which was the previous standard. The following tables may be of use as you look for a scale. There is no intent to endorse any of the scales shown, only to show the relative cost in 2011 for the various tolerances. Note the wider the range desired, the lower the relative tolerance. Pay attention to both the capacity and increment data: they are available in different combinations. The best combination is a large range with a small increment, which costs the most.

Columns 1 and 2 of the following table contain the manufacturer's name and model number for an assortment of commercially-available scales. The next column is the maximum capacity of

the scale. The fourth column indicates the smallest measurement increment that can be read. The comments column contains any special considerations listed by the manufacturer in the literature. The cost column provides typical prices as found on the internet in 2015. The last column shows the theoretical tolerance in terms of the range of the scale, that is, one part per thousands. Ideally, a scale listed as 1:10,000 will have one gram of error in 10 kg of total weight (see the Notes after the table). The last three rows provide the ideal, suggested and minimum tolerances for comparison.

**SCALE COMPARISON SUMMARY**

| Manufacturer | Model | Capacity | Resolution | Comments | Cost | "tolerance" |
|---|---|---|---|---|---|---|
| Sartorius | CPA34000 | 34 kg | 1 g | NTEP Class III, internal cal | 3200 | 1:34,000 |
| CBK | CBK35a | 16 kg | 0.5 g | | $300 | 1:32,000 |
| Ohaus | RD6RS | 6 kg | 0.2 g | NTEP Class III | $782 | 1:30,000 |
| Ohaus | RD30LS | 30 kg | 1 g | NTEP Class III | $1030 | 1:30,000 |
| Ohaus | EB6 | 6 kg | 0.2 g | | $400 | 1:30,000 |
| Ohaus | EB15 | 15 kg | 0.5 g | | $400 | 1:30,000 |
| Ohaus | EB30 | 30 kg | 1 g | | $400 | 1:30,000 |
| Ohaus | RD12LS | 12 kg | 0.5 g | NTEP Class III | $900 | 1:24,000 |
| AND | EK-12ki | 12 kg | 1 g | | $400 | 1:12,000 |
| Acculab | SVI-10A | 10 kg | 1 g | | $210 | 1:10,000 |
| Acculab | SVI-20B | 20 kg | 2 g | | $210 | 1:10,000 |
| new Trackmaster | | 20 kg | 2 g | | | 1:10,000 |
| Doran | 7025XL | 25 lb | 2 g | NTEP Class III | $1048 | 1:5,000 |
| Doran | 7050XL/12 | 50 lb | 5 g | NTEP Class III | $1062 | 1:4,500 |
| Pennsylvania | 7000 | 20 lb. | 2 g | | $495 | 1:4,500 |
| Pennsylvania | 7000 | 50 lb. | 5 g | | $495 | 1:4,500 |
| Yamato Accuweigh | PPC-200W-20 | 20 lb | 5 g | | $370 | 1:2,500 |
| old Trackmaster | | 16 lb | ~4 g | | | ~1:2,000 |
| Yamato Accuweigh | PPC-200 | 50 lb | 20 g | | $370 | 1:1,000 |
| bathroom | | 300 lb | 1 lb | | | 1/300 |
| | | | | | | |
| **IDEAL** | | | | | | ≥1:10,000 |
| **Suggested** | | | | | | 1:3,000 |
| **Minimum** | | | | | | 1:1,000 |

**Note 1**: The cost and tolerances of the scales roughly track each other. This is another case of "you get what you pay for."
**Note 2**: Some of the more expensive scales have optional battery packs available. Some of the less expensive scales have integral battery compartments.
**Note 3**: The numbers in the "resolution" column need to be interpreted carefully. "Increment" means the smallest granularity which the scale will display. This is **not** always the same as accuracy. An NTEP scale's accuracy should approach its minimum increment. A non-NTEP scale's actual accuracy may be two or three times its minimum increment. Therefore, the "tolerance" column is a guide only.

For inspectors wishing to check their own scales, the following table is provided with mass standards that span the range of the throwing implements. Ideally, the heaviest standard

should approximately equal the maximum capacity of the scale, and other standards, if used, should be selected evenly among the implements weights of interest. Mass standards are available from Rice Lake Weighing Systems, Henry Troemner LLC and Mettler-Toledo, among others.

**Class F Tolerances for Field Standard Weights**

NIST Handbook 105-1

| Standard (lb) | Standard (kg) | grams | NIST Class F Tolerance (g) | Implement weights in this range |
|---|---|---|---|---|
| 66.1 | **30** | 30,000 | 3.0 | 56 lb |
| **50** | 22.7 | 22,680 | 2.3 | 56 lb |
| 44.1 | **20** | 20,000 | 2.0 | 20 kg, 35 lb |
| **30** | 13.6 | 13,608 | 1.4 | 35 lb |
| **25** | 11.3 | 11,340 | 1.1 | 25 lb |
| 22.0 | **10** | 10,000 | 1.0 | 25 lb, 20 lb |
| **20** | 9.07 | 9,072 | 0.91 | 20 lb, 16 lb |
| 11.0 | **5** | 5,000 | 0.50 | 6 kg, 5 kg, 4 kg, 12 lb |
| **10** | 4.54 | 4,536 | 0.45 | 12 lb, 5 kg, 4 kg, 8 lb |
| 6.6 | **3** | 3,000 | 0.300 | 3 kg, 6 lb |
| **5** | 2.27 | 2,268 | 0.227 | 6 lb, 2 kg |
| 4.4 | **2** | 2,000 | 0.200 | 2 kg, 1.6 kg, 1.5 kg |
| **3** | 1.36 | 1,361 | 0.136 | 1.6 kg, 1.5 kg |
| 2.2 | **1** | 1,000 | 0.100 | 1 kg |
| **2** | 0.907 | 907 | 0.091 | 800 g, 700g, 600 g |
| **1** | 0.454 | 454 | 0.070 | 600 g, 500 g, 400 g |

The following table is intended as a starting point for selecting a scale. Select the maximum weight implement to be weighed and find the ideal and suggested tolerances. These can be compared against the Scale Comparison table to get an idea of what scales may be of interest.

**Scale Tolerances for Implements**

Based on full use of Class F Standards

| Implement Weight | | | Tolerance | | Implement Name |
|---|---|---|---|---|---|
| lb | kg | g | Ideal (1:10,000) (g) | Suggested (1:5,000) (g) | |
| 56 | 25.40 | 25401 | 2.54 | 5.08 | 56 lb Weight |
| | 20 | 20000 | 2.00 | 4.00 | 20 kg Weight |
| 35 | 15.88 | 15876 | 1.59 | 3.18 | 35 lb Weight |
| 25 | 11.34 | 11340 | 1.13 | 2.27 | 25 lb Weight |
| 20 | 9.07 | 9072 | 0.91 | 1.81 | 20 lb Weight |
| 16 | 7.26 | 7260 | 0.73 | 1.45 | 16 lb Shot/Hammer/Weight |
| | 6 | 6000 | 0.60 | 1.20 | 6 kg Shot/Hammer |
| 12 | 5.44 | 5443 | 0.54 | 1.08 | 12 lb Shot/Hammer/Weight |

One final consideration regarding the selection of a scale: One must consider how much

accuracy is enough. How much accuracy is not enough? How much is too accurate (i.e., too expensive)? Consider the following two cases:

Scale #1 has an actual accuracy of 10 grams (±10 g). This means, depending on its adjustment, it could show a true 4.000 kg mass standard to weigh anywhere between 3.990 kg and 4.010 kg (that is, anywhere between 10 grams low to 10 grams high). Since the ±10 g performance is within the manufacturer's stated tolerance, the scale will be deemed to be working properly. In the real world, this means the scale *could* indicate an illegal 3.990 kg shot to weigh 4 kg, if its adjustment happened to be high in its tolerance band. Or it *could* indicate a legal 4.009 kg shot to weigh 3.999 kg, if its adjustment happened to be low in its tolerance band.

Scale #2 has an actual accuracy of ±1 gram. This means it could show a true 4.000 kg mass standard to weigh between 3.999 kg and 4.001 kg. This means the scale *could* indicate an illegal 3.999 kg shot to weigh 4 kg, if its adjustment happened to be high in its tolerance band. Or it *could* indicate a legal 4.000 kg shot to weigh 3.999 kg, if its adjustment happened to be low in its tolerance band.

Clearly, Scale #2 will cause fewer illegal implements to be passed, and fewer legal implements to be disqualified. It is up to the individual, association, school or club to decide how tight the scale's tolerance should be, vs. how much they want to pay for the scale.

*Weights:* If a balance scale is being used, various combinations of weights will be required, depending on the competition. This can be accomplished with the following sets of weights: (a) 1, 2, 5, 10, 20 lb; (b) 1, two 2, 5 kg; and (c) 50, 100, 300, 400, 600, 800 g. This allows the weighing of all implements up to the 56 lb weight. The following list shows the types of meets and the expected implements:

| | **Men's Open** | **Women's Open** |
|---|---|---|
| Shot and Hammer: | 7.26 kg | 4 kg |
| Javelin: | 800 g | 600 g |
| Discus: | 2 kg | 1 kg |
| Weight | 56 lb, 35 lb | 20 lb |

| | **Junior Men** | **Junior Women** |
|---|---|---|
| Shot and Hammer: | 6 kg | 4 kg |
| Javelin: | 800 g | 600 g |
| Discus: | 1.75 kg | 1 kg |

| | **Collegiate Men** | **Collegiate Women** |
|---|---|---|
| Shot and Hammer: | 7.26 kg | 4 kg |
| Javelin: | 800 kg | 600 g |
| Discus: | 2 kg | 1 kg |
| Weight: | 35 lb | 20 lb |

| | Men's Masters | Women's Masters |
|---|---|---|
| Shot & Hammer: | 3 kg, 4 kg, 5 kg, 6 kg, 7.26 kg | 2 kg, 3 kg, 4 kg |
| Javelin: | 400 g, 500 g, 600 g, 700 g, 800 g | 400 g, 500 g, 600 g |
| Discus: | 1 kg, 1.5 kg, 2 kg | 0.75 kg, 1 kg |
| Weight: | 12 lb, 16 lb, 20 lb, 25 lb, 35 lb | 4 kg, 12 lb, 16 lb, 20 lb |
| Superweight: | 25 lb, 35 lb, 20 kg, 56 lb | 16 lb, 20 lb, 25 lb, 35 lb |

| | High School Boys | High School Girls |
|---|---|---|
| Shot & Hammer: | 12 lb | 4 kg |
| Javelin: | 800 g | 600 g |
| Discus: | 1.6 kg | 1 kg |

| | Jr. High School Boys | Jr. High School Girls |
|---|---|---|
| Shot: | 8 lb, 4 kg | 6 lb |

| | Youth Boys | Youth Girls |
|---|---|---|
| Shot: | 2 kg, 6 lb, 4 kg, 12 lb | 2 kg, 6 lb, 4 kg |
| Javelin: | 300 g, 450 g, 600 g, 800 g | 300 g, 450 g, 600 g |
| Discus: | 1 kg, 1.6 kg | 1 kg |
| Hammer | 12 lb | 4 kg |
| Weight | 25 lb | 20 lb |

| | IAAF Boys | IAAF Girls |
|---|---|---|
| Shot and Hammer: | 5 kg | 3 kg |
| Javelin: | 700 g | 500 g |
| Discus: | 1.5 kg | 1 kg |

**Athletics for the Disabled:**

| Visual impairment | IPC Class 11-13 | Men | Women |
|---|---|---|---|
| | Shot | 4 kg, 5 kg, 6 kg, 7.26 kg | 3 kg, 4 kg |
| | Javelin | 700 g, 800 g | 500 g, 600 g |
| | Discus | 1 kg, 1.5 kg, 1.75 kg, 2 kg | 1 kg |

| Intellectual impairment | IPC Class 20 | Men | Women |
|---|---|---|---|
| | Shot | 4 kg, 5 kg, 6 kg, 7.26 kg | 3 kg, 4 kg |
| | Javelin | 700 g, 800 g | 500 g, 600 g |
| | Discus | 1 kg, 1.5 kg, 1.75 kg, 2 kg | 1 kg |

| Muscle impairment | IPC Class 31-38 | Men | Women |
|---|---|---|---|
| | Shot | 1 kg, 2 kg, 3 kg, 4 kg, 5 kg | 1 kg, 2 kg, 3 kg |
| | Javelin | 500 g, 600 g, 700 g, 800 g | 500 g, 600 g |
| | Discus | 750 g, 1 kg, 1.5 kg | 750 g, 1 kg |
| | Club | 397 g | 397 g |

| Short stature | IPC Class 40-41 | Men | Women |
|---|---|---|---|
| | Shot | 4 kg | 3 kg |
| | Javelin | 600 g | 400 g |

| | | | |
|---|---|---|---|
| | Discus | 1 kg | 750 g |
| Limb impairment | **IPC Class 42-46** | **Men** | **Women** |
| | Shot | 4 kg, 5 kg, 6 kg | 3 kg, 4 kg |
| | Javelin | 500g, 600 g, 700 g, 800 g | 400 g, 500 g, 600 g |
| | Discus | 750 g, 1 kg, 1.5 kg | 750 g, 1 kg |
| Wheelchair | **IPC Class 51-58** | **Men** | **Women** |
| | Shot | 2 kg, 3 kg, 4 kg, 5 kg | 2 kg, 3 kg, 4 kg |
| | Javelin | 400 g, 500 g, 600 g | 400 g, 500 g, 600 g |
| | Discus | 750 g, 1 kg | 750 g, 1 kg |
| | Club | 397 g | 397 g |
| | **Special Olympics** | **Men** | **Women** |
| | Shot | 3 kg, 4 kg | 2 kg, 3 kg |
| | Mini-Javelin | 300 g, 400 g | 300 g |

Weights should be handled with care so as not to damage them so they either gain weight, less likely or lose weight by being dropped.

Note: There are 16 oz per lb, 453.5924 g per lb, 28.349527 g per oz, and 2.20462 lb per kg. Only the 6, 8 and 12 lb shots, because they are youth, junior high and high school implements, respectively, are still weighed in pounds. The other weights have been accepted internationally and have taken on the metric weight equivalent shown.

# 4 DAY OF THE MEET

1. Arrive early at the site to make sure equipment being supplied by meet management is present and in good working order. Normally this should be at least two hours before the first throwing event. If possible, do it before the day of the meet. Larger meets will accept implements the day before competition starts.

2. Inform the appropriate Event Heads and the Field Referee the type, color and location of the mark to be used on the implements that particular day. If the possibility of breaking a national or world record exists, let the judge and the referee know your location. Try to have a location near the venue where an implement could be rechecked during the competition in such a case.

3. While returning to the Implement Inspection room, you should make sure that there are adequate signs to direct athletes to your location from where they will normally enter the track. Post the times for weigh-ins. Make sure you have a copy of the event schedule and post it nearby to avoid having to answer questions regarding starting times.

4. Set up the Weigh-In room. Set aside an area for receiving and marking implements with the athlete's name or school. This should be near the door to keep athletes away from the

measurement area. In addition, set aside separate areas for storing competition-ready implements, impounded implements and unchecked implements. It is important that each of these areas is segregated to avoid problems. See drawing in the Appendix A.

5. Set up your measuring equipment. Pay particular attention to having your scale level. Place the scale on the table carefully, so that flexing of the table under load won't tilt the scale. Put the scale in an area with plenty of space to avoid moving it to weigh all the different size implements. The scale should not be in direct sunlight, as heating it may alter its adjustment. The scale should be turned on about 15 minutes before any calibration check to allow for adequate warm-up time. Cross check your scale versus a second scale or standard. Two calibration weights may be needed, one at the low end and one at the high end, i.e., 400 g or 600 g and 8 kg respectively. Lay out your javelin measuring tape. Try to have separate areas for each implement and its measurement. If there is more than one person working, make sure there is enough room to move around, particularly with the javelin. It becomes more difficult if the ceiling is not at least 9 feet to allow the javelin to be turned vertically.

6. Set up an implement check-in sheet. Have room to record the name of the individual, school and manufacturer for all implements measured and/or impounded. The Equipment and Facilities Specification Sub-committee (E&FSS) would like information on impounded new implements in order to work with the manufacturers on improving equipment and gathering statistics on common explanations for implement impoundment. This information will help us suggest to the manufacturers improved specifications for the various implements as well as suggesting changes in the order of doing the measurements.. Send the information to the chair, Bob Springer, 10063 Arrowsmith Ave. S., Seattle, WA 98178 or via e-mail at bobspringer2@comcast.net.

7. Prepare to make the first measurement at least an hour to an hour and a half before the first throwing event. If the inspector is to bring the implements to the competition venue, then take them out 10 minutes prior to the start of the warm-up period for the scheduled event. Typically this is so they arrive about 30 to 35 minutes before the event starts. Make sure to turn them over to an event official and not just leave them on the field. It is helpful to brief the event official regarding any implement disqualifications from that flight so the affected athletes do not think their implements have been lost.

# 5 CHECKING OF EQUIPMENT

The following sections are ordered in such a manner so the most common implement defects are listed first in order to minimize time spent on equipment that eventually will not pass. The order was generated from a consensus of the most experienced implement inspectors in the country. The order may be varied at the implement inspector's discretion, but be consistent and don't leave out a measurement.

## 5.1 RECOMMENDED ACCURACY IN MEASUREMENTS

1. As discussed in the scales section on equipment, NIST recommends an accuracy of 0.01% or 1 part in 10,000. This is equivalent to 0.1 g per kg for weight or 10 mm (1 cm) per 100 meters for length measurements. However, because of cost and the continued use of older

scales, the E&FSS committee recommends a weight tolerance minimum of 0.02%.

2. Based on the accuracy for measuring record lengths by steel tape and the impact of temperature, plus the recommended procedures for certifying electronic measurements, the accuracy varies from 0.04% to 0.17% for sector lines in the long throws. The E&FSS Committee recommends a minimum standard of 0.1% or 0.1 mm for every 100 mm in diameter for a shot. This means gauges used for implement measurement should be accurate to 1 part in 1000. If properly manufactured, the gauges would be accurate to ± 0.005 inch ( 0.127 mm) or 7 parts in 10000 versus our recommendation of 10 parts in 10000. However, the proper care and handling is mandatory in order to maintain its accuracy. Remember any standard has some error in it. Note a temperature change of 36 °F (20 °C) with some linear measuring devices can alter the reading by as much as 0.24 mm per m. This may be additive to the tolerance limit. Thus if you have an implement just missing the spec and there is a large temperature difference between the measuring device and the implement or the measuring device and the temperature at which the device was calibrated, pass the implement. This illustrates why it is good practice not to have the implement or the measuring equipment in the sun.

**Basis for Accuracy Measurements**

| Type of Measurement | Expected Accuracy | Measurement | % | Parts/ 1000 |
|---|---|---|---|---|
| Pole Vault Electronic | ± 2 mm | 5 m | 0.04 | 0.4 |
| High Jump Electronic | ± 2 mm | 2 m | 0.01 | 1 |
| Discus/Hammer Sector | ±164 mm | 100 m | 0.164 | 1.64 |
| Javelin Sector | ± 169 mm | 100 m | 0.169 | 1.69 |
| Temperature Correction at 10 °C difference | ± 12 mm | 100 m | 0.012 | 12 |
| Weight , NIST Class F | ± 0.07 g | 700 g | 0.01 | 0.1 |

## 5.2 GENERAL PROCEDURE FOR ALL IMPLEMENTS

1. Have an implement check-in sheet for each athlete to signs and indicate the number and type of implement(s) he or she is leaving. Have pens available so the athletes can put their name and their school name, if appropriate, on the implement.

Write a unique identifier for the implement on the check-in sheet and the implement. For example, M65-15 could be used, where M65 stands for the gender and age group of a Masters athlete, and the 15 indicates that his implement is the 15$^{th}$ on the check-in sheet.

2. Have a separate box or container for the implements to be inspected to avoid mixing with previously certified implements.

3. Check implements for internal movement (including the javelin) or loose connections when they are picked up. However, internal movement is not a consequence for a shot.

4. Check the general appearance. Is this a homemade implement or a modified implement? Are all the original pieces there? Does it have the expected shape? There should be no significant nicks, gouges, and logos, decals or movable implement weights or parts that would

give an advantage for a better grip or better aerodynamics.

5. Does the implement have previous weigh-in markings?

6. Does the implement have a name or school identification, in case you have to impound it, so it can be identified for picked up later?

7. Is the implement clean or dirty or with excess tape or other removable debris which might affect its weight or center of gravity? Note a single piece of tape or label will not make enough difference in weight or balance such that it needs to be removed. Your equipment is not accurate enough to detect that small an increment.

8. Weighing is first because it is the most common reason for implement failure. Constant use and damage tend to reduce the weight of an otherwise legal implement. When checking the weight of the implement, do it carefully. There are three common types of scales used. Any scale which can or has been certified by your local or state authority or an accredited calibration lab is acceptable. The three types of scales are electronic, balance and lever or beam. Be aware that there have been two different types of the beam scales used in the Trackmaster™ kits over the years. The older versions of the TRACKMASTER(TM) made by Red Meade or Jack Balko used a beam scale. Red Meade manufactured units with serial numbers below 180. Make sure to know the steps in calibrating the scale. Normally put the calibration weights on and then set the balance point. To pass, an implement must be at or above the balance point. The new version by Daktronics uses an electronic scale. Because even these scales can't be exact, err on being fair to the athlete. If an implement fails on one scale but passes on another, let it go unless there is a significant difference in calibration or tolerance between the two scales. If it is that close to weight, it really will not have any impact on the competition or a record. (See previous section on scales for discussion of accuracy and tolerance.)

NOTE: When using any scale, treat it carefully. When removing implements or weights from the scale, do it gently to avoid damaging the knife edges or bearings. This is particularly true for a single pan balance such as that used in the TRACKMASTER(TM). Hold the bar when removing weights or implements so the bar doesn't damage the knife edges or bearings. With care, the scale will last a long time. Without care, damage can occur very quickly. Remember, with normal use, scales and weights need to be calibrated at least annually. When moving the scales, immobilize the scale to protect the knife edges or bearings. Use foam rubber under the arm and/or on top of it for protection. Calibrate the scale before use each day or each time you move it. For the double pan variety, try weighing two identical weights switching them to make sure the weights are balanced and level enough. Keep the scale out of the wind and sun because both can impact even an electronic scale.

Before putting any weight on the scale, test the movement of the pan(s) to make sure it moves easily and isn't bound by anything. When putting an implement on the pan make sure it is well balanced. For hammers, shots and weights, use a washer on each pan (so balanced) to prevent the implement from rolling. Make sure the scale balances before weighting the implements since the two holding devices may vary in weight. On an electronic scale with one pan you can tare the weight out. For the hammer put the ball in the handle loop. Be careful with new wires that may spring out. Make sure the wire isn't in contact with any other surface

while weighing the hammer. For the javelin, the center of gravity is near the front of the handle so place the javelin with the front of the handle near the center of the pan. In general place the weights and the implements as near to the center of the pan as possible (see also discussion of tolerance/accuracy under the equipment section on scales).

The original TRACKMASTER beam scales were designed specifically for implement inspection. They have a defined set of counterweights that are varied with each weight of implement. A listing of these counterweights and their usage is given in Table 8.

9. Continue on with the other implement specific tests.

10. If the implement passes all the tests, then mark it. Label it in a place where the marking is less likely to come off - like at the weight mark, the hex screw, near the swivel or just in front of the grip. Some inspectors mark javelins on the tip, but I find it can come off more easily there. Do not put the mark behind the grip where the javelin thrower may grip the javelin. Some use symbols, some use lines, some use initials and even dates. Make sure the mark is dry and then place it with the other approved implements for the day. This is the recommended procedure. Short on help? Then return it to the athlete to transport to the competition site.

11. If you are impounding an implement, let the athlete know the reason and the time to pick up the implement after the event. Record the reasons for impounding any implement in your notebook, on the check-in sheet and place a piece of tape or label on the implement. This will save time if there is a protest or the coach or referee becomes involved. This way the implement in question can be located quickly and the reason for disqualification easily given.

12. If possible, take the implements out to the competition area either 35 minutes before the scheduled start or ten minutes before warm-ups or have an event official pick them up. If possible, always turn over the marked implements to an event official insuring the chain of custody and making sure no implements are lost.

The following sections detail how to certify each of the implements. Because there are subtle differences between the wordings in each rulebook, it is always a good idea to review the rulebook the night before the meet. This is particularly true for a meet with a different set of rules than have been used recently. Use the rulebook as the ultimate authority, unless there has been in intervening change. The E&FSS committee keeps implement inspectors apprised of changes throughout the year. Send an e-mail to bobspringer2@comcast.net so notification can be done in a timely fashion. These sections try to point out the similarities and the differences between the various rulebooks.

When demonstrating to athletes or coaches how much their implement is light, use the following table for coins as an indication. Thanks to Shirley Crowe and Emmitt Griggs:

| Coin | weight (kg) | weight (g) |
|---|---|---|
| Dime | 0.0020 | 2 |
| Penny | 0.0025 | 2.5 |
| Nickel | 0.0050 | 5 |
| Quarter | 0.0055 | 5.5 |

## 5.3 SHOT

Shot specifications are found in Table 1. Shot inspection can be grouped into the following areas:

- Surface smoothness
- Shape
- Weight
- Diameter
- Other considerations

**A. Surface Smoothness.** The following are excerpts from the rule books:

- IAAF: "surface finish shall be smooth"
- USATF: "finish shall be smooth"
- NCAA: "surface must be smooth without indentations so that an advantage is not gained by grip"
- NFHS: "The shot shall not have indentations other than a weight marking which must be manufactured in such a manner that no advantage is gained by grip"

IAAF and USATF further define smoothness as a roughness number of N7 or less, which is close to a polished surface. NCAA and NFHS use the "advantage is not gained by grip" criteria. This means that any indentation, roughness, groove, ridge, flat spot or out-of-roundness that can aid in gripping the shot (that is, the size of a dime, or larger), is not legal. Conversely, surface blemishes, which cannot be gripped for additional advantage can be passed for most meets.

Run your fingers over the shot. Any features, mentioned above, which provide an additional grip beyond that of a smooth surface, are not legal, and those shots should be disqualified.

Spun shots, including those made of stainless steel and brass, usually have their weights stamped on them. Although the stamping creates an indentation, it is considered acceptable, and should not be disqualified. The two shots shown below are examples of this.


Cast iron shots are another matter, where the weight, and sometimes the name of the manufacturer, are integral to the mold. Some judgment is required here. If the molded feature is small and shallow, no bigger than one finger tip, then accept it. If the molded feature is bigger than a dime, then disqualify it. There are no objective criteria in this matter; the important thing is to be consistent in evaluating these moldings.


The three shots shown above are disqualifiable based on excessively large identification moldings. Additionally, the shot at right has a rough surface.

Most *indoor shots* are made of a tough plastic shell. When used on an appropriate surface, these shots will provide reasonable longevity. However, some schools or athletes do not have adequate indoor facilities and must go outdoors to practice. Shots that are thrown on asphalt or similar surfaces will get roughed up very quickly, and are no longer legal for competition, unless the entire surface is filed or sanded back to smoothness.

## B. Shape

NFHS rules require the shot to be a sphere. The other rule books specify "spherical in shape." In either case, a shot that is oblong or has flat spots is not legal. None of the rule books provide guidance on how spherical a shot must be. This is left to the inspector. In short, if a shape feature on the shot can provide an unfair advantage, impound the shot. This includes flat spots that can be used as finger grips, and fill plugs that are not flush with the surface.

Most outdoor shot fill plugs are difficult to remove, unless they've been recently loosened. A mark across the plug to indicate its location when it was checked is usually adequate. However, loose fill plugs on metal shots must be tightened or disqualified.

Continuing with the indoor shot, the rule books diverge somewhat:

1. IAAF allows shots of soft plastic or rubber casings.
2. USATF also allows shots made of soft plastic or rubber casings, but does not allow that "indentations in the surface be created to improve a grip."
3. NCAA simply requires the shot be "unalterable in shape."
4. NFHS has no indoor specification

The USATF and NCAA rules are interpreted to mean that "soft" shots, that can be readily deformed, are **not** legal. This includes the shots pictured below:

**C. Weight**. There are no differences between indoor and outdoor shots as regards weight. The basic weights are 2 kg, 6 lb, 3 kg, 4 kg, 5 kg, 12 lb, 6 kg and 7.260 kg. These cover the full slate of Youth, HS, Juniors, Collegiate, Open and Masters competition.

Of note is a Special Olympics rule change for 2012, where the 4 lb shot was replaced by the 2 kg shot.

The above numbers are the minimum weights which must be met for implement certification. There is no maximum weight for any category of shot, ***provided that*** none of the other rules are violated. Therefore, it is acceptable, in principle, for a HS boy to bring a 16 lb shot into the competition area for warmups (more on this later, however).

Ensure the shot is clean of any foreign substances and weigh it. For scales with flat weighing surfaces, use a large washer, curtain ring or similar doughnut-shaped object to keep the shot from rolling around. Tare the scale before placing the shot on it.

In areas where junior high or middle school boys throw the 8 lb shot, be alert for 8 lb shots masquerading as high school girls 4 kg shots – this is a common problem. Additionally, 8 lb shots are occasionally found in college and Masters competition, as well. In the hands of a competent thrower, an 8 lb shot will yield a distance of 1 to 2 feet farther than with a 4 kg shot, thus underscoring the need to be vigilant for these intruders.

Also be aware that the Masters W75+ and Youth 8 & Under shot is 2 kg, not 4 lb.

**D. Diameter.** Shot diameters are mostly a function of their weight, although the athlete's gender and the Masters category add some additional rules. See Table 1 for diameter specifications.

All outdoor shots, except for the 6 lb shot, have maximum and minimum diameters specified by the various rule books. In general, the diameters change in relation to the weight of the shot. However, USATF Masters and WMA have created an exception wherein the shots all have a maximum diameter of 130 mm for men and 110 mm for women. The latter point means that 3 kg and 4 kg shots have differing maximum diameters for Masters men and women.

Indoor shots are allowed a larger diameter due to the plastic shell construction. Open, Masters and NCAA men's shots are allowed an additional 15 mm diameter, whereas women's shots are allowed an additional 20 mm. The following notes also apply:

a. In the Youth division, the 12 lb boys shot also is allowed a 15 mm larger diameter,

but the 4 kg shot, regardless whether it's used by boys or girls, is allowed a 20 mm larger diameter.

b. Effective in 2016, High School rules specify diameters for indoor shots.

c. Since Masters men are allowed 130 mm max diameter outdoor shots of all weights (3 kg thru 7.260 kg), it follows that they are allowed 145 mm max diameter indoor shots of all those same weights. And Masters women are allowed 130 mm max diameters of their indoor shots (4 kg, 3 kg, 2 kg).

d. The 6 lb shot does not have any specified diameters, either for indoor or outdoor use.

Shot diameter is commonly checked with ring gauges. Place the minimum diameter gauge on top of the maximum diameter gauge; then lower the two gauges on the shot. The first gauge should drop past the shot; the second gauge should hang up on the shot. If either measurement is marginal, measure it on three more planes. If the shot passes on 3 of the 4 planes, pass it; otherwise disqualify it. This measurement is easy to perform when the shot is on the scale.

*NOTE: Some new stainless steel shots have not been making the minimum diameter.*

## E. Other considerations

(1) **The "overweight" shot.** What does an Inspector do if an athlete brings a shot that is heavier than is specified for his/her age group? A common example is a high school boy wanting to use a 16 lb shot for warm-ups. And some women prefer to warm up with 5 kg shots. Since there is no maximum weight limit for a shot, this is not a disqualifying consideration. However, the other criteria (diameter, smoothness, shape) still apply.

Frequently, a heavier shot will exceed the maximum diameter spec of the regulation shot and must be impounded on that count. For example, the outdoor 12 lb shot's max allowable diameter is 117.5 mm. But most cast 16 lb shots are larger than 117.5 mm in diameter, which would disqualify them from ever being sent into the field.

Only the smaller (and expensive) spun stainless and brass shots can be had in the 110-115 mm range. These are rarely found in HS inventories, but if one is encountered, and it passes all the rules, it must be allowed into the field. In such a case, the Inspector would do well to specially mark this shot, and also brief the event judge about its existence.

While the above examples use outdoor shot dimensions, the same situation can arise with indoor implements.

(2) **Cracks in the casing.** Although today's indoor plastic shots are quite robust, they can develop cracks in the casing, usually starting at the fill hole. These cracks are generally not repairable and will grow with time. The rate at which they grow is not predictable. Therefore, as a general rule, most cracks in the plastic shell are disqualifiable conditions.

Additionally, watch for protruding fill plugs. Although a protruding fill plug can be pushed back into place, it should be viewed with suspicion because it has already worked its way partly out at least once.


The shots pictured at left & center are cracked, leaking lead pellets and underweight. The shot pictured at right has started to crack, possibly loosening its grip on the fill plug. All should be retired permanently.

(3) **Internal movement.** Internal movement within a shot, whether detected by sound or feel, is legal and *can not* be used as a reason to disqualify a shot. This is particularly true for indoor shots which contain lead pellets.

(4) **Mass eccentricity.** The shot has no specification for center of gravity. Therefore, a non-uniform filling, which may cause the shot to roll irregularly on a table, is legal.

If the shot meets all of the requirements, mark it and put it with the other approved implements for that event. Sharpies and paint pens are common marking tools. Paint pen markings are usually more durable, while Sharpie markings dry faster.

## 5.4 DISCUS

Discus specifications are found in Table 2. Discus inspection can be grouped into the following areas:

- Construction
- Fit and finish
- Weight
- Dimensions
- Other considerations

### A. Construction

Under IAAF, USATF and NCAA rules, the discus must have a metal rim. Only high school rules allow rims made of metal, plastic or rubber.

In general, the body of the discus may be made of wood, metal or synthetic material. Only high school rules allow an all-rubber discus.

Metal center plates may be set flush into the sides of the discus. But whether or not the plates

are used, the equivalent symmetrical cross section, per the specifications, must be met.

**B. Fit and finish**

All components, rim, body and center plates, if used, must be set flush together.

Note that the flat surfaces, on both sides of the discus, must meet only the dimension requirement and do not necessarily have to made of metal. Indeed, some discuses have metal plates smaller than the whole flat surface (early Denfi discuses ~ 1995). Both are OK.

Since a discus is handled and thrown from the rim, the rim condition is important. It must be smooth; grooved rims are not allowed. The rule book requirements for rim condition are:

- IAAF: "shall have no roughness and the finish shall be smooth and uniform throughout" [it also references the N7 smoothness spec of the shot]
- USATF: "shall have no roughness and the finish shall be smooth and uniform throughout"
- NCAA: [references the IAAF specifications]
- NFHS: "shall not be sandblasted and shall remain smooth"

Run your fingers around the full circumference of the rim, checking for any dents, gouges, cracks or roughness that would provide additional grip. The rims of rubber discuses, in particular, wear quickly, resulting in a fine roughness that is no longer legal for competition.

Check for flushness of all the pieces, and that all components are held together tightly:

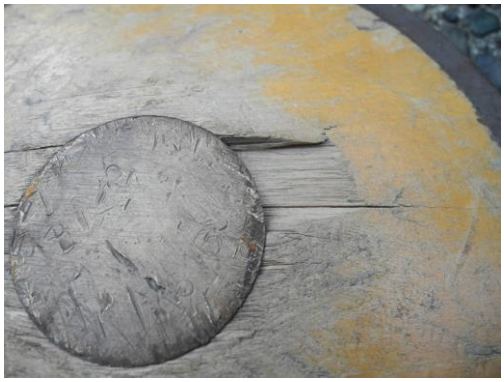
- If any parts are loose, the center fasteners should be tightened or the discus disqualified.
- Check the fit of the body to the rim. On occasion, the rim is machined too deeply and there is a "step" between the body and the rim; this is not legal.
- Check the metal plates, if installed. Occasionally they mushroom outwards due to over-tightening of the fasteners, or an accumulation of dirt under the plates. This violates the flushness requirement, and frequently causes the discus to exceed the maximum body thickness specification. Such plates must be removed and flattened, or the discus disqualified.

In the above images, the center plate is slightly mushroomed (bent) and not flush. This should be cleaned up, the plate flattened and the parts retightened.

Ensure the profiles of both sides are the same. Hold the discus vertically in front of you and verify that both sides have the same profile or form. Small dents are acceptable as long as they aren't along the outer edge of the body, too big or cause the edge not to fit in the rim. Any holes or significant cracks in the body are disqualifiable. A broken or cracked metal rim is reason enough to impound a discus. Safety should be a major concern. A discus is held at the edge of the rim so indentions closer to the center should not give a thrower an advantage. Therefore, small dents and cracks on the side of the discus can be allowed because these flaws don't aid in holding the discus, unless its structural integrity is compromised.

The major cracks in the above discuses will disqualify them.

The above gouges and dents can be gripped, and therefore, are not legal. But any rim condition that improves grip is not permitted.



The above discus is missing a significant chip from its body and is not legal

The body of the left discus does not fit in the rim – the rim may be bent. The cracked rim at right is not legal because it offers an additional grip and may not be safe

Some athletes have immersed wooden discuses in water in order to make weight. On a hot, sunny day a wet implement dries quickly and is underweight during the competition. Impound any wet discus. Also beware of non-wooden discuses that have water sloshing around inside.

Place a straight edge on each side. The discus contour should be in contact along the entire length of the straight edge for a legal implement. That is, the taper should not be concave or convex in nature. A bent rim is usually the cause of the last problem.

The rule books do not discuss the issue of rattle or movement inside the discus. If, in the opinion of the inspector, the rattle is due to a structural issue within the discus, it should be investigated or disqualified.

*NOTE: 1) In 1993 USATF and IAAF rule changes limited the degree of roughness allowable on the edge of the discus. Manufactured grooves in the metal rim or elsewhere are not allowed. The NCAA and NFHS also require a smooth rim.*

*2) The PACER Gold Plus was declared illegal for USATF and IAAF competition because it was weighted more on side than the other. Although the NCAA did not declare it illegal, their rules read the same as the USATF and IAAF on discus conformity which in my opinion makes it illegal. The high school rule is less clear and therefore is probably legal since there is no mention that both sides be symmetrical. This discus was weighted on one side more than the other as part of the manufacturing process.*

## C. Weight

Weigh the discus. The basic weights are 2 kg, 1.75 kg, 1.6 kg, 1.5 kg, 1.0 kg and 750 gram.

## D. Dimensions

Gauge the overall diameter, overall thickness and rim thickness of the discus. See Table 2 for specifications. These dimensions are usually checked using metal template gauges, which are available from Gill, UCS and other sources. When checking these dimensions, it is important to always hold the gauge perpendicular to the discus. Otherwise, an erroneous measurement can result, and accelerated wear of the gauge will result.

(1) Check the diameter for both the minimum and maximum limits. Check the diameter at two

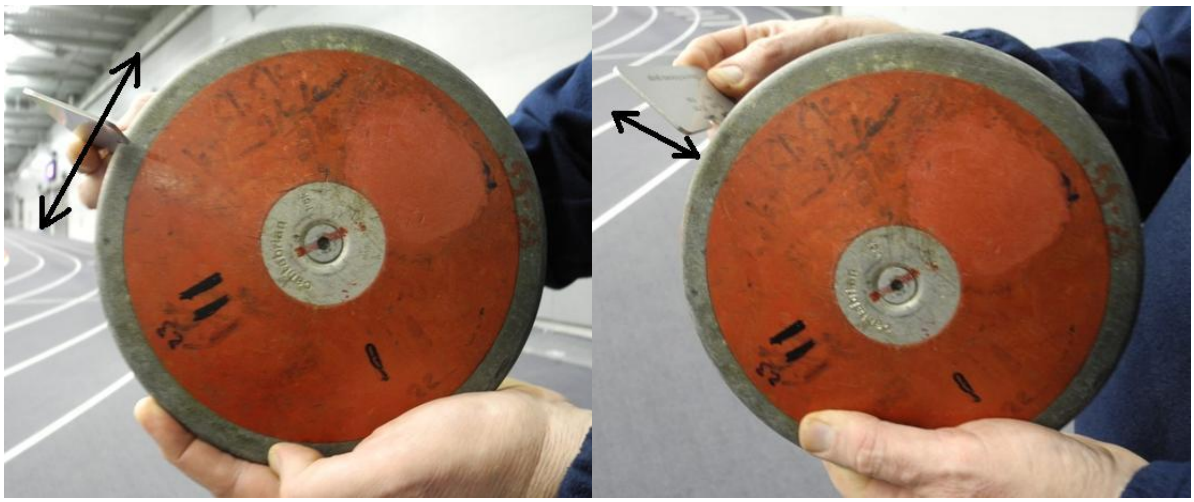
or three different orientations; this will detect a bent rim that is oval in shape.

(2) Gauge the overall thickness, watching for bent or mushroomed center plates. If the plates are flat, but the discus falls outside the thickness spec, the fasteners can be tightened or loosened to bring it back into spec. A thread compound may be needed on the fasteners to ensure they do not come free. Once again, always hold the gauge perpendicular to the discus.

(3) Check the rim thickness in three locations, equally spaced around the rim. The rim thickness is measured at a point 6 mm from the edge; a notched gauge should be used for this and must be held perpendicular to the sides.

Place one point of the rim perpendicularly into the ***minimum thickness*** notch. Most of the time, the rim will ***not*** touch the bottom of the notch. If the rim touches the bottom of the notch, try rattling it back and forth. If there is no movement, the rim is still legal (being at exactly the minimum thickness). If there is movement, the rim thickness is less than spec.

Place the same point of the rim perpendicularly into the ***maximum thickness*** notch. Most of the time, the rim ***will*** touch the bottom of the notch, which is required. If the rim does not touch the bottom of the notch, the rim thickness is greater than spec.



INCORRECT
Rotating a rim in the notch, or dragging the notch over the rim will quickly wear out the shoulders of the notch

CORRECT
Place the notch in to the rim

Early Denfi discuses had thick rims, and some imported discuses recently have had the same problem. Heavily worn discuses can have rims that are under the minimum spec. Some training discuses have been found with rims that are over or under the spec. The allowable rim thickness range is 12 mm to 13 mm for the 1, 1.5, 1.6, 1.75 and 2 kg discuses. It is 10 mm to 13 mm for the 750 g discus.

If three of four measurements are legal, pass this check.

(4) Gauge construction: The original Trackmaster discus gauges are large and robust. However, the setscrew gaps must be checked periodically to ensure the gauge is producing correct results.

If Trackmaster gauges are not available, then machined gauges from ¼" plate steel, particularly for the rim thickness gauge, are the next preference. These would need to be custom made, and will be heavy. However, they will last for a long time.

The most common gauges are laser-cut from stainless sheet steel, such as those available from Gill and UCS. If custom made gauges of this style are desired, it is recommended that 14 gauge (0.078 inch) stainless steel be used for durability. Since this style of gauge will wear the fastest, it should be checked yearly for proper dimensions with a quality caliper. Also, some discus dimensional specs have changed over the years; therefore, unfamiliar gauges should be checked to ensure they comply with today's rules.

### E. Other considerations

(1) Underweight discus: This is an uncommon condition but easily correctable. Disassemble the discus and wrap some copper wire around the inner spool.

(2) The 750 g discus: There are two types of 750 g discuses that are commercially available. The first has unique dimensions, including a 169 mm maximum diameter, which was originally specified in the 2008 WMA and USATF rule books. However, in 2014 WMA increased the allowable maximum diameter to 182 mm, which is the same as for the 1 kg discus, and USATF has followed that lead. Inspectors must be aware that the 750 g discus now has an allowable diameter range from 166 mm to 182 mm.

(3) Disassembly & reassembly of a discus for field repair: There is no standardization regarding the fasteners used to hold a discus together. A tool kit will require metric and English hex wrenches, #4 Phillips and a broad, slotted screwdriver (2 of each size).

Mark the body plates relative to the rim, to ensure it will be put together the same way.

Usually a discus is disassembled to repair the center plates. These can be flattened by use of pliers or Vise-Grips. Alternately, they can be tapped flat with a hammer or mallet.

At times, a rubber mallet or deadblow hammer is useful for reassembling the discus parts.

Do not disassemble a discus that is known to have a warped (oval) rim. It may be difficult to reassemble.

## 5.5 HAMMER

Hammer specifications are found in Table 3. Hammer inspection can be grouped into the following areas:

- Construction
- Connection
- Weight
- Dimensions
- Other considerations

### A. Construction

The hammer consists of a head (ball), wire and handle.

### A.1 The Head

The rule books vary slightly in defining the head. All the rule books agree that the head must be solid, and USATF further requires no detectable internal motion by feel, sight or sound. All rule books require the head to be spherical. Only USATF requires the finish of the head to be smooth. All rule books require the center of gravity to be no more than 6 mm from the center of the sphere.

Examine the head for cracks, large flat spots or dents. The presence of a crack suggests a heavy collision with a cage post or other object, and that the integrity of the head is compromised; impound such an implement. Similarly, internal movement inside a head is cause for disqualification. Any significant dent or flat spot violates the spherical requirement. Small dimples are ok. See Section E for more.

Check the swivel plug. Ensure it is tight.

Special note for the 2 kg hammer: WMA and USATF have recently expanded the allowable diameters of the 2 kg head. The legal range is 75 mm to 100 mm.

### A.2 The Wire

All the rule books require the wire to be a continuous piece of spring steel, not less than 3 mm in diameter, that can not stretch appreciably while the hammer is thrown. Wires are normally looped on both ends for attachment to the handle and swivel. USATF previously restricted the maximum diameter of the wire loops, but that has been revoked effective 2015. There is no restriction on loop diameter.

Remove any tape from the wire, particularly from the wire loops. These locations will be retaped later. Check for illegal weights under the tape. Check for the condition of the wire under the tape. Athletic tape, in particular, can remain wet for a while and start corroding the wire underneath.

Check the diameter of the wire in three locations. Then pinch the wire on one end and run your fingers the length of the wire, feeling for kinks or areas of necking in the wire. Kinks and

necking create stress risers and are likely locations for the wire to fail. Impound the implement unless the athlete can change the wire and resubmit for inspection.

Mild curling of the wire is allowable. It is a judgment call as to how curled a wire can be before it should be replaced.

### A.3 The Handle

The handle consists of a grip, braces and loop. It must have a symmetrical design and be rigid without any hinging joints or looseness in the brace-to-grip connection. The handle has elasticity and strength specifications, but these can not be checked by an Inspector in the field.

The handle previously had a 110 mm maximum length specification, but this requirement was eliminated by all rule books starting in 2014. Only the overall length of the hammer matters.

The handle grip may be straight or curved. The bails can be straight, symmetrically curved or symmetrically bent. Check the handle for physical distortion, damage and loose joints; any of these conditions are grounds for replacement of the handle or impounding the hammer.

## B. Connection

The wire must be attached to the handle via the loop in the handle; a swivel may not be used. The wire is attached to the head via a swivel.

Check the swivel for cracking or distortion; both are impoundable conditions. Oil the swivel if necessary.

## C. Weight

The basic hammer weights are 2 kg, 3 kg, 4 kg, 5 kg, 12 lb, 6 kg and 7.260 kg. These cover the full slate of Youth, Juniors, Collegiate, Open and Masters competition.

The NFHS allows the hammer throw as a special event for high school (NFHS Rule 8-2-1) and advises the use of USATF Youth rules unless the local activities body decrees otherwise. Therefore, in those high school meets where the hammer is thrown, the 12 lb and 4 kg hammers should be used.

Check the weight. This is most easily done by placing the handle on the scale and then putting the head in the handle so it doesn't roll. Make sure the wire does not contact anything in the process. Also ensure the wire loop is pointing away from everyone in case it snaps loose.

## D. Dimensions

**Overall length.** All rule books now have maximum allowable hammer lengths only; the minimum length specs have been eliminated. The 7.260 kg, 6 kg and 12 lb hammers must be not more than 1215 mm from the inside of the grip to the end of the head. The 5 kg hammer's max length is 1200 mm. For 4 kg, 3 kg and 2 kg implements, the maximum is 1195 mm.

Whatever type of hammer stretcher is used for measuring length, the Inspector must ensure two things:

a. The zero point of the measuring scale is properly indexed to where the bottom of the head is held. If the scale is not installed, scribed or adjusted properly, then all length measurements will be in error.
b. The part of the stretcher that engages the handle must accommodate handles with both straight and curved grips.

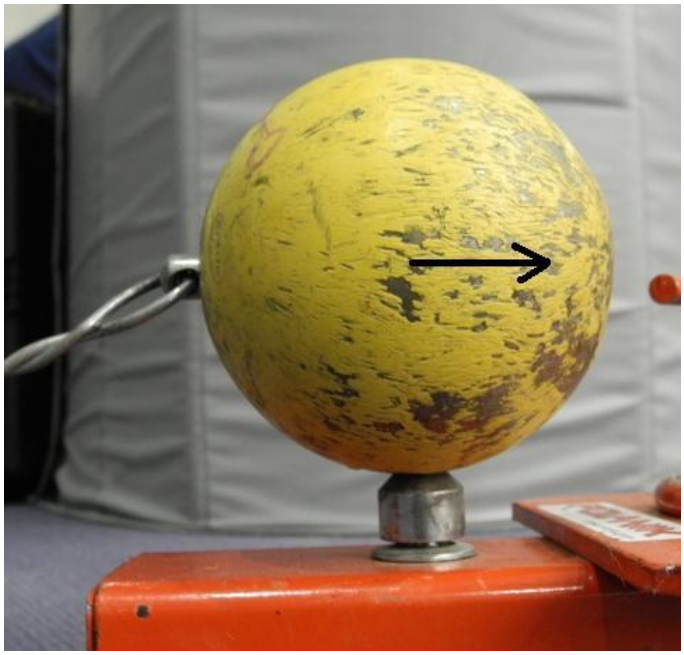
When measuring length, ensure the wire is straight and not stretched or curled. The weight of the hammer itself is usually not enough to straighten the wire, particularly if the wire has been curled from normal use or for transport. Applying additional tension may be necessary. Be careful not to apply too much tension so as to stretch the wire, the wire loops, or handle. With a hammer stretcher, be careful to make sure the handle and ball are properly placed so neither will come loose as the tension is increased. Tighten until the wire is reasonably straight; in fact, the USATF rules state, "*Pressure should be applied to make sure the wire is straight*." The intent is to straighten the wire, not replicate the tension experienced during a throw.

Some inspectors use a standard tension, such as 50 lb, when stretching the wire. This is fine, but several hundred pounds of applied tension is not acceptable. When taut, use the gauge to check the maximum length. Be careful in doing this measurement. If you are using the TRACKMASTER(TM) or Gill hammer stand, we recommend you use a "C" clamp to hold it firmly to the table surface.

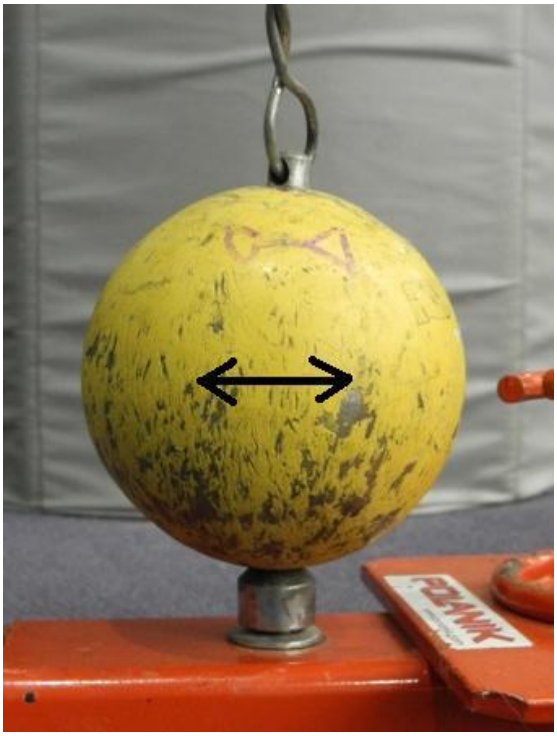
For larger meets, consider placing a second hammer stretcher at the check-in desk. This is for athletes to perform a length check before signing in the hammer. If this is done, perform a verification of this stretcher vs. your primary stretcher to ensure they both read the same.

**Head diameter.** Check the hammer head diameter and roundness, using the same gauges as for the shot. The hammer should be essentially spherical. It must pass in at least three different planes. If it doesn't pass, impound it.

**CG.** Check the center of gravity by placing the hammer head sideways on a 12 mm diameter horizontal sharp-edge orifice; that is, the swivel should be oriented horizontally, which isolates the measurement to the most critical axis for the hammer. It passes if it doesn't fall off.



Correct CG measurement
This checks the axial CG offset. If the offset is toward the bottom of the head, it's an unfair advantage to the thrower.



NOT a useful measurement
This checks the lateral CG offset, which is not an advantage to the thrower

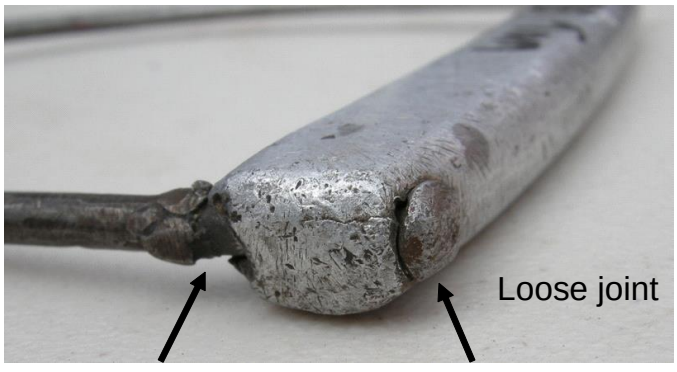
If the hammer passes all the above checks, tape the ends of the wire with electrical or duct tape to keep it from unraveling and so the wire ends don't get caught in the cage netting. Use more tape rather than less. This is a safety concern. Use tape of different colors as the certification mark of the day. Different colors can also be used to differentiate between the six different hammer weights at a Masters meet.

## E. Other Considerations

The above swivel was damaged in a collision with a cage post. While this is an extreme example, any swivel that is cracked, necked or elongated should be disqualified.

Once a swivel lug is cracked or begins to fail, its separation can be catastrophic.

The above broken wire was found under several wraps of athletic tape. The tape should be removed, particularly tape that appears to be old, and the wire examined underneath.




Be wary of distorted handles (above left). The bale-to-grip joint may be compromised; the handle should be retired. The bale (above right) had broken out of this grip. The owner had

apparently drilled a hole in the grip, pushed the bale thru, and ball-peened the end. The joint was loose and a small crack is visible at the end of the grip. This handle must be impounded.


Cracked or otherwise damaged handles must be impounded and retired from use.


A kinked wire must be retired (left). Be mindful of extra weight that has been attached with tape (right). The weight can easily be removed during competition. Weigh the hammer after any such add-ons have been removed.


The crack in the above left stainless hammer head was large enough that the internal fill material had begun to leak out. The hammer head at right was severely damaged during competition and immediately removed from service.

**Shape and texture of the head**. This is a topic that has received attention recently. A quick rules review follows:

IAAF Rule 191.5 dictates that the head must be a sphere, but says nothing about smoothness, texture or dents.

USATF Rule 191.5 states that the head "…must be spherical in shape and smooth."

NCAA Rule 2-10-1 requires the head to be a sphere, but, similar to the IAAF, says nothing about the surface condition of the head.

Clearly, the head must pass the minimum and maximum diameter checks. If it is oblong, not passing on three of four planes, it should be disqualified. However, the next problem is dealing with dents and dimples in the head. The general consensus is that small or moderate sized dents in the head are acceptable, since the concept of "sphere" is not fully defined in this context. It is up to the Inspector to decide at what point the dents are too large and should be disqualified.

The head, upper left, has severe denting from collisions with a cage post. The head at right has experienced severe erosion/abrasion. Both of these heads have been damaged sufficiently to warrant their disqualification. The threshold for disqualification may vary according to the level of the meet.

## 5.6 WEIGHT

Specifications for the throwing weight are found in Table 5, which originate from NCAA, USATF and WMA rules; the IAAF does not use the throwing weight. NFHS allows the indoor weight throw as a special event. Furthermore, this implement has both indoor and outdoor variants, with their attending specifications. Inspection of the throwing weight can be grouped into the following areas:

- Construction
- Weight
- Dimensions
- Other considerations

### A. Construction

The weight consists of a head (ball), handle, connection, and (in the case of an indoor weight) a harness.

## A.1 The Head

The outdoor (or "all-metal") head must be a sphere, not softer than brass, with no detectable internal movement. All rule books require the center of gravity to be no more than 9 mm from the center of the sphere.

Ensure the swivel plug in an outdoor weight head is tight.

The indoor (or "filled") head must be a sphere made of plastic or other suitable polymer material. It may be filled with lead or other material in such a manner that *minimizes* any internal void or internal movement (NCAA & USATF rules), or does not allow internal movement (WMA rules). In all cases, the 9 mm center of gravity specification applies. It is a partly subjective call on the part of the Inspector as to what constitutes a minimal internal void (a 1 inch deep void is acceptable, but can't be directly measured).

All rule books allow the indoor head to deform slightly upon impact, but it must return to the shape of a sphere immediately afterwards. The latter requirement disqualifies any heads made of rubber or other material that allow flat spots to remain after an impact. In fact, the NCAA & USATF rules specifically disallow rubber as the shell material for an indoor weight.

Check all weight heads for flat spots, dents or cracks. Check indoor weight heads around the fill hole for cracks or a protruding fill plug. All such conditions are grounds for disqualification. Sometimes small hairline cracks will be seen around the fill plug. How do deal with these is a judgment call. At a minimum, inform the athlete or coach of this condition. These cracks are not repairable and will grow over time. If these cracks are small and do not appear to be an immediate problem, place athletic or duct tape over the area for good measure.

The head at left is made of a rubber shell and has a pronounced flat spot. Both conditions are cause for disqualification. The head at right also has a noticeable flat spot; this extends its center of gravity unfairly – it should also be disqualified.

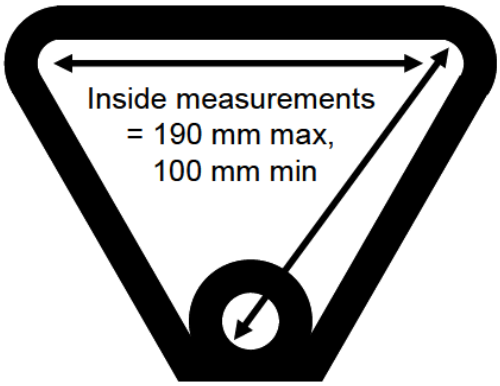
## A.2 The Handle

Handle specifications vary by rule book and whether the handle is attached to an indoor or outdoor weight.

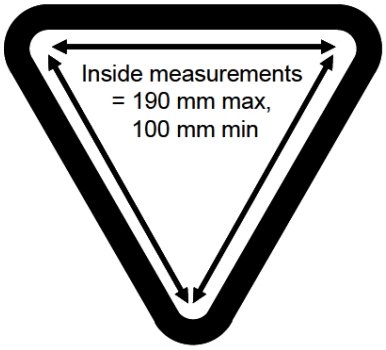
NCAA and USATF require a triangular handle made of steel rod, but do not specify any maximum or minimum rod diameter. Furthermore, the handle must not display any signs of elasticity or malformation before, during and after competition. Hammer handles may not be used under NCAA and USATF rules.

Under WMA rules, the outdoor weight handle has a relaxed definition which allows the use of hammer handles. However, the indoor weight handle is very similar to the NCAA handle, except the metal rod diameter may not exceed 12.7 mm diameter (~1/2 inch).

**NCAA handle dimensions**: No side of the triangle may be greater than 19 cm (inside measurement), nor less than 10 cm (inside measurement). Furthermore, an indoor weight may only have a handle with a permanent attachment point. A handle with no permanent attachment point may only be used on an outdoor (all-metal) weight, and its sides must all be of equal length.

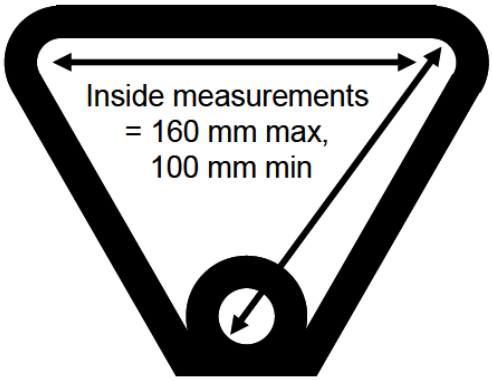



Handle with internal brace
(indoor or outdoor weight)

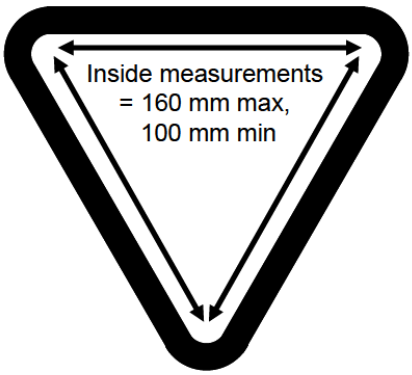



Handle without internal brace
(all sides equal)
(outdoor weight only)

**USATF indoor handle dimensions**: No side of the triangle may be greater than 160 mm (inside measurement), nor less than 100 mm (inside measurement). A handle with no permanent connection point must have all sides of equal length.

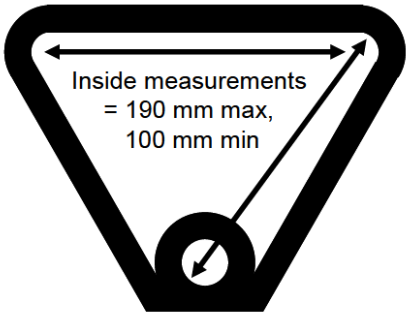



Handle with internal brace

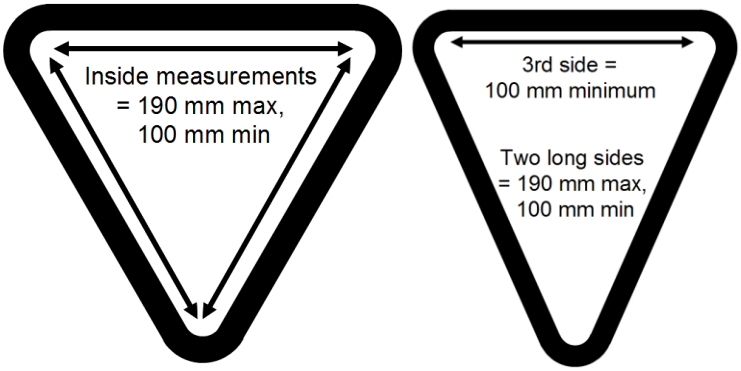



Handle without internal brace
(all sides must be equal)

**USATF outdoor handle dimensions**: No side of the triangle may be greater than 190 mm (inside measurement), nor less than 100 mm (inside measurement). As of 2015, a handle with no permanent connection point shall be constructed in such a manner that regardless of how the handle is turned, the length of the implement does not exceed the specified maximum length of the implement..




Handle with internal brace




Handle with no internal brace: Must be oriented such that the implement is at its maximum length when the length measurement is performed.

**WMA indoor handle dimensions**: No side of the triangle may be greater than 190 mm (inside measurement), nor less than 100 mm (inside measurement). A handle with no permanent connection point must have all sides of equal length.

**WMA outdoor handle dimensions**: Dimensions are not specified.

## A.3 The Connection Assembly

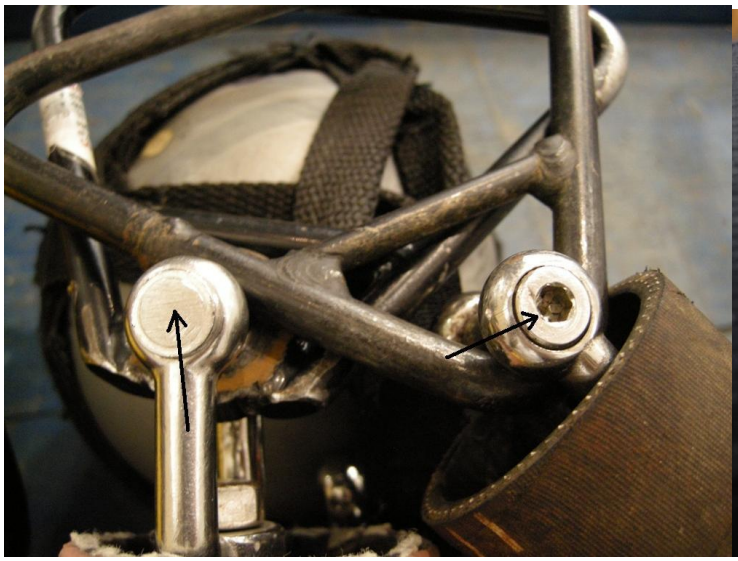
For an outdoor weight, the handle is connected to the head by no more than two steel links (USATF), by one or two steel links (NCAA), and by any number of links per WMA rules. The links must be robust enough to not stretch while thrown. The handle is connected to the links without use of a swivel, but a swivel is optional where the links are attached to the

head. Frequently threaded connectors ("quick links"), pictured at right, are used as one of the attachment links. The nuts on these links should always be checked for tightness.

For an indoor weight, with or without a harness, NCAA requires a swivel and no links. USATF, at a minimum, requires a link or swivel, and if both are used, the swivel must be attached to the head. WMA requires a harness, and up to two metal links with an optional swivel. A protective sleeve may be placed around the links or swivel.

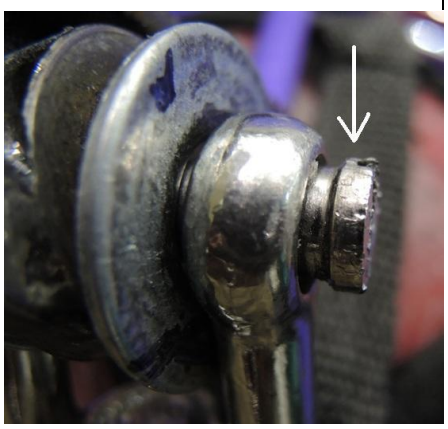
Inspect the links and/or swivel. Look for pitting corrosion, necking or other signs of damage or yielding by these components. If their integrity is in doubt, impound the implement.

CHECK the fasteners on the swivels, both top and bottom, and tighten when necessary. Experience has shown that such fasteners regularly come loose during throwing. This will require English and metric hex wrenches, needle-nose locking pliers, and one slotted screwdriver (preferably two screwdrivers of different sizes). Adding Loktite or a plumber's compound to the fastener threads is a plus, but use a small amount; otherwise the fastener might be nearly impossible to remove in the future.



The middle fastener, above, is a socket cap screw which requires a hex wrench to tighten it. The other two fasteners are seen with some regularity; they have no features to accept a wrench or screwdriver – locking pliers work best for tightening these.

This fastener, pictured at right, has backed out a couple of turns – it is an accident waiting to happen. But all indoor weight fasteners should be checked for tightness, whether or not they appear loose.



Inspect the protective sleeve, if present. In particular look for a damaged sleeve that might rip open and separate from the implement. If in doubt, wrap the sleeve with plenty of athletic or duct tape.

### A.4 The Harness

The harness is a common method of attaching a filled (indoor) head to the handle via the connection assembly. When used, it must be made of a minimum of four straps that are sewn together to form a sling. The harness may not stretch or show evidence of elasticity before, during and after the competition. As such, netting can not be used as a harness material.

With sufficient use, a harness can become abraded, start fraying and its stitching can come undone. Therefore, a visual inspection of the harness is required. If a harness is coming apart, the implement should be impounded. In particular, check the locations where the harness straps are attached to the metal hardware. Some designs are less robust than others.

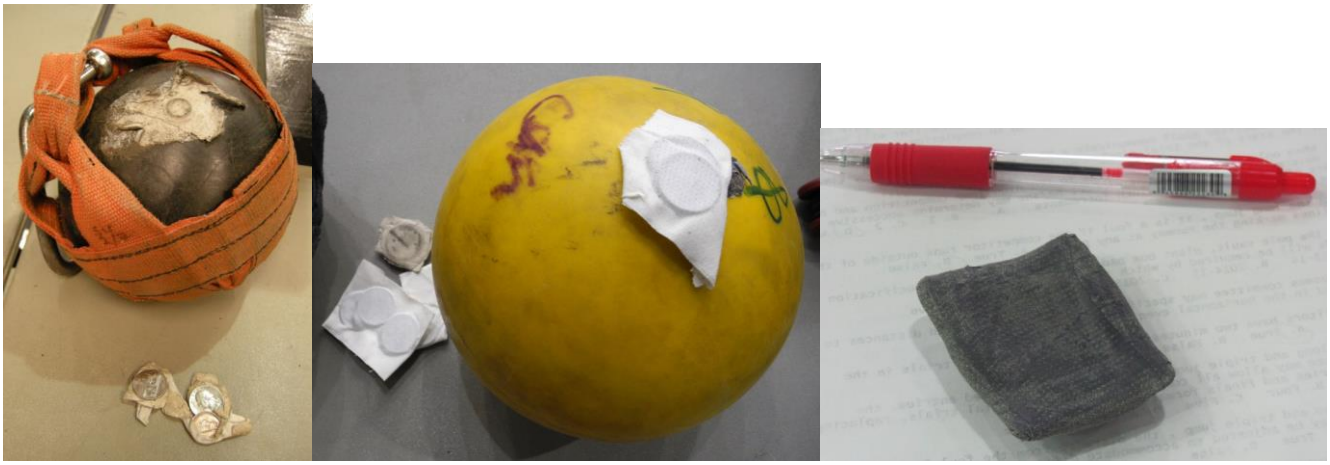
## B. Weight

The nominal weights are 4 kg, 12 lb, 16 lb, 20 lb, 25 lb, 35 lb, 20 kg and 56 lb. These cover the full slate of Collegiate, Open and Masters competition. The values listed in pounds are nominal; see the table for the exact values in kilograms.

The NFHS allows the indoor weight throw as a high school special event (NFHS Rule 8-2-1) and advises that USATF Youth rules be used. Effective 2017, USATF Youth rules now include the 25 lb weight for Boys and the 20 lb weight for Girls.

Check the weight. This is most easily done by placing the handle on the scale and putting the head in the handle so it doesn't roll.

For indoor weights that include a harness, some athletes will tape quarters or large washers onto the head to help them make weight. As the head rotates within the harness during successive throws, the quarters will rip free and detach. The Inspector should be aware of this type of hobby-shop repair.



The above pictures show two indoor weights that were received with taped coins inserted in the harnesses to make minimum weight. This is not legal. The picture at right is of a taped packet of lead pellets that was found inside of a different harness.

A more proper repair is adding washers to the connecting harness upper clevis pin (at the

handle connection) as shown below. Avoid adding washers to the lower clevis pin since that can abrade the harness straps.

## C. Dimensions

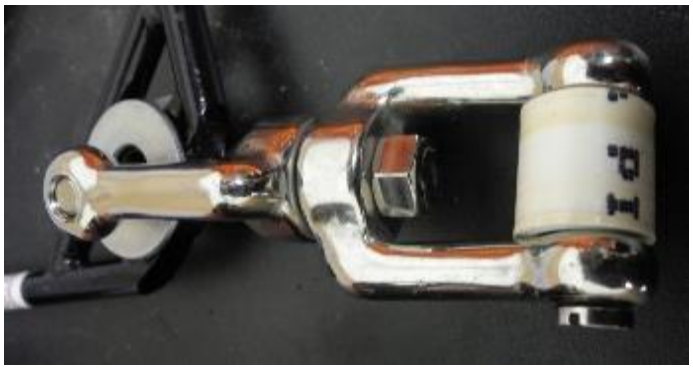
Check the length of the weight. The length is measured from the inside surface of the ***middle*** of the handle to the bottom of the complete implement. If the bottom of the indoor weight includes harness straps, then the length is measured to the bottom of the straps.

All rule books are now harmonized in that the maximum length of the implement, indoor or outdoor, is 410.0 mm.

WMA does not specify the lower point to which the length measurement is made, however adherence to the intent of the rule suggests that the measurement be made to the bottom of the complete implement. The maximum length is 410.0 mm.

Make sure the links are straight and not curled. For indoor weights, ensure the straps are at their "longest" positions; this is done by holding the weight by the handle and bouncing or jerking it up and down a few times to get the straps settled into position. Be aware of synthetic indoor weights that are not round. These have been deliberately flattened to ensure they meet the length specification. This is not allowed; the head itself must be round.

Indoor weights that fail the maximum length measurement due to stretched nylon straps are a common problem. These are corrected by disassembling the center link and twisting one or more straps, effectively shortening them. Alternately, a metal bushing or piece of ½" PVC pipe can be added to the lower clevis pin.

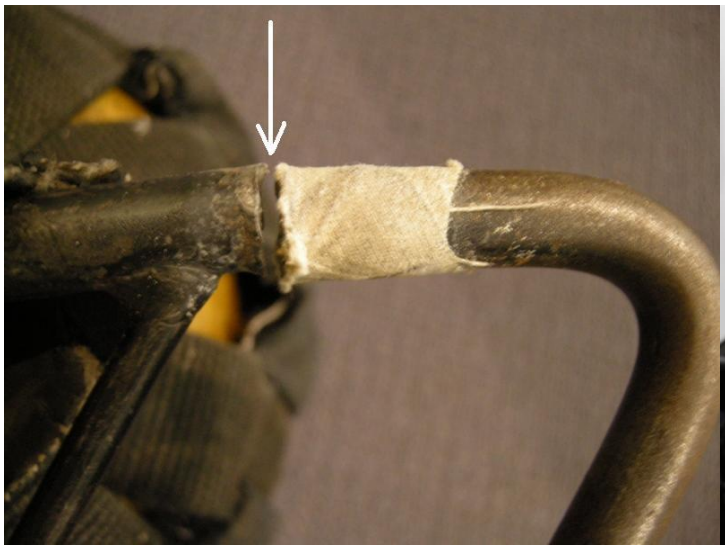


Like the hammer, the weight has diameter specifications for the head. The specs vary by rule book. See Table 5 for details.

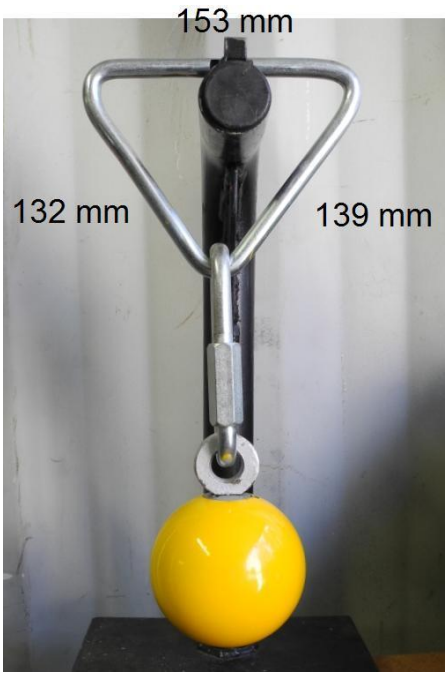
All rule books now specify both minimum and maximum head diameters; indoor weights are allowed a maximum head diameter of 15 mm more than for the outdoor weight.

## D. Other Considerations

Weight handles are made of welded steel rod. Many designs also include permanent connection points. These are normally quite robust when considering the abusive environment in which they serve. However, once in a while, a weld joint can crack – such a handle should be disqualified. The following image (below left) shows a weld failure on a handle; the break was covered by athletic tape.



Be alert for heads that have cracked and are leaking lead pellets. Tell-tale signs are: (1) A throwing weight that is underweight, and (2) a gray or blackish reside that covers part of the head and harness. In the case of the latter (above right) the leaking lead pellets are being ground into dust between the head and harness during throws. This dust is toxic; the head must be retired permanently and disposed of in a proper fashion.




Be alert for illegal handles, particularly those which do not include a permanent connection point in their design (also called a "brace" herein). This picture at right shows an outdoor handle with dimensions as marked. Under NCAA rules, a handle without a brace must have all sides of equal length; therefore, this implement would be disqualified. Under USATF rules, the handle would need to be rotated until the longest implement dimension is achieved before the length could be officially measured.

The handle and links should be inspected for integrity, and disqualified if there are signs of a structural problem. However, the head should be examined as well for erosion. The weight pictured here displays failure of the outer shell and erosion of the fill material, resulting in a loss of mass. It should be disqualified.

The implement pictured below has a hammer handle and four connecting links. It is legal for WMA outdoor competition, but not for NCAA or USATF competition.

If the implement passes, then mark it appropriately. Colored electrical tape or duct tape can be wrapped on the sides of the handle. Like the hammer, this can serve as the certification symbol, and also identify weights of different sizes, particularly at Masters meets. Alternately, the top of the head can be spray-painted.

## 5.7 JAVELIN

This section addresses the traditional javelin; the aero jav and mini jav are discussed in a later section. Javelin specifications are found in Table 4.

The javelin requires the most amount of time and, arguably, the most amount of technique to inspect properly. This leads to two considerations when planning for an upcoming meet:

A.. There are occasions when the full inspection can not be performed due to time constraints. High school and college invitationals, when some schools show up at the last moment, are examples of this. In these situations, the Inspector may have no choice except to perform an abbreviated inspection on all javelins.

B. The javelin has the most required measurements so it is very important that the inspection be done in approximately the order listed to limit the measurements on an implement that won't pass. The most common reasons for failure are listed first (and also form the core of the abbreviated inspection).

1. Hold the javelin vertically, first tip down then rotate so the tip is up and shake. Listen for any internal movement. Internal movement might impact the center of gravity and therefore its flight characteristics. This may be due to a loose lead slug that was originally affixed in the head of the javelin. Loose or rusted internal parts may also be an indication of imminent failure of the javelin – usually snapping in half during the throw or landing.

2. Check the javelin whipcord (grip) to see if it is damp which might help it make weight. If the grip is damp, impound the javelin. Also check the grip to see if it is unraveling, fraying, or otherwise not attached to the shaft. A loose cord can be repaired with Superglue, but a cord that is coming apart should be impounded.

*Remove tape from the grip cord or impound the javelin*

3. Check for indentations, rings, roughness, flutes or other aerodynamic improvements, i.e. non-smooth finish. Normal wear is acceptable as long as the grooves aren't symmetric. Remove any clumps of dirt, as this may affect the balance.

Check the javelin for tape or decals. Manufacturer stickers are ok, but other tape is not, which may affect balance or aerodynamic characteristics.

*Dents or punctures are cause for disqualification.*

4. Make sure that there isn't any paint or solder on the tip that might come off during the competition thus altering the balance point. Use nail polish remover if you need to remove the paint.

5. Check the overall length of the javelin. Less-expensive javelins periodically are found to be too long or too short; therefore, this measurement should not be ignored. There are at least three ways to perform the length measurement:

a. Measure each javelin on an inspection board that, among other things, includes a length scale.
b. Measure each javelin on a table with a measuring tape or other markings that denote the maximum and minimum lengths for each size of javelin.
c. Line up all javelins of one size against a wall. Pick out the longest and shortest one, and measure those with a tape; if those two pass, then all the rest will pass also.


*These two 400 gram javelins were found to be considerably over the maximum allowable length. This is not common, but it happens*

6. Weigh the javelin. The nominal weights are 400, 500, 600, 700 and 800 grams. This covers the full spectrum of high school, college, Youth, Open, Juniors and Masters javelins.

The javelin in the following picture was sold as, and labeled as a 50 meter, 600 gram jav. Its physical dimensions and balance conformed to those of a 600 g jav. However, its actual weight was 517 grams. Although underweight javelins are, as a rule, uncommon, this sort of manufacturing problem does happen on occasion.


7. Check the center of gravity by performing the balance test. Most javelins balance at about the second cord on the grip. That is not a specification, just a fact. By rule, the balance point must be somewhere on the grip cord. Any type of fulcrum can be made to work, but a knife edge gives the best results when the balance point is barely on the first wrap of the grip. If the balance point is off the grip, impound the javelin. If the balance point is on the grip, it passes; mark this point (this is where a silver Sharpie pen is very useful if the cord is black).

Measure the distance from the mark on the grip to the forward tip of the javelin. The allowable distance is different for every size of javelin; therefore, a handy spec sheet is advisable, particularly for Masters meets where all five sizes are thrown. See Table 4 for dimensions. This measurement can be done with a tape, but a measurement board with a built-in fulcrum and length scale will greatly speed up the process.

Most javelins are balanced by the manufacturers to be near the maximum allowable CG-to-tip length. If it exceeds the minimum or maximum allowed length, impound the javelin.

One additional point should be made here. If the CG-to-tip length is more than slightly out of spec long, you may be dealing with an "old rules" javelin. For example, the CG spec for an 800 g jav is a maximum of 1060 mm. If you measure a jav to have a forward CG length of 1070 mm or more, it was probably built to pre-1986 rules. It would be good to advise affected the athlete and/or coach of this fact, and tell them that the jav definitely needs to be rebuilt to today's specifications.

**NOTE**
The above steps are generally known as the abbreviated inspection. If there is insufficient time to perform *all* measurements on *all* javelins submitted for inspection, it is recommended that, as a minimum, the above inspections be performed.

The remaining checks should be made whenever possible, but generally don't change with use, i.e., they are characteristic of the javelin manufacturing process. Thus, if these have been previously checked as signified by the mark of the day or one you recognize then, with limited time, skip them. The first time a javelin is inspected each year you should check these items. Then use a special mark to indicate that these have inspected. These points can then be overlooked for the rest of the season.

8. Check the forward tip for the forty-degree maximum taper using the tip guide. This can also be done with a plastic protractor and several pieces of tape. The very tip may be rounded due to wear, but the taper of the head into the tip must be 40° or less.

9. Check the length of the head. The spec varies by the size of the javelin.

10. Check the length of the grip cord. The spec varies by the size of the javelin.

11. Check the diameter of the tail. It must be no less than 3.5 mm. Be aware that some athletes drag their javelins around the field by the head, thus scraping the tail on the ground and "sharpening" it. This type of abuse can bring the tail diameter down to less than 3.5 mm.


*This jav's tail was "sharpened" and then painted over. However, it fits within a 3.5 mm notch. It should be repaired or disqualified*

12. Mark the javelin in preparation for the profile measurements:
    a. Place a small mark that is 150 mm behind the tip of the javelin. This applies to all except the 400 g javelin; the location of the mark is 125 mm behind the tip of a 400 g jav.
    b. Place a small mark that is 150 mm in front of the tail of the javelin. This applies to all except the 400 g javelin; the location of the mark is 125 mm in front of the tail of a 400 g jav.
    c. Place a mark that is exactly half-way between the balance point (Step 7) and the forward tip of the javelin. This can be done by measuring the distance, dividing by two, then remeasuring and marking the half-way point. It can be done faster by measuring with

center point tape which also provides the center position. This point is alternately called the *forward mid-point* by some inspectors.

**NOTE**: It is very important that the measurement is made between the *balance point* and the tip. Some Inspectors measure from the *front of the grip cord* to the tip – this is an incorrect procedure.

d. Place a mark that is exactly half-way between the balance point (Step 7) and the tail of the javelin. The same comments apply from above. This point is alternately called the *aft mid-point* by some inspectors.

13. Measure the diameter of the javelin shaft just in front of the grip cord. This should be done with a caliper at 3 or 4 locations ("clockings" of the javelin). Each measurement will be slightly different – mentally calculate the average value of the measurements and make a note of it (this value will be used as the basis for several other measurements). The diameter value at this location is called "D0" (D-zero) in the IAAF rule book, the "thickest point" in the USATF rule book, and the "max diameter" by many Inspectors. Check the measured value against minimum and maximum values in the rule book or in Table 4.

NOTE 1: When using the calipers don't pinch the jav too much. Lightly snug the caliper at the measurement point and rotate it slightly to ensure the instrument is at a right angle to the shaft.

NOTE 2: Some inspectors use precut gauges with the max and min values of D0. This provides an approximation of the true value of D0, but can lead to false rejections or false passes. Caliper measurements provide the best answer.

14. The cross section of the shaft is supposed to be circular but there is a 2% allowance between the largest and smallest diameters at any location. Multiply the average value of D0 by 2% (0.02) and compare that with the largest and smallest individual measured values. For example, if the average value of D0 is 29 mm (on an 800 g jav), then the 2% out-of-round allowance is 0.58 mm. Accordingly, the max and min measured diameters must differ by no more than 0.58 mm.

15. Measure the diameter of the shaft immediately behind the grip cord. It must be no larger than the D0 value less 0.25 mm.

16. Measure the diameter of the grip cord. Take care to not to squeeze the grip which would provide a false reading. The diameter at the grip must be no larger than D0 + 8 mm.

17. Measure the diameter of the point that was marked 150 mm behind the tip (125 mm for 400 g javs). This diameter must be 80% of the value of D0 ***or less***.

18. Measure the diameter of the forward mid-point. This diameter must be 90% of the value of D0 ***or less***.

19. Measure the diameter of the aft mid-point. This diameter must be 90% of the value of D0 ***or more***.

20. Measure the diameter of the point that was marked 150 mm in front of the tail (125 mm for 400 g javs). This diameter must be 40% of the value of D0 ***or more***.

In the interest of time, some of these measurements may be excluded if a visual check does not show a gross or obvious problem.

The javelin gauges are quick to use, but not as accurate as calipers. An apparent failure, or a measurement close to the limit, with a javelin gauge should be double-checked with a caliper. Otherwise, experience from the field indicates that some false DQs will occur.

21. There can be no abrupt changes in diameter along the length of the javelin, except where the head transitions to the shaft. In the case of the latter, the maximum diameter change can be 2.5 mm.

22. The javelin shaft must be cylindrical or slightly convex in profile, except at the grip cord. That is, a straight edge, when placed along the shaft must rock slightly or exactly join the shaft. It must be impossible to insert a 0.20 mm feeler gauge between the straight edge and the shaft.

If the javelin passes all the tests, mark it on the forward end near the grip cord or just above the metal head. Do not mark it behind the grip because the athlete's hand will rub it off.

Because of the many changes in specifications in javelins over the last 20 years the following table of older javelin specifications is included. You may continue to see some of these implements at meets for the next few years. This table will help you verify what they are. All the dimensions shown are in millimeters. Note: Although there have been several changes to the Masters' 400 g javelin over the last ten years to make it more aerodynamic and easier to manufacture there has not been the formal demarcation date for the specs changes which occurred with the open 800 and 600 g javelins.

**HISTORICAL JAVELIN SPECIFICATIONS**

| Measurement/Group | | High School Pre 2002 | IAAF Pre 1992 | IAAF Pre 1999 | High School Pre 2002 | IAAF Pre 1986 |
|---|---|---|---|---|---|---|
| Users | | Girls | Open | Open | Boys | Open |
| Weight, g | | 600 | 600 | 600 | 800 | 800 |
| Length of Javelin | Min. | 2200 | 2200 | 2200 | 2600 | 2600 |
| | Max. | 2300 | 2300 | 2300 | 2700 | 2700 |
| Length of Head | Min. | 250 | 250 | 250 | 250 | 250 |
| | Max. | 350* | 330 | 330 | 350* | 330 |
| Length of Rubber Tip | Min. | 35 | | | 35 | |
| | Max. | 77 | | | 77 | |
| Diam. of Front of Rubber Tip | Min. | 14 | | | 14 | |
| | Max. | 35 | | | 35 | |
| Thickness at Front of Rubber Tip | Min. | 5 | | | 5 | |
| Length of Grip | Min. | 140 | 140 | 140 | 150 | 150 |
| | Max. | 150 | 150 | 150 | 160 | 160 |
| Length from Tip to | Min. | 800 | 800 | 800 | 900 | 900 |
| | Max. | 950 | 950 | 950 | 1100 | 1100 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Diameter of Shaft (D) | Min. | 20 | 20 | 20 | 25 | 25 |
| | Max. | 25 | 25 | 25 | 30 | 30 |
| Diam. Reduction Front to Back of Grip | Max. | - | 0.25 | 0.25 | | 0.25 |
| Diam. Reduction behind Head | Max. | - | 2.5 | 2.5 | - | 2.5 |
| Diam. at mid point CG to Tip | Max. | - | 0.9D | 0.9D | - | 0.9D |
| Diam. at mid point CG to Tail | Min. | - | 0.7D | 0.9D | - | 0.9D |
| Diam. 150 mm from Tip | Max. | - | 0.8D | 0.8D | - | 0.8D |
| Diam. 150 mm from Tail | Min. | - | 0.3D | 0.4D | - | 0.8D |
| Diam. 125 mm from Tip | Max. | | | | | |
| Diam. 125 mm from Tail | Min. | | | | | |
| Diam. of Tail | Min. | - | 3.5 | 3.5 | - | 3.5 |
| Diam. of Grip | Max. | | D+8 mm | D+8 mm | | D+8 mm |
| Circumference of Grip over Diam. | Max. | D+1 in | | | D+1 in | |
| Diam. at mid point fm front of grip to Tip | Max. | | | | | |
| Diam. at mid point fm front of grip to Tail | Max. | | | | | |
| Angle of Tip | Max. | | 40º | 40º | | 40º |

Note: When a rubber tip is used, the overall length, balance point and weight of the javelin is unchanged. The metal head must then terminate in a slightly-rounded button shape or other feature onto which the rubber tip is attached. It is not legal to press a rubber tip onto a regular head that has a pointed tip.

## 5.8 AERO JAVELIN

The aero javelin was adopted as an exhibition implement during 2016 for the 11-12 year Youth group while maintaining the 300 g mini javelin as the competition implement. However, **starting in 2017** the aero jav has replaced the mini jav as the competition javelin for the 11-12 Youth group.

The aero jav is either nearly or entirely constructed of synthetic material, depending on the configuration of the grip. The grip may be constructed of plastic, or wound with cord same as the regular javelins. It weighs no less than 450 g, and has the following specifications (all dimensions in mm):

| **Dimension** | **Min** | **Max** |
|---|---|---|
| Overall length | 1765 | 1785 |
| Length of head * | 140 | 160 |
| Distance from tip to CG ** | 760 | 770 |
| Diameter of shaft § | 20 | 28 |
| Length of grip *** | 115 | 120 |
| Location of front of grip from tip | 755 | 770 |
| Length of tail | 175 | 195 |

* The max diameter of the head shall not exceed the nominal shaft diameter by more than 10 mm
** The grip is not required to cover the CG
*** The max grip diameter shall not exceed the nominal shaft diameter by more than 8 mm
§ The diameter of the shaft shall not vary from the nominal diameter by more than ±2 mm anywhere along the length of the shaft.

Inspecting the aero jav is fairly straight-forward, but with a few deviations from how a regular javelin is handled.

1. If so equipped, check the grip cord to see if it is damp which might help it make weight. If the grip is damp, impound the javelin. Also check the grip to see if it is unraveling, fraying, or otherwise not attached to the shaft. A loose cord can be repaired with Superglue, but a cord that is coming apart should be impounded.

2. Check for indentations, rings, roughness, flutes or other aerodynamic improvements, i.e. a rougher finish than the stock texture of the shaft. Normal wear is acceptable as long as the grooves aren't symmetric. Remove any clumps of dirt, as this may affect the balance.

Check the javelin for tape or decals. Manufacturer stickers are ok, but other tape is not, which may affect balance or aerodynamic characteristics.

3. Check the overall length of the javelin.

4. Weigh the javelin. Minimum passing weight is 450 g.

5. Check the center of gravity by performing the balance test. The aero jav is unlike regular javelins in that the center of gravity does not have to be on the grip; a balance point forward of the grip on the shaft is acceptable. Mark the balance point; then measure the distance from the mark to the forward tip. If it exceeds the minimum or maximum allowed length, impound the javelin.

6. Measure the distance between the front of the grip and tip. This is a separate consideration than the balance point.

NOTE
The above steps are generally known as the abbreviated inspection. If there is insufficient time to perform *all* measurements on *all* javelins submitted for inspection, it is recommended that, as a minimum, the above inspections be performed.

7. Measure the lengths of the head and tail.

8. Measure the length of the grip.

9. Measure the diameter of the shaft in four locations. None of the measurements should be more than ±2 mm from the average value.

## 5.9 MINI JAVELIN

In 2000 the Youth Committee adopted the 300 gram mini javelin for use with the younger age groups. In 2010 the 500 gram mini javelin was redefined, and the 600 gram mini javelin was introduced.

Each dimension should be checked. Because of the fins, finding the center of gravity requires a much higher balance point. Most dimensions are easily measured with a 15 or 30 cm (6-12 inch) straight edge and the diameters with a caliper. The only other specifications are weight and center of gravity. Alternately you can mark your javelin board with the required dimensions and get a larger fulcrum to determine the center of gravity. Checking the center of gravity is particularly important since some mini javelins have been found to be significantly out of specification in recent years. See Table 6 and ***Figure 32*** in the Appendies.

## 5.10 ULTRAWEIGHT

The ultraweight pentathlon was formally accepted in the USATF rules book as a Masters event in 2011. It uses implements weighing between 20 lb and 300 lb, depending on the age and gender of the thrower.

For this competition, the 20 lb, 25 lb, 35 lb, 20 kg and 56 lb weights are the same implements as are used in the weight and superweight throws. In addition to the normal inspection, both Meet Management and the Implement Inspector must ensure the correct implements are available per Appendix C.

The 98 lb, 200 lb and 300 lb implements are unique to the ultraweight pentathlon – only a limited number of these are available in the United States. The top priority should be the weighing of these implements. Since Associations are not expected to own certified scales in this weight range, Meet Management and/or the Implement Inspector must arrange for the weighing to take place in advance of the meet at an establishment with an appropriate scale. The dimensional specifications of these ultraweights are per Table 7.

## 5.11 USE OF THE TRACKMASTER(TM) or OTHER CERTIFICATION KITS

The following section is included as an introduction the TRACKMASTER(TM), UCS, Gill or Polanik Implement Certification equipment. (See Figures 33 to 38 in Appendix.) It is the most commonly used weights and measure system in the United States. However, the TRACKMASTER(TM) does not perform all the indicated tests listed in the measurement section. You may have to construct or buy some additional devices to do the measurements. Most are reasonably straight forward. If you have access to either a wood or metal shop you can make your own. Use a caliper and make sure it is accurate, to at least 0.1%.

Generally the TRACKMASTER(TM), UCS, and Gill kit are set up on the principle of pass or fail. It doesn't give you the actual measurement but indicates that you are above the minimum or below the maximum. The TRACKMASTER(TM) is the most widely used system with over 350 units throughout the United States before Daktronics began manufacturing the newer version in 1997. Before that, there were four models sold by Red Meade (original Inventor) of Southern California until the mid-80s and then Jack Benko out of Texas who was the inventor of the Accutrack(TM) timing system until the late 90s. Mark I for Men, Mark II for Women, Mark III for Men, Women and Junior, and Mark IV for High School. Now there are just three: High School with and without Javelin, and NCAA, IAAF & WMA. Gill began sales in 2000. UCS started in 2007. Instructions come with each system but the following is a more detailed description of the tests and how they should be performed and interpreted.

Some of the most common complaints about this equipment are:

1. Initial cost is high ($1250 to $3700 depending on implements to be measured)
2. Cost of maintenance is high
3. Old models have not all been updated with improvements
4. Instructions are not current with rule changes
5. Owners neglect leads to inaccurate measurements
    a. Equipment gets wet and isn't properly dried, and cleaned.
    b. Instructions get lost.
    c. Equipment gets lost.

d. Equipment gets damaged.
e. Scale not accurate, or impossible to calibrate.
f. Every scale responds differently with different accuracy.
g. Scale cannot be calibrated for the "heavy end" of weights.

**USE OF OTHER METHODS:**
If you know of other methods that should be discussed please pass them along to Bob Springer, 10063 Arrowsmith Ave. S., Seattle, WA 98178 or via e-mail at bobspringer2@comcast.net.

**IMPORTANT IMPLEMENT SPECIFICATION DIFFERENCES BETWEEN THE VARIOUS RULEBOOKS AND DIVISIONS:**

Tables 1 -7 summarize all of specifications for all implements. Some data are still needed for the handicap implements. These tables were compiled as a convenient way to have all the data in one place. In case of a question always refer to the rulebook itself in the event that a table has an incorrect entry.

**Weight:** There are still some slight differences between rule books concerning the Weight specifications. Notably, the WMA rules are different as regards the connection links and the allowable handle.

**Javelin**: There are no longer any differences between the rulebooks for the javelin specifications, except NFHS allows the use of rubber tips. All refer to the IAAF specifications.

**Discus:** NFHS allows the use of the rubber discus, whereas none of the other rule books do.

# TABLE 1
# THROWING IMPLEMENT SPECIFICATIONS SUMMARY
# SHOT

| SHOT | | Nominal size | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **16 lb** | **6 kg** | **12 lb** | **5 kg** | **4 kg** | **3 kg** | **6 lb** | **2 kg** |
| **Age group**: | | | | | | | | | |
| USATF Open, NCAA: | | Men | | | | Women | | | |
| USATF Masters Men: | | M30-M45 | M50-M55 | | M60-M65 | M70-M75 | M80+ | | |
| USATF Masters Women: | | | | | | W30-W45 | W50-W70 | | W75+ |
| USATF Youth Boys: | | | | 15-16 | | 13-14 | | 11-12 | 8 & under |
| | | | | 17-18 | | | | 9-10 | |
| USATF Youth Girls: | | | | | | 15-16 | | 13-14 | 8 & under |
| | | | | | | 17-18 | | 11-12 | |
| | | | | | | | | 9-10 | |
| High school: | | | | Boys | | Girls | | | |
| IAAF Seniors: | | Men | | | | Women | | | |
| IAAFJuniors: | | | Men | | | Women | | | |
| IAAF Youth: | | | | | Boys | | Girls | | |
| WMA Men: | | M35-M45 | M50-M55 | | M60-M65 | M70-M75 | M80+ | | |
| WMA Women: | | | | | | W35-W45 | W50-W70 | | W75+ |
| | | | | | | | | | |
| **Weight**: | Nom. lb | 16.00 | 13.23 | 12.00 | 11.02 | 8.82 | 6.61 | 6.00 | 4.41 |
| | Nom. lb-oz | 16-0 | 13-3.7 | 12-0 | 11-0.3 | 8-13 | 6-10.6 | 6-0 | 6-6.5 |
| | Nom. kg | 7.26 | 6.00 | 5.44 | 5.00 | 4.00 | 3.00 | 2.72 | 2.00 |
| | Min. kg | 7.260 | 6.000 | 5.443 | 5.000 | 4.000 | 3.000 | 2.720 | 2.000 |
| Range for supply: | Min. kg | 7.265 | 6.005 | 5.450 | 5.005 | 4.005 | 3.005 | 2.725 | 2.005 |
| | Max. kg | 7.285 | 6.025 | 5.475 | 5.025 | 4.025 | 3.025 | 2.745 | 2.025 |
| | | | | | | | | | |
| **Diameter** (all): | Min. mm | 110 | 105 | 98.4 | 100 | 95 | 85 | | 80 |
| Dia (USATF men, youth) | Max. mm | 130 | | 117.5 | | 110 | | | 90 |
| Dia (USATF masters men) | Max. mm | 130 | 130 | | 130 | 130 | 130 | | |
| Dia (USATF master women) | Max. mm | | | | | 110 | 110 | | 110 |
| Dia (high school) | Max. mm | | | 117.5 | | 110 | | | |
| Dia (NCAA) | Max mm | 130 | | | | 110 | | | |
| Dia (IAAF) | Max mm | 130 | 125 | | 120 | 110 | 110 | | |
| Dia (WMA men) | Max mm | 130 | 130 | | 130 | 130 | 130 | | |
| Dia (WMA women) | Max mm | | | | | 110 | 110 | | 110 |
| Dia (Masters men indoors) | Max. mm | 145 | 145 | | 145 | 145 | | | |
| Dia (Masters women indrs) | Max. mm | | | | | 130 | 130 | | 130 |
| Dia (USATF Open, NCAA indoors) | Max. mm | 145 | | | | 130 | | | |
| Dia (IAAF indoors) | Max. mm | 145 | 140 | | 135 | 130 | 130 | | |
| **Circumference** HS only: | Min. mm | | | 309.1 | | 298.4 | | | |
| | Max. mm | | | 369.1 | | 345.6 | | | |

Sources:
USATF Rules 188.4, 221.5, 301, 320.2, 332.3.(g)
NCAA Rules 2-8.3, 10-7.3
NFHS (high school) Rule 6.5.2
IAAF Rules 188.5, 221.6
WMA: Rule 188

NOTE:
Masters W75+ group is effective 5-1-10
Youth 8 & Under group is effective 2011

# TABLE 2
# THROWING IMPLEMENT SPECIFICATIONS SUMMARY
# DISCUS

| DISCUS | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **2 kg** | **1.75 kg** | **1.6 kg** | **1.5 kg** | **1.0 kg** | **0.75 kg** |
| **Age group:** | | | | | | | |
| USATF, IAAF, NCAA Open: | | Men | | | | Women | |
| USATF Masters Men: | | M30-M45 | | | M50-M55 | M60+ | |
| USATF Masters Women | | | | | | W30-W70 | W75+ |
| USATF Youth Boys: | | | | 15-16 | | 11-12 | |
| | | | | 17-18 | | 13-14 | |
| USATF Youth Girls: | | | | | | all | |
| High school: | | | | boys | | girls | |
| IAAF Youth Boys: | | | Junior | | Youth | | |
| IAAF Youth Girls: | | | | | | all | |
| WMA Men: | | M35-M45 | | | M50-M55 | M60+ | |
| WMA Women: | | | | | | W35-W70 | W75+ |
| | | | | | | | |
| **Weight**: | Nom. lb | 4.41 | 3.86 | 3.53 | 3.31 | 2.20 | 1.65 |
| | Nom. kg | 2.00 | 1.75 | 1.60 | 1.50 | 1.00 | 0.75 |
| | Min. record | 2.000 | 1.750 | 1.600 | 1.500 | 1.000 | 0.750 |
| Range for supply: | Min kg | 2.005 | 1.755 | 1.605 | 1.505 | 1.005 | 0.755 |
| | Max kg | 2.025 | 1.775 | 1.625 | 1.525 | 1.025 | 0.775 |
| | | | | | | | |
| **Diameter** (overall): | Min mm | 219 | 210 | 209 | 200 | 180 | 166 |
| | Max mm | 221 | 212 | 211 | 202 | 182 | 182 |
| Diameter (center plate): | Min mm | 50 | 50 | 50 | 50 | 50 | 50 |
| | Max mm | 57 | 57 | 57 | 57 | 57 | 57 |
| Thickness (at center plate): | Min mm | 44 | 41 | 40 | 38 | 37 | 33 |
| | Max mm | 46 | 43 | 42 | 40 | 39 | 39 |
| Thickness (rim @ 6 mm in): | Max mm | 13 | 13 | 13 | 13 | 13 | 13 |
| | Min mm | 12 | 12 | 12 | 12 | 12 | 10 |

Sources:
USATF Rules 189.3, 301, 320.2, 332.3.(g)
NCAA Rules 2-9.3
NFHS (high school) Rule 6.4.2
IAAF Rule 189.2
WMA: Rule 189

# TABLE 3
# THROWING IMPLEMENT SPECIFICATIONS SUMMARY
# HAMMER

| **HAMMER** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| USATF RULE: 191 | | | | | | | | |
| IMPLEMENT NAME | | **7.26 kg** | **6 kg** | **12 lb** | **5 kg** | **4 kg** | **3 kg** | **2 kg** |
| AGE GROUP | | | | | | | | |
| USATF OPEN, NCAA | | MEN | | | | WOMEN | | |
| USATF MASTERS | | M30-M45 | M50-M55 | | M60-M65 | M70-M75 | M80+ | |
| | | | | | | W30-W45 | W50-W70 | W75+ |
| JUNIORS | | | MEN | | | WOMEN | | |
| IAAF YOUTH | | | | | BOYS | | GIRLS | |
| USATF YOUTH | | | | 15-16, 17-18 | | 15-16, 17-18 | | |
| HIGH SCHOOL | | | | BOYS | | GIRLS | | |
| | | | | | | | | |
| WEIGHT | NOM. lb | 16.00 | 13.23 | 12.00 | 11.02 | 8.82 | 6.61 | 4.41 |
| | NOM. lb-oz | 16-0 | 13-3.6 | 12-0 | 11-0.3 | 8-13 | 6-9.8 | 4-6.5 |
| | NOM. kg | 7.26 | 6.00 | 5.44 | 5.00 | 4.00 | 3.00 | 2.00 |
| Weight for record | MIN. kg | 7.260 | 6.000 | 5.443 | 5.000 | 4.000 | 3.000 | 2.000 |
| RANGE FOR SUPPLY | MIN kg | 7.265 | 6.005 | 5.450 | 5.005 | 4.005 | 3.005 | 2.005 |
| | MAX kg | 7.285 | 6.025 | 5.475 | 5.025 | 4.025 | 3.025 | 2.025 |
| HEAD DIAMETER | MIN mm | 110 | 105 | 98.4 | 100 | 95 | 85 | 75 |
| | MAX mm | 130 | 125 | 117.5 | 120 | 110 | 100 | 100 |
| OVERALL LENGTH* | MAX mm | 1215 | 1215 | 1215 | 1200 | 1195 | 1195 | 1195 |
| | | | | | | | | |
| WIRE DIAMETER | MIN mm | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Center of Gravity (off-center) | MAX mm | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | | | | | | | | |
| INTERNAL MOVEMENT | | NONE | NONE | NONE | NONE | NONE | NONE | NONE |
| HANDLE DIMENSIONS ** | MAX mm | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| LOOP DIAMETER ** | MAX mm | n/a | n/a | n/a | n/a | n/a | n/a | n/a |

NOTE: 2 kg hammer spec and W75+ group effective 5-1-10

* No minimum length as of 2014
** There are no specifications for handle dimensions or loop diameter

# TABLE 4
# THROWING IMPLEMENT SPECIFICATIONS SUMMARY
# JAVELIN

| **JAVELIN** | | | | | | |
|---|---|---|---|---|---|---|
| USATF RULE: 193 | | | | | | |
| IMPLEMENT NAME | | **800 g** (Post-86) | **700 g** | **600 g** (Post-98) | **500 g** | **400 g** |
| AGE GROUP | | | | | | |
| OPEN | | Men | | Women | | |
| NCAA | | Men | | Women | | |
| MASTERS | | M30-M45 | M50-M55 | M60-M65<br>W30-W45 | M70-M75<br>W50-W74 | M80+<br>W75+ |
| JUNIORS | | Men | | Women | | |
| IAAF YOUTH | | | Boys | | Girls | |
| USATF Youth | | B15-16<br>B17-18 | | B,G 13-14<br>G15-16<br>G17-18 | | |
| High School | | Boys | | Girls | | |
| Weight | NOM., g | 800 | 700 | 600 | 500 | 400 |
| | NOM., oz | 28.22 | 24.69 | 21.16 | 17.64 | 14.11 |
| Weight for record | MIN, g | 800 | 700 | 600 | 500 | 400 |
| Range for supply | MIN, g | 805 | 705 | 605 | 505 | 405 |
| | MAX, g | 825 | 725 | 625 | 525 | 425 |
| Location of max. diameter (D0) | | Immediately in FRONT of grip | | | | |
| Diameter at D0 | MIN, mm | 25 | 23 | 20 | 20 | 20 |
| | MAX, mm | 30 | 28 | 25 | 24 | 23 |
| Diam. reduction to rear of grip | MAX, mm | 0.25 | | | | |
| Overall length | MIN, mm | 2600 | 2300 | 2200 | 2000 | 1850 |
| | MAX, mm | 2700 | 2400 | 2300 | 2100 | 1950 |
| Length of head | MIN, mm | 250 | | | 220 | 200 |
| | MAX, mm | 330 | | | 270 | 250 |
| Distance from tip to Center of Gravity | MIN, mm | 900 | 860 | 800 | 780 | 750 |
| | MAX, mm | 1060 | 1000 | 920 | 880 | 800 |
| Width of grip | MIN, mm | 150 | | 140 | 135 | 130 |
| | MAX, mm | 160 | | 150 | 145 | 140 |
| Grip diam. over max. shaft diam. | MAX, mm | 8 | | | | |
| Diameter variation | MAX % | 2% | | | | |
| Diam @ 125 mm from tip [a] | MAX % | | | | | ≤80% D0 |
| Diam @ 150 mm from tip [a] | MAX % | ≤80% D0 | | | | |
| (Diam of head) – (Diam behind head) | MAX, mm | 2.5 | | | | |
| Diam @ midpoint from CG to tip [a] | MAX % | ≤90% D0 | | | | |
| Diam @ midpoint from CG to tail [b] | MIN % | ≥90% D0 | | | | |
| Diam @ 125 mm from tail [b] | MIN % | | | | | ≥40% |
| Diam @ 150 mm from tail [b] | MIN % | ≥40% D0 | | | | |
| Diam at tail | MIN, mm | 3.5 | | | | |
| Tip angle (c) | MAX, deg | 40 | | | | |
| Concavity of shaft or head | MAX, mm | 0.20 | | | | |

(a) The gauge *should* pass beyond the mark since it is a "shall not exceed" dimension; i.e., less than or equal to this measurement.
(b) The gauge *should not* pass beyond the mark since it is a "shall exceed" dimension; i.e., greater than or equal to this measurement.
(c) If a rubber tip is mandated by the state association, then see javelin Rule 6-6-1 in the High School Rule book. Overall length of rubber tip 35-77 mm, diameter at front of the tip is 14-35 mm. The javelin should otherwise meet all IAAF specs.

# TABLE 5
# THROWING IMPLEMENT SPECIFICATIONS SUMMARY
# WEIGHT & SUPERWEIGHT

| **WEIGHT and SUPERWEIGHT** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| USATF RULE: 195 | | | | | | | | | |
| IMPLEMENT NAME | | **56 lb** | **20 kg** | **35 lb** | **25 lb** | **20 lb** | **16 lb** | **12 lb** | **4 kg** |
| AGE GROUP | | | | | | | | | |
| OPEN (weight) | | | | MEN | | WOMEN | | | |
| OPEN (superweight) | | MEN | | WOMEN | | | | | |
| HS, USATF Youth | | | | | BOYS | GIRLS | | | |
| MASTERS WEIGHT | | | | M30-M45 | M50-M55 | M60-M65 | M70-M75 | M80+ | |
| | | | | | | W30-W45 | W50-W55 | W60-W70 | W75+ |
| SUPERWEIGHT | | M30-M55 | M60-M65 | M70-M75 | M80+ | | | | |
| | | | | W30-W45 | W50-W55 | W60-W70 | W75+ | | |
| | | | | | | | | | |
| WEIGHT | NOM. lb | 56.00 | 44.09 | 35.00 | 25.00 | 20.00 | 16.00 | 12.00 | 8.82 |
| | NOM. kg | 25.40 | 20.00 | 15.88 | 11.34 | 9.08 | 7.26 | 5.45 | 4.00 |
| | MIN. for record, kg | 25.400 | 20.000 | 15.880 | 11.340 | 9.080 | 7.260 | 5.450 | 4.000 |
| RANGE FOR SUPPLY | MIN. kg | 25.405 | 20.005 | 15.885 | 11.345 | 9.085 | 7.265 | 5.455 | 4.005 |
| | MAX. kg | 25.425 | 20.025 | 15.905 | 11.365 | 9.105 | 7.285 | 5.475 | 4.025 |
| Overall length (NCAA) | MAX mm | | | 410.0 | | 410.0 | | | |
| Overall length (WMA, USATF) | MAX mm | 410.0 | 410.0 | 410.0 | 410.0 | 410.0 | 410.0 | 410.0 | 410.0 |
| Handle (triangular) * | MAX mm ** | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 |
| | MAX mm *** | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 |
| | MIN mm | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Head, center of gravity | MAX mm | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| Head, diameter | MIN mm | - | - | 145 | 130 | 120 | 110 | 100 | 95 |
| | MAX mm | - | - | 165 | 150 | 140 | 130 | 120 | 110 |
| Head, indoor diameter † | MAX mm | - | - | 180 | 165 | 155 | 145 | 135 | 125 ‡ |

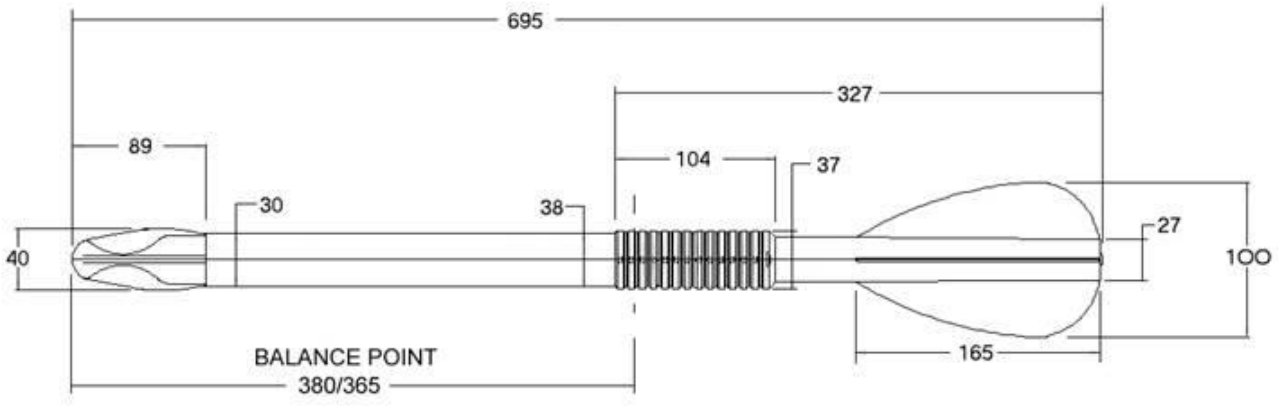
* USATF, WMA Indoor, NCAA rules only. WMA Outdoor rules do not specify handle type or dimensions.
** USATF indoor weight (filled head) only; inside dimensions
*** USATF all-metal head weight, WMA indoor and NCAA; inside dimensions
‡ Max diameter for 4 kg indoor WMA weight is 110 mm

**Note 1**: No internal movement for all-metal heads. Minimal internal movement allowed in USATF & NCAA indoor heads.
**Note 2**: See individual rule books for harness and connection requirements.

# TABLE 6
# THROWING IMPLEMENT SPECIFICATIONS SUMMARY
# MINI JAVELIN

In 2000 the Youth Committee adopted the 300 gram mini javelin for use with the younger age groups. In 2010 the 500 gram mini javelin was redefined, and the 600 gram mini javelin was introduced. The shaft, grip and fins will be made out of plastic; the tip shall be made of soft rubber with a blunt, rounded tip. The fins must be smooth, and shall be parallel to the centerline of the shaft.

| MINI JAVELIN SPECIFICATIONS | | |
|---|---|---|
| Weight, minimum, g | 300 & 400 | 500 & 600 |
| Overall Length min., mm | 685 | 1100 |
| Overall Length max., mm | 705 | 1140 |
| Length of Head min., mm | 84 | 85 |
| Length of Head max., mm | 94 | 95 |
| Tip Diameter at largest point, min., mm | 37 | 35 |
| Tip Diameter at largest point, max., mm | 43 | 45 |
| Distance from tip to CG min., mm | 365 | 560 |
| Distance from tip to CG max., mm | 380 | 610 |
| Diameter of Shaft forward of grip min., mm | 30 | 30 |
| Diameter of Shaft forward of grip max., mm | 38 | 38 |
| Diameter of Shaft behind grip min., mm | 24 | 31 |
| Diameter of Shaft behind grip max., mm | 30 | 37 |
| Diameter of Shaft at grip min., mm | 34 | 40 |
| Diameter of Shaft at grip max., mm | 40 | 45 |
| Length of grip min., mm | 99 | 105 |
| Length of grip max., mm | 109 | 125 |
| Location of front of grip from tip of tail min., mm | 322 | 550 |
| Location of front of grip from tip of tail max., mm | 332 | 570 |
| Number of Fins | 4 | 4 |
| Fin Length min., mm | 162 | 165 |
| Fin Length max., mm | 168 | 175 |
| Fin diameter (peak to peak opposing fins) min., mm | 95 | 85 |
| Fin diameter (peak to peak opposing fins) max., mm | 105 | 95 |




300 & 400 gram Mini Javelin
All dimensions (except balance point) are typical

# TABLE 7
# THROWING IMPLEMENT SPECIFICATIONS SUMMARY
# ULTRAWEIGHT PENTATHLON

| | | | Ultraweights | | | | | |
|---|---|---|---|---|---|---|---|---|
| Age Group | Weight | Super-Weight | 35 lb | 20 kg | 56 lb | 98 lb | 200 lb | 300 lb |
| | **MEN** | | | | | | | |
| Open-49 | 35 lb | 56 lb | | | | x | x | x |
| 50-59 | 25 lb | 56 lb | | | | x | x | x |
| 60-69 | 20 lb | 20 kg | | | x | x | x | |
| 70-79 | 16 lb | 35 lb | | x | x | x | | |
| 80+ | 12 lb | 25 lb | x | x | x | | | |
| | **WOMEN** | | | | | | | |
| Age Group | Weight | Super-Weight | 20 lb | 25 lb | 35 lb | 20 kg | 56 lb | 98 lb |
| Open-49 | 20 lb | 35 lb | | | | x | x | x |
| 50-59 | 16 lb | 25 lb | | | x | x | x | |
| 60-74 | 12 lb | 20 lb | | x | x | x | | |
| 75+ | 4 kg | 16 lb | x | x | x | | | |

Ref.: USATF Rule 196.

**Main body:** The main body is either a solid cylinder, or constructed of no more than two solid cylinders for the 200 lb weight, and no more than three solid cylinders for the 300 lb weight. The material shall be no softer than lead. The cylinder's diameter shall not be less than 15.25 cm, nor more than 26.70 cm.

**Handle:** The handle shall be in a triangular or modified triangular shape, with no side exceeding 20 cm inside dimension. The handle shall be made of steel rod not less than 12 mm in diameter, and must be rigid and not show evidence of elasticity or malformation after being thrown.

**Connection assembly:** The main body shall incorporate a permanent eye bolt, u-bolt or shackle in its construction, which may swivel. The handle should be connected by means of a removable shackle or links. No more than two links shall be used, in addition to the handle, shackle and main body connection.

**Overall length:** The overall length of the complete implement, from the inside surface of the handle (grip) to the bottom surface of the main body shall not exceed 45.75 cm.

**Weight specifications**: The ultraweights shall conform to the following specifications:

| **Implement** | **98 lb** | **200 lb** | **300 lb** |
|---|---|---|---|
| Minimum Weight (kg) | 44.50 | 90.80 | 136.10 |