WEIGHTS AND MEASURES HANDBOOK APPENDIX

FOR THE
PACIFIC ASSOCIATION
UNITED STATES TRACK & FIELD

Appendix to the USATF Equipment and Facilities
Specification Subcommittee's Weights and Measures Handbook

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INTRODUCTION:

This manual was prepared for the use, education and training of Inspectors of Implement in the Pacific Association. Besides dealing with general procedures, it was specifically written to train local officials how to use the implement measurement equipment available from the Pacific Association Equipment Committee and used at Stanford and the University of California at Berkeley. This manual is an appendix to the latest version of the national manual for Weights and Measures Officials, which was developed by the author for the Equipment and Facilities Specifications Subcommittee of the Officials Committee of USA Track and Field. This manual covers only variation use in the Pacific Association and the specialized Pacific Association equipment. Additional copies of both manuals are available by sending $3.00 for each copy to George Kleeman, 5104 Alhambra Valley Road, Martinez, Ca 94553-9773, 925-229-2927 to cover the cost of postage and reproduction. Comments and recommendations are welcome and can be sent to the same address or via e-mail at george_kleeman@comcast.net. These manuals are the first known publication of how to do the job of an Implement Inspector. In addition to these manuals there is available a free newsletter for Weights and Measures Officials across the country, published by the subcommittee. To get on the mailing list write to the same address or e-mail with your request.

This manual is intended as a “how to” book for the novice Inspector of Implements as well as a guide to the seasoned veteran. 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.

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. Only weighting an implement does not approve it for use in competition. It must meet all the measurement standards.

HOW TO BECOME A CERTIFIED OFFICIAL:

At the present time USA Track & Field is the major 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 or the International Amateur Athletic Federation 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 three levels of officials, Association, National and Master. Each has its own qualifications. You begin at the Association level after you have attended an officiating clinic and taken the association level test on the USATF rulebook. Each association sets the requirements for their local area. The Pacific Association covers all of Northern California from San Luis Obispo to the Oregon Border and east to beyond the Reno/Sparks area. If you want to join us or get further information in becoming a certified official, you can contact the author or the Officials Certification Chair, Jim Hume at 1561-B Marina Court, San Mateo, CA 94403 or E-mail at Jimhume.certchair@sbcglobal.net. If you are from another association, contact your local association to obtain their requirements. You can get their address from the USATF Website at www\USATF.org or www\usatfofficials.com under the certification chair. At the present time USATF is the only one who is training and certifying W&M officials for USATF, NCAA and high schools in northern California and northern Nevada.

PREMEET REQUIREMENTS:

EQUIPMENT:
This manual will describe equipment that has been developed by Norm Morrison and Carl Strombom based on their years of measuring implements in the Pacific Association. This is the equipment that is for rent from the Pacific Association and is used at the University of California, Berkeley and Stanford. You can make some of your own if you have access to shop facilities. In the future, the Equipment and Facilities Subcommittee of USATF plans to make standards for being able to checking the TRACKMASTER(TM) and other equipment being used for implement certification.

Measuring equipment must be handled with care and properly stored, maintained and calibrated 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.

NOTE: All measurement equipment should be checked at least annually against a known standard. The standard should be traceable to a Bureau of Standards standard. This is true for scales, weights and measurement devices i.e. tapes and calipers. When you first get your equipment, make sure that all implements are measured, verified and marked correctly and you know the use for each. Each year check that the gauges have not been damaged enlarged or incurred weight loss as a result of usage.

DIFFERENCE IN EQUIPMENT:
The Pacific Association, the University of California and Stanford have double pan balances. When using a double pan balance the weights go on the left and implements on the right. This can be tested by moving the ounce slide to the 1 ounce and see which way the balance moves, i.e. it take one ounce of weight or pressure on the side which should have the implements to rebalance the scale to zero. Note some of the scales have a plus and minus designation to indicate over weight or underweight.

Remember every measurement has some level of error or uncertainty associated with it. For a scale that uncertainty is called tolerance. Every scale but even an electronic scale has a degree of uncertainty. However, because there is a digital read out people tend to believe all the significant places shown. Within the tolerance/accuracy of that scale you cannot tell if the scale is weighting lighter or heavier than the indicated weight by plus or minus that tolerance. Or put another way you cannot tell the difference between the following two implements one that weight exactly at the measured weight minus the tolerance and one that weighs the measured weight plus the tolerance. Thus a scale that can measure to plus or minus 1 gram in a kilogram cannot tell the difference between a 1 kg discus weighing 999 g and 1001g or 0.999 kg and 1.001 kg. Both could read 1.000 kg on the scale. Similarly if a discus showed 0.999 kg it could weight 1.000 kg or 0.998 kg. Thus you would have to accept as legal a discus that weighed 0.999 kg on this scale but not one that weighed 0.998 kg. This is statistical reality. Obviously if you have a more accurate scale with a lower tolerance then you might be able to distinguish between the disci. Remember that there is a tolerance for any scale but particularly the electronic scale. Because there is a read out people tend to believe all the numbers.

Weights: Unless you are using an electronic scale, you will need the following weights depending on the competition:

	Men's Open	Women's Open
Shot and Hammer	16 lb.	4 kg
Javelin:	800 g	600 g
Discus:	2 kg	1 kg
Weight	56, 35 lb. (we don't have these)	20 lb. (must use most lb weights and rider)
	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:	16 lb.	4 kg
Javelin:	800 g	600 g
Discus:	2 kg	1 kg
Weight:	35 lb.	-
	Men's Masters	**Women's Masters**
Hammer:	4, 5, 6 kg, 16 lb.	3, 4 kg
Shot:	4, 5, 6 kg, 16 lb.	3, 4 kg
	Men's Masters	**Women's Masters**
Javelin:	600, 800 g	400, 600 g
Discus:	1, 1.5, 2 kg	1 kg
Weight/Superweight:	12, 16, 20, 25, 35 lb.	12, 16, 20 lb.
	High School Boys	**High School Girls**
Shot:	12 lb.	4 kg
Javelin:	800 g	600 g
Discus:	1.6 kg	1 kg
	Youth Boys	**Youth Girls**
Shot:	6, 12 lb., 4 kg	6 lb., 4 kg
Javelin:	800 g	600 g
Discus:	1, 1.6 kg	1 kg

Athletics for the Disabled:

	Javelin	Discus	Shot
Cerebral Palsy	600 g 800 g	1, 1.5 kg	4, 6 lb., 3, 4, 5 kg
Wheelchair	600 g 800 g	1, 1.5kg	2, 3, 4, 5 kg 4, 6, 8 lb.
Blind	400, 600, 800 g	1, 1.5, 2.0 kg	3, 4, 5, 7.26 kg
Ambulatory	Javelin 600, 800 g	Discus 1, 1.5 kg	Shot 4, 5, 6.25 kg
	Javelin	Discus	Shot
Special Olympics			3, 4, 6 lb., 4 kg
Hearing Impaired	800 g	2.0 kg	7.26 kg

Weights should be handled with care so as not to damage them so they either gain weight, less likely or loose weight by being dropped.
Note: There are 16 oz in a lb., 453.5924 g per lb., 28.349527 g per oz, and 2.20462 lb. per kg.

WEIGHTS AND MEASURES TOOLS FROM THE PACIFIC ASSOCIATION:

The following makes up the W&M instruments for the association:
Double Pan Balance Scale
Box of Weights

Tool Box of Instruments
Hammer Stretcher
Hammer Measuring Device
Javelin Board (2 Pieces)

SCALE WEIGHTS:
The weight box has the following weights which can be used to measure most of these implements but not all (400g, 500g, 700g, 6 kg, and weights over 16 lb.). These weights are traceable to the NBS and should be handled carefully as not to damage them and loose some of their weight.

600 g and 800 g
which allows you to weigh most common javelins but not the 400 g, 500 g and 700 g javelins. The 400 g can be approximated by using the ounce slide at between 14 oz and 14 1/4 oz since you can't get smaller than _ oz or 7 g. The correct value is 14.1 oz. This translates into 397.1 g to 404.2 g respectively. The accuracy for this is poor since it is about 1%. But you won't have more than one or two to weigh in usually. The 500 g can be approximated by the 1 lb weight plus 1.5 and 1.75 oz which is 496.1 g to 503.2g. The 700 g can be approximated very well by the 600 g weight plus 3.5 oz which is 699.2 g.

1 lb.
2 lb.
3-5 lb.
1 kg
2-2 kg
which allows you to weigh the discus at 1 kg, 2 kg, 1.5 kg (3 lb. and 5 ounces which is 1.05025 g or 2.5 g too much) and 1.6 kg (600g plus 1 kg), the shots/hammers at 6 lb., 3 kg, 4 kg, 5 kg, 12 lb., and 16 lb. The missing one is 6 kg since you can only get to 13 lb. and 3.5 or 3.75 oz, which are 5.996 and 6.003 kg or 4 grams off. At this weight that translates in 0.066% or 2 in 3000. For the 6.25 kg shot for wheelchairs you can use 13 lb. and 12.5 oz which translates into 6.251 kg or 1 g over. For these implements many of the electronic scales would be better.
Note: For conversion purposes there are 16 oz in a lb., 453.5924 g per lb., 28.349527 g per oz, and 2.20462 lb. per kg.

Scale Weights for Various Implement Weights

Implement Weight	Scale setting in oz.	600 g	800 g	1 lb.	2 lb.	5 lb.	1 kg	2 kg	Actual Weight
Number Available	16	1	1	1	1	3	1	2	
400 g	14-14.25								397.1-404.2 g
500 g	1.5-1.75			1					496.1-503.2 g
600 g		1							
700 g	3.5	1							699.2 g
800 g			1						
Implement Weight	**Scale setting in oz.**	**600 g**	**800 g**	**1 lb.**	**2 lb.**	**5 lb.**	**1 kg**	**2 kg**	**Actual Weight**
1 kg							1		
1.5 kg	5			1	1				1.5025
1.6 kg		1					1		
2 kg								1	
6 lb.				1		1			
3 kg							1	1	
4 kg								2	
5 kg							1	2	
12 lb.					1	2			
6 kg	3.5-3.75			1	1	2			5.996-6.003
6.25 kg	12.5			1	1	2			6.251
7.26 kg/ 16 lb.				1		3			7.2575

The accepted conversions (although not exact) are:

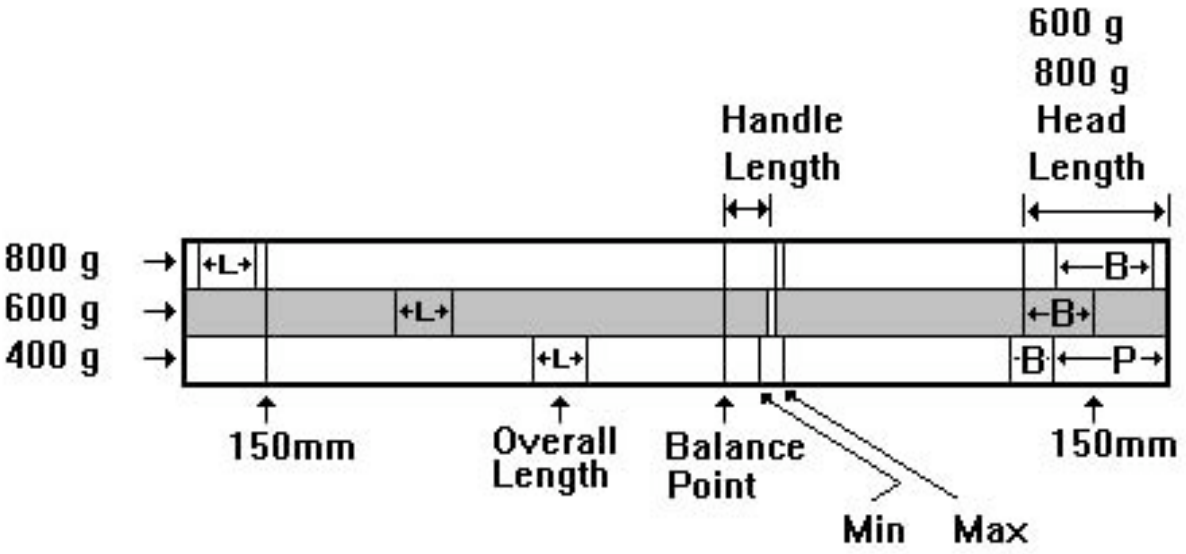
lb.	kg	lb.	kg.	lb	kg
12	5.450	25	11.340	98	44.50
16	7.260	35	15.880	200	90.80
20	9.080	56	25.400	300	136.10

Note the metric weights are the legal weights, not the lb or imperial weights.

Note you can use coins to make up the small difference for the 16lb shot by adding a penny to the 16lbs.

Coin	Weight, kg
Dime	0.0020
Penny	0.0025
Nickel	0.0050
Quarter	0.0055

JAVELIN MEASURING GAUGE:



L=Overall Length
B=Balance Point
P=Point Length

JAVELIN BOARD

Not to Scale

You can make your own out of wood or even tape on the edge of the table. The following example was made in three pieces so it could be easily transported. It is color coded so that three javelin weights can be easily measured. In fact, it can also add the 500 g and 700 g javelins and the Youth Javelin. The dimensions are:

Overall Length: 9 ft-9 in / 3.0 m
Overall Width: 3 _ in / 9 cm or 5 1/2 in for all five.
Each Piece: 3 ft 3 in / 1.00 m

It is made out of hardwood with pieces of shelf hanger pieces or aluminum angle as sides so the javelin doesn't roll off. All marks were engraved into the wood before it was painted for accuracy. The three boards are held together by hinges and pins to assure that the length is always the same. Alternatively, the javelin board could be laid out on a paper or cloth template that could be rolled up and then tapped to a table or the floor. Then you would only need to have a hinge or other sharp edge that you could place at the balance point.

PACIFIC ASSOCIATION TOOL BOX INDEX:

This box includes the various manuals, markers and measuring devices for all the implements.

Weights and Measures Signs: Paper signs to indicate location of Weights and Measures in a red folder.
Weights and Measures Spec Tables: Complete tables of specifications for all implements in an orange folder.
Weights and Measures Implement and Impoundment Forms: Copies of forms from Appendix.
Marking Pens: Some Marks a Lots pens are available in the kit for emergency use, but these aren't the best marking devices.
Implement Measuring Tape: 3 meter/10 ft combination tape for javelin and event circles. This can also be used for measuring the bar in the High Jump and Pole Vault
Level: Used to level scale location and for javelin board to get balance point
Calculator: For use in calculating percentages for javelin measurements.
Caliper: Used to measure the hammer wire diameter and the various points on the javelin.
Newer kits have an electronic one. Extra battery in the box.
Rulebook: Copy of NCAA rulebook since it is the one most used.
Handbook: There is a copy of this handbook in a red folder. Note included in 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 fast check of the javelin taper or to measure the taper when used with feeler gauges as well as measuring the slope of the discus.
Angle Gauge: For checking javelin point
Shot and Hammer Diameter Gauges: For 16 lb., 12 lb. and 4 kg. If doing a Masters meet, you will need to use the appropriate one. Variations in Masters Diameters means you will need to use more than one gauge on the shot.
Discus Gauge: Single one for 1 kg, 1.6 kg and 2 kg. By appropriate use of the gauge you can do all but the minimum diameter of 200 mm for the 1.5 kg master discus also. But since it is only 11 mm smaller than the maximum which is the same maximum diameter as the high school implement you can use a stop or insert 11 mm thick. If you're going to do a lot of Master's meets you may want to get a new Trackmaster gauge. See specification summary table in appendix)
Notebook: To do any needed calculations and to record calibration procedure. Also record the following information on any implement that is impounded. Owner/Athlete, School, type, brand, failing parameter, condition of implement, i.e. is failure due to wear or damage or is it a new implement. See Appendix for a sample Weights and Measures Inspector of Implements form.

OTHER MEASURING DEVICES:

Javelin Measuring Gauge: You can make your own out of wood or by marking a folding ruler or cloth tape. Either of the latter should be taped to the front side of one of the tables for easy gauging. The association's are made of wood and allow all of the length measurements as wall as checking the balance point. An alternate which you can make is shown under personal equipment on page 4.
Hammer Stretcher and Measuring Gauge: The hammer stretching device is used to straighten the wire so an accurate measurement can be made. The gauge is used to do the measurement once the wire is reasonably straight and or taut. Don't put so much pressure on it that you bend the handle. Be careful in using it because the handle can come off the retainer.

GENERAL PROCEDURE FOR ALL IMPLEMENTS:

NOTE: When using any scale, treat it carefully. When removing implements or weights, make sure to do it gently so that you do not damage the knife edges or bearings. This is particularly true for a single pan balance such as that used in the TRACKMASTER(TM) or the double pan available in the Pacific Association kit. Hold the bar when removing weights or implements so the bar doesn't damage the knife edges or bearings or you don't move the counter balance calibration weight. With care, your scale will last a long time. Without this care you can damage it very quickly. Remember scales and weights need to be calibrated periodically. With normal use that should be at least bi-annually if not annually. When moving scales make sure to protect the knife edges or bearings by immobilizing the scale. You can use foam rubber under the arm and/or on top of it for protection. You should calibrate the scale before use each day or each time you move it. For the double pan try weighing two identical weights and then switching them to make sure you are balanced and level enough. For the Pacific Association equipment you can use either the 2 kg or the 5 lb. weights.

Before putting any weight on the Pacific Association 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, you can use a washer on each pan (so balanced) to stop the implement from rolling. On an electronic scale with one pan you can tare the added weight out. For the hammer put the ball in the handle loop. Be careful because if you have a new wire, it may spring out. Make sure the wire isn't hitting anything while you are trying to weight the hammer. For the javelin, the

center of gravity is near the front of the handle so tend to place the javelin so that the front of the handle is near the center of the pan. In general you should 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 following sections detail how to certify each of the implements. Because there are subtle differences between the wording in each rulebook, it is always a good idea to review the appropriate rulebook the night before the meet particularly if it is for a meet that is using a different set of rules than you have recently be using. Always use the rulebook as the ultimate authority, unless you know there has been in intervening change. The E&FS committee tries to keep you apprised of these changes as they occur during the year. If you have e-mail, send your address to georgeklee@aol.com **so that this can be done in a more timely fashion. These sections try to point out the similarities and the differences between the books.**

SHOT: (Numbers refer to section in National Manual)
3. Weigh the shot. Note if you are using the Pacific Association double pan scale place an equal size washer on each pan to keep the shot from rolling off the pan, and place the weight on one pan and the shot on the washer on the other one.

DISCUS:
3. In measuring the thickness of the discus be sure that the measuring tool is perpendicular to the sides. Some thickness measuring devices are too thin so that if not held properly might indicate a correct thickness when it really was too thin. This gauge should be at least a _" thick to minimize this problem since at this thickness it is hard to use the gauge and not be perpendicular to the sides. Note there are both a maximum and a minimum. The Pacific Association equipment does not have the maximum 13 mm gauge.

HAMMER:
2. When you use the hammer wire stretcher make sure the wire is straight but not stretched and not curled. Be careful not to apply too much tension so that you start to stretch the wire, the wire loops, or bend the handle. The weight of the hammer itself is usually not be enough to straighten the wire, particularly if the wire has been curled from normal use or for transport. You may need to apply some additional tension to these hammers. In using the hammer stretcher, be careful to make sure the handle and ball are properly placed so that they won't come loose as you increase tension. Tighten until the wire it is reasonably taut. Don't bend the handle. When taut use the gauge to check the maximum and minimum lengths and the wire diameter particularly at each end. Be careful in doing this measurement. If you are using the TRACKMASTER(TM) hammer stand, we recommend you use a "C" clamp to hold it firmly to the table surface.

5. We don't have this check in our kits although it can be simply made. Check the center of gravity by placing on 12 cm sharp edge orifice. It passes if it doesn't fall off.

WEIGHT:
2. Check the weight. Typically our scales will not weight this implement (too heavy) so you will need to make alternate plans for weighting it.

JAVELIN:
3. Use the javelin board to measure the overall length and the incremental distances as shown in the equipment section, page
4. Alternately you can mark a retractable steel tape or adhesive tape on the edge of a table with the necessary dimensions. This allows you to quickly lay the javelin on it and check the overall length, the length of the point, and length of the grip. You can also mark the 150 mm tip and tail marks used later for contour measurements. Note the 400g measurements are done at 125 mm.
5. Check the weight. If you are using the Pacific Associations weights, we don't have a 400g, 500g or 700g weight but you can use the sliding scale to get close. See previous table for values needed.
6. Check the tip to see if it meets the maximum of forty degree taper using the tip guide. This can also be done with a plastic protractor and several pieces of tape. The Pacific Association kits have a measuring device. Since the spec is a maximum it needs to hit the side at the bottom or not hit the sides at all to be legal.

USE OF OTHER METHODS:
If you know of other methods that should be discussed please pass them along to the editor at 5104 Alhambra Valley Road, Martinez, Ca. 94553-9775, 510-229-2927 or e-mail georgeklee@aol.com.