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Programs

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Instructions for Testing Livestock and Animal Scales

Subject to the Packers and Stockyards Act



Table of Contents

Introduction	1
Definitions	2
Examination of a Scale	3
Inspection	3
Zero-Balance Condition	4
Indicating and Recording Elements	5
Installation	7
Stock Rack, Gates, and Scale Deck	9
Weighing Elements	9
Suitability of Load Cells	10
Maintenance, Use, and Environmental Factors	11
Assistance	11
Pre-Test Determinations	11
Acceptance and Maintenance Tolerances	11
Tolerance Testing and Error Weight Testing	12
Test	12
Zero-Load Balance Test	12
Sensitivity Test	13
Discrimination Test	13
Shift Test	14
Increasing Load Test	14
Decreasing Load Test	16
Radio Frequency Interference Test	16
Motion-Detection Test	16
Special Tests	16
Evaluation	17
Approval	17
Rejection	17
Repair	17
Removal	17
Condemnation	17
Test Reports	18
Packers and Stockyards Regional Offices	25

Introduction

This publication conforms to the concept of primary use of International System of Units “SI” (metric) measurements recommended in the Omnibus Trade and Competitiveness Act of 1988 by citing SI units before inch-pound units where both units appear together. In accordance with U.S. Department of Agriculture policy, the meter/liter spellings are used in this document. However, the metre/liter spellings are acceptable.

Regulation 201.71 issued under the Packers and Stockyards (P&S) Act of 1921 incorporates by reference National Institute for Standards and Technology (NIST) Handbook 44. All scales subject to the P&S Act are required to meet applicable requirements contained in the Handbook 44. It can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402-9325. It also is available for inspection at the Federal Register Information Center, Room 8301, 1100 L Street, NW, Washington, D.C.

This publication is a practical guide for testing livestock and animal scales. It explains proper procedures for inspecting and testing scales subject to the P&S Act, while following the requirements of Handbook 44. Each year Handbook 44 is subject to change and adoption by State and Federal Governments. The currently-adopted version of Handbook 44 should be referenced for specific legal requirements. Copies of the P&S Act and regulations can be obtained from any of the regional offices listed at the end of this publication.

Under the P&S Act, the USDA’s Grain Inspection, Packers and Stockyards Administration (GIPSA) requires printing devices on all livestock and animal scales. Inaccurate scales are not permitted to be used until they have been repaired, retested, and found to be accurate.

Scale owners are responsible for maintaining the accuracy of their scales. The scale is tested to determine if it is being maintained in an accurate condition. This is referred to as the “as found” condition. Owners are required to have their scales tested as found semiannually. These tests are done by either weights and measures officials or by scale testing agencies hired by the scale owner. Test reports are sent to GIPSA’s Packers and Stockyards Programs (P&S) regional offices, to report the “as found” condition, adjustments, repairs, and final test results. If the scale is adjusted, it must be calibrated as closely as possible to zero error. The test procedures in this publication are the same as the requirements in Handbook 44 and should be followed by private test agencies, weights and measures officials, and P&S personnel.

Proper tests of livestock and animal scales require sufficient certified test weights. (Certified test weights should be traceable to “the National Standard of Mass”.) Test weights should be certified by an approved laboratory at least every 3 years (normally a State weights and measures laboratory). They should be maintained in appearance, accuracy, and suitability between periods of certification.

A competent test can only be accomplished by properly trained and experienced personnel, using sufficient test weights, and following prescribed test procedures. The “as found” test should disclose the accuracy and performance of the scale under all conditions which may occur during actual use. Routine tests should not be conducted blindly by rule-of-thumb methods. They should be made with a thorough understanding of the effects of the test and the reaction of the various tests being conducted.

P&S personnel provide training and teach the National Conference on Weights and Measures (NCWM) National Training Program Module 7, “Livestock and Animal Scales,” several times a year. Attendance is open to all scale testing personnel.

Definitions

A **proper test** is one that fully discloses the accuracy and other performance characteristics of the scale under all conditions which may prevail during actual use. It includes the application of loads of standard test weights in successive stages to the maximum capacity at which the scale is used; includes separate tests of individual components, which independently may affect weighing accuracy; demands a reasonably exact determination of errors which develop; and, finally, requires the recording in permanent form of all pertinent data developed during the test.

A **competent testing agency** is one which employs experienced personnel and utilizes a sufficient amount of standard test weights to conduct tests in accordance with prescribed procedure. Agencies considered competent, on that basis, include certain weights and measures departments, railroad scale departments, commercial scale repair and service companies, and some stockyards and packers having adequate test equipment and employing qualified scale mechanics or service personnel.

Discrimination (of an automatic-indicating scale). The value of the test load on the load-receiving element of the scale that will produce a specified minimum change of the indicated or recorded value on the scale.

A **suitable interval** between tests is a period

of approximately 6 months. In instances where tests and inspections disclose that a scale does not maintain its accuracy between tests or is otherwise undependable, or is mechanically deficient as regards construction, installation, or maintenance, more frequent tests may be required.

Livestock scale. A scale equipped with stock racks and gates and adapted to weighing livestock standing on the scale platform.

Animal scale. A scale designed for weighing single heads of livestock.

Sensitivity response (SR). A performance requirement for a non-automatic-indicating scale. Specifically, the minimum change in the position of rest of the indicating element or elements of the scale in response to the increase or decrease, by a specified amount, of the test load on the load-receiving element of the scale.

Shift test. A test intended to disclose the weighing performance of a scale under off-center loading.

Zone of uncertainty. The zone between adjacent increments on a digital device in which the value of either of the adjacent increments may be displayed.

Examination of a Scale Inspection

Inspection

The inspection phase of the examination is used to determine if the scale complies with specifications and other technical requirements relating to its design, installation, operation, maintenance, use, and suitability for the intended use and environment. Consideration of the potential for fraudulent use and abuse is part of the inspection process. The decision to accept or reject is the duty of the regulatory official. The private test agency should use the same criteria to select, sell, install, maintain, and repair the scale to meet these requirements.

A proper inspection will require sound judgment to determine if the scale is appropriate based on each situation, intended use, and environment. You must be alert to detect fraudulent use, abuse of equipment, and inappropriate application of the scale. Scales are designed with specific applications in mind. Some de-

vices are designed for a single purpose, others have a multitude of features which may be turned OFF or ON depending on the intended use. These features may be mandatory in one situation and prohibited in another. For example, a tare device is not appropriate and could be used to facilitate fraud on livestock and animal scales. The zero adjustment should be sufficient for most zero balance needs. However, a tare device may be appropriate and necessary if a horse and rider were on the scale during weighing of livestock and the zero adjustment is not sufficient to zero balance such a heavy load.

New scales will require more time and effort to inspect than a scale that is familiar to you from previous experience or testing. Many scales will have received a National Type Evaluation Program (NTEP) Certificate of Conformance. NTEP is a cooperative program between the NIST, the NCWM, the States, scale manufacturers, and users for determining if a scale prototype conforms with the requirements of Handbook 44. The inspection may be easier if a Certificate of Conformance was issued, since you may not need to extensively examine certain design features on a NTEP evaluated scale. Remember that the Certificate of Conformance means that a model was examined (not all models), and you should at least review each applicable requirement on a new scale.

Manufacturers submit models of their devices for evaluation under the NTEP program. NIST or an authorized laboratory conducts the evaluation. When a device is found to meet all applicable requirements, NIST issues a Certificate of Conformance for that device. The certificate provides details of the evaluation results and device characteristics necessary for inspection and use in commerce. You should determine if a model of the device has been type evaluated, and, if it has, you should review the certificate to determine which features have been approved. The certificate will state

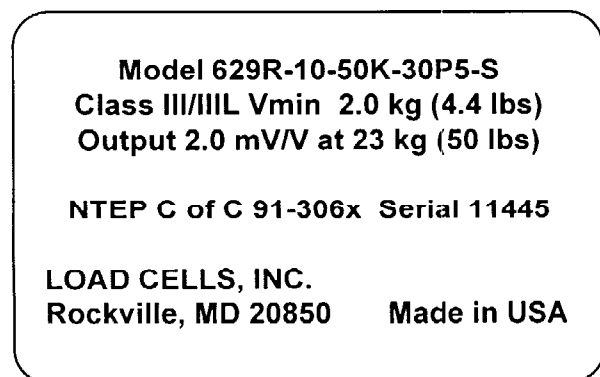


Illustration 1. Identification Plate with NTEP Certificate Number

the intended application of a device type. If you find a new or unusual device or feature on a device in an unusual application, it should be thoroughly tested to determine its appropriateness and to assure that it does not facilitate fraud. NCWM has issued a National Type Evaluation Program Index of Device Evaluations (NCWM Publication 5) to help determine if a particular device has been evaluated. The index is available from:

NIST, Office of Weights and Measures
P.O. Box 4025
Gaithersburg, MD 20885

The major areas that must be inspected are as follows:

1. ZERO-BALANCE CONDITION. Check the zero-load balance "as found." If the scale is not found in a zero-load balance condition, the user should be advised how to adjust the scale to a proper zero-load balance and maintain the scale in a proper balance condition at all times. The scale must be able to indicate and record zero balance. Dial/printer and digital/printer scales must be able to record out-of-balance conditions. The scale deck should be clean and free of debris which might adhere to test equipment or otherwise cause the balance to change during the test.

Dial and Digital Scales: On dial and digital scales, the indicator should display zero and the scale must also print the displayed zero. Dial scales will normally have a screwdriver-adjustable balance ball that is enclosed within the cabinet for adjusting the indicator so it is directly in line with the zero defined on the dial face. Digital scales may have screwdriver, knob, or push-button zero adjustments. A push-button zero adjustment must be operated or accessible only by a tool or enclosed in a cabinet, unless a motion detect circuit prevents its operation within specified limits. This prevents the operator from changing the balance

while a load is going onto the scale during weighing.

The digital scale may have an electronic circuit that automatically zeroes the scale. This is commonly called an Automatic Zero Setting Mechanism (AZSM). AZSMs have a required range of (+/-) 1 division on animal scales and (+/-) 0.6 divisions on livestock scales. P&S recommends that an AZSM not be operational since personnel operating the gates frequently have caused the scale to track-off weight when they made contact with the gates. On a digital scale, zero is defined as (+/-) ¼ division if there is a center-of-zero indicator or (+/-) ½ division without a center-of-zero indicator. All digital scales manufactured after January 1, 1993, must automatically maintain a center-of-zero condition of (+/-) ¼ division or have an auxiliary center-of-zero indicator that defines a zero-balance condition to (+/-) ¼ division.

Beam Scales: On beam scales, return all poises to the zero position. The poise should not be capable of going behind zero. The pawl should sit firmly in the zero notch and the notch should not be worn. The normal balance position of a weighbeam, with a balance indicator, is when the tip of the indicator points to the zero position in the central target area and the beam is horizontal. On a beam scale without a balance indicator, a zero-load balance condition is when the beam is equidistant between the trig loop stops and the beam is horizontal. The scale must have a zero balance adjustment that cannot shift to alter the balance condition. Balance balls should not rotate by themselves. They should require a tool, normally a screwdriver to adjust them. Requiring the use of a tool makes adjustments of zero obvious and prevents accidental changes to the zero-load balance reference. Any loose material used for adjusting zero-load balance must be enclosed so it cannot shift position or be removed. Tip and butt counterbalance weights should not have loose nails, nuts, bolts, etc., on them.

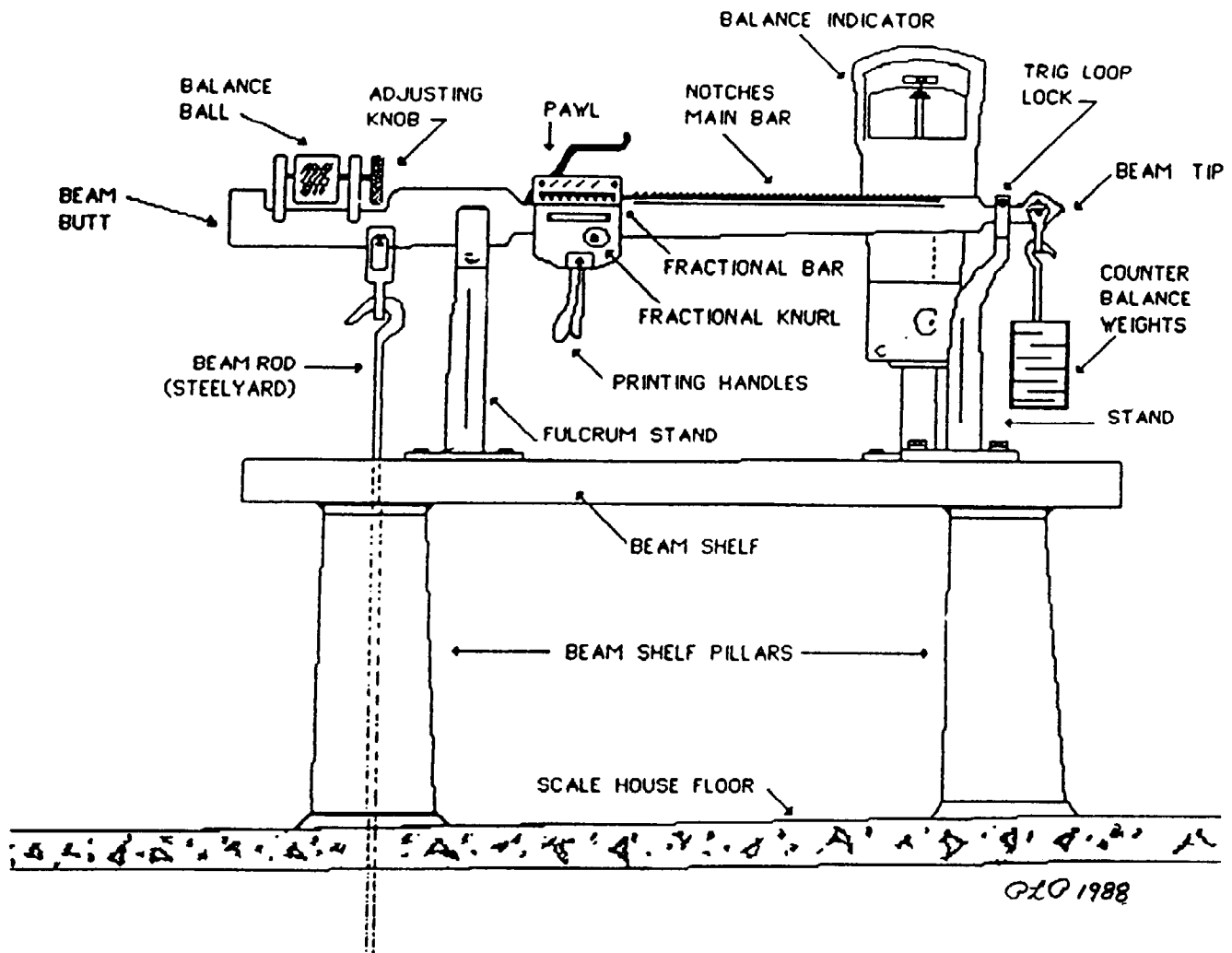


Illustration 2. Type – Registering Weighbeam

2. INDICATING and RECORDING ELEMENTS. Scale divisions must be in a unit of weight equal to 1, 2, or 5. They may be decimal multiples or sub-multiples of 1, 2, or 5 (for example: .1, .2, .5, 1, 2, 5, 10, 20, or 50 pounds). Livestock scales normally have 5 pound scale divisions and animal scales 1 pound scale divisions. Under special conditions, livestock scales may have scale divisions greater than 5 pounds. However, weighing loads of less than 5,000 pounds are not permitted on scales with 10 pound divisions and weighing loads of less than 10,000 pounds are not permitted on scales with 20 pound divisions.

Scales manufactured after January 1, 1986, must be marked with an Accuracy Class such as Class III for animal scales and Class III L for livestock and vehicle scales.

Automatic indicating scales must be equipped with effective damping to bring the indicating elements quickly to rest (3 to 5 oscillations is desirable for dial and balance indicator type scales). Indicating and recording elements should be appropriate in design and adequate in amount. They should be clear, definite, accurate, and easily read under normal conditions. They should not display or record values above 105 percent of the scale's capacity.

The scale should be suitable for its intended use. This includes, but is not limited to, its capacity, the number and value of scale divisions, and minimum load capacity.

Animal scales must have at least 500 scale divisions and not more than 10,000 divisions; livestock scales must have at least 2,000 divisions and not more than 10,000 divisions. To determine the number (n) of scale division, divide the scale capacity by the value of the scale division (d).

$$\frac{\text{Scale Capacity}}{\text{Scale Division}} = \frac{20,000}{5} = 4,000$$

It is recommended that livestock scales not be used for weighing loads of less than 50 scale divisions and animal scales should not be used for weighing loads of less than 20 scale divisions. This recommendation may be used to identify the need for another scale that may be more appropriate for the intended use.

If a tare device has been demonstrated as being appropriate on a livestock scale, the division size must be the same as the scale division. The tare mechanism shall only operate in a backward direction from zero.

Graduation on beam scales must be uniform in size, shape, and arrangement. They must be easily and accurately read. Notches should not be worn and the reading edge of the poise should be sharply defined and parallel to the beam's graduations. Material used for adjusting the weight of the poise must be contained and firmly fastened in place.

Parallax conditions on balance indicators and dials must be reduced to a practical minimum. The clearance between the index of the indicator and the graduations may not be more than 1.5 mm (0.06 inch).

Indications and recordings must agree with one another. In other words, the digital indicator must agree with the printer, scoreboard, and remote indicators. P&S recommends the scoreboard and remote indicators display the signal sent to the printer. This prevents disagreement among buyer, seller, and weighmaster.

All scales are required to be marked with the manufacturer's name, initials, or trademark and the model designation of the device. This information must be located so that it is readily observable without having to use a tool to disassemble a part of the scale. Scales manufactured after January 1, 1968, must be marked with a nonrepetitive serial number. Those manufactured after January 1, 1977, should have all controls marked. The accuracy class, scale capacity, sectional capacity, and concentrated load capacity (CLC) must be marked on scales manufactured after January 1, 1986. The identification plate with this information should be permanently attached to the device. Rivets are acceptable but screws are not considered permanent. A pressure-sensitive label is acceptable if it cannot be removed without being destroyed or distorted in appearance so that it cannot be reused.

Adjustable components that can affect the performance of an electronic scale are required to be sealed with a security seal. These components should be located inside the housing of the scale indicator.

It is impossible to list all the inappropriate conditions for a scale; you must be alert and sensitive to the application and intended use for each situation. Ask yourself: Does this scale make sense in this situation? Does the device meet the requirements of this use? Is the environment appropriate for this scale? Are these features needed to perform and get accurate weighing results?

3. INSTALLATION. The scale must be designed and installed in such a way that it is protected from environmental hazards. Foundations and supports of the scale must be installed according to the scale manufacturer's instructions and specifications. All elements and mechanisms should be installed and maintained in a plumb and level condition. They should be sufficiently strong, rigid, and permanent for the purpose. There must be adequate clearances between the scale and surrounding walls to prevent any contact between the two, either during a weighing or when the deck is empty.

Load cells installed in the steelyard should be installed in the scale pit to protect it from environmental problems, such as being bumped, exposure to space heaters, etc. The load cell cable should be routed in the scale pit to the indicator so that it does not interfere with other backup weighing systems.

The ON/OFF approaches to the scale should be on the same plane as the scale deck. If the scale is installed in a way that makes it impractical to test in a normal manner, it is the scale owner's responsibility to supply labor and facilities to permit testing.

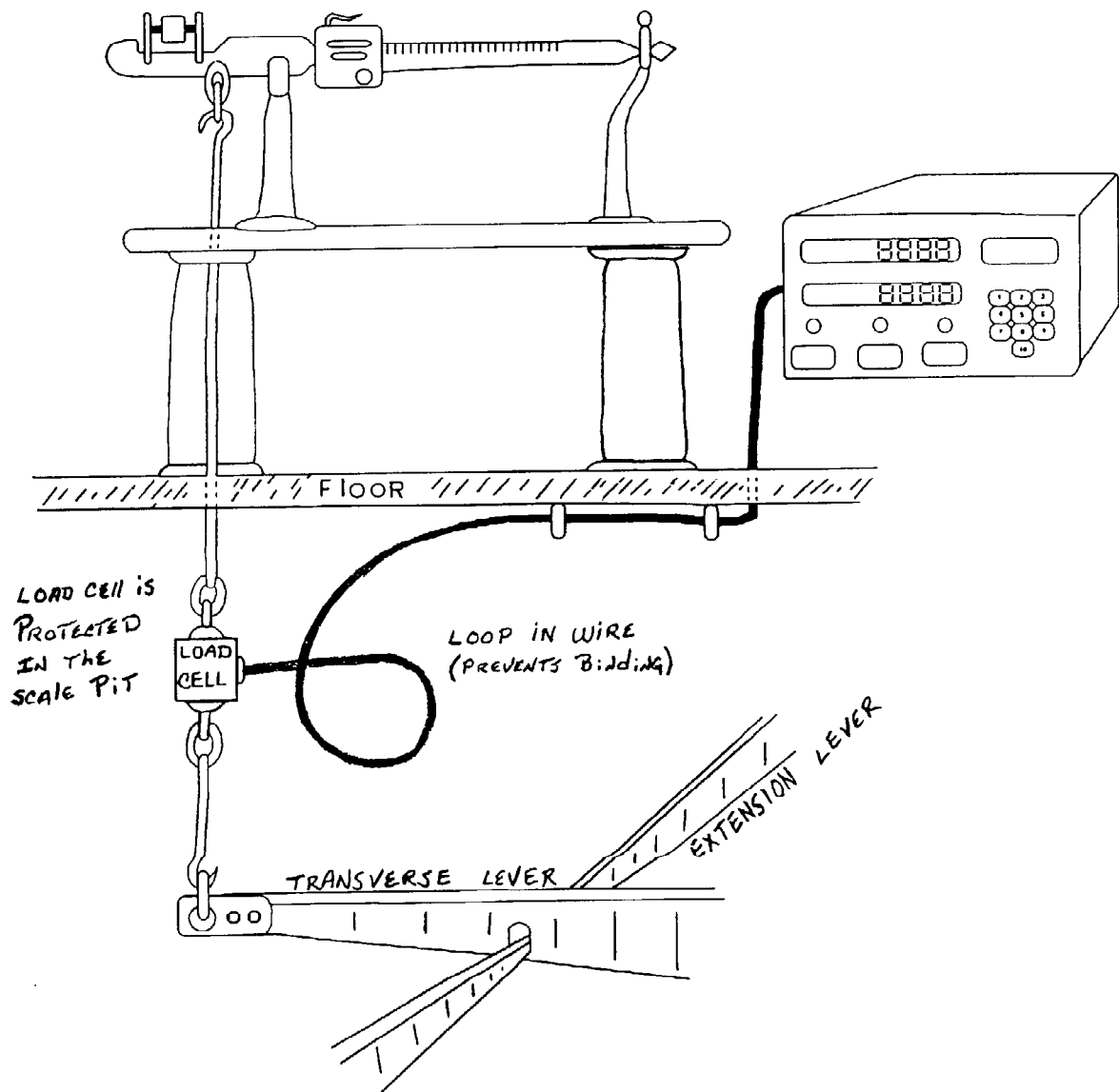


Illustration 3. Electro-Lever Installation

The weighmaster should have a clear view of the indicator, scale platform, and gates. If the weighmaster's view is obstructed, there must be a convenient and permanent communication link between the weighmaster and the load-receiving element. A video surveillance camera and monitor may serve the purpose.

Most livestock and animal scales are designed to have a pit underneath the scale deck that allows access to the weighing elements. A clearance height of at least 48 inches is recommended as the minimum for ready access. At least one electrical outlet should be in each pit, so that a light cord can be plugged in for inspection, repair, and cleaning. The depth of the pit may vary in those States with a Pit Law.

Pit-Less and Pit Scales: The cost savings associated with pit-less scales may not be realized in the livestock industry. Pit-less scales require special attention. There may be problems with: (a) poor access for cleaning; (b) the scale binding due to an accumulation of dirt and debris; (c) lack of access to inspect, adjust, replace, or repair load cells; and (d) ramps that are too steep and unsafe for loading and unloading livestock or test weights. The design of pit-less scales should be such that binding conditions caused by a build-up of debris can be controlled by a reasonable amount of housekeeping and cleaning.

The scale pit should be of a design that can easily be kept clean. It should be free of standing

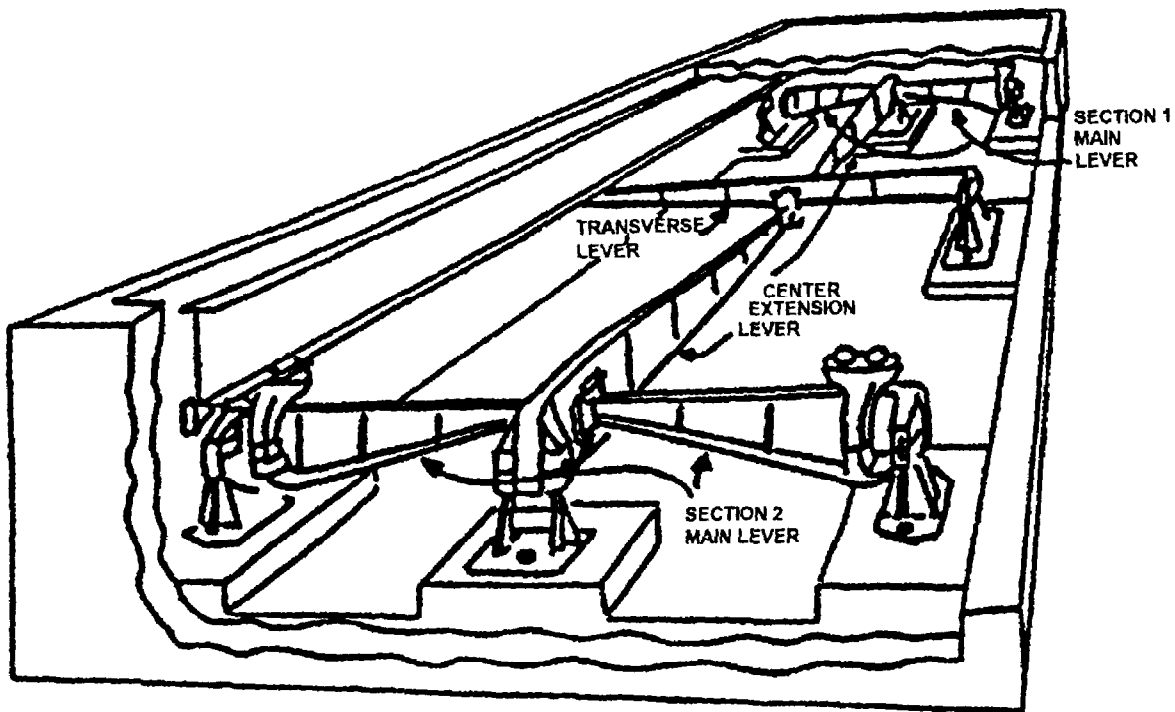


Illustration 4. Two-Section Scale

water and any build-up of dirt or debris that might interfere with live components of the scale. A pit depth of 48 inches and a floor sloping toward a drain or sump is most desirable. These recommendations should be sufficient to meet most housekeeping needs. Some states have additional requirements for scale pits.

4. STOCK RACKS, GATES, and SCALE DECK. Livestock and animal scales must have stock racks and gates to contain the animals being weighed. They must be firmly anchored to the scale platform in a way that assures adequate clearance all around, and must be fenced or walled to prevent interference during weighing. Racks must be substantial, whether made of wood or metal. The necessary entrance and exit gates must have positive latches. There should be at least a 12.5 mm (½ inch) and not more than 25 mm (1 inch) clearance between the pit wall and deck coping and a 75 mm (3 inch) clearance around adjacent structures. The outside edges of the deck should be beveled

toward the deck (undercut) to prevent debris from binding. The deck should be made of a suitable material, with a surface that provides appropriate traction for livestock, while considering the need to clean the deck as well as the ability to move test equipment.

5. WEIGHING ELEMENTS. The weighing elements must be designed in a way that minimizes friction, and reduces the likelihood of parts being dislodged accidentally. Pivots should be sharpened to a knife edge and be of hardened steel, and each should be opposed by a bearing of suitable shape. The nose-iron must be held locked in place by a set screw, bolt, or nut. On scales with a capacity over 1,000 kg (2,000 lbs.) the position of a nose-iron must be defined accurately, clearly, and permanently as determined by the factory adjustment. Adjustable parts must be securely held in adjustment. On electronic scales, this means that the potentiometer located in junction boxes or in the indicator must be secured so that its adjustment

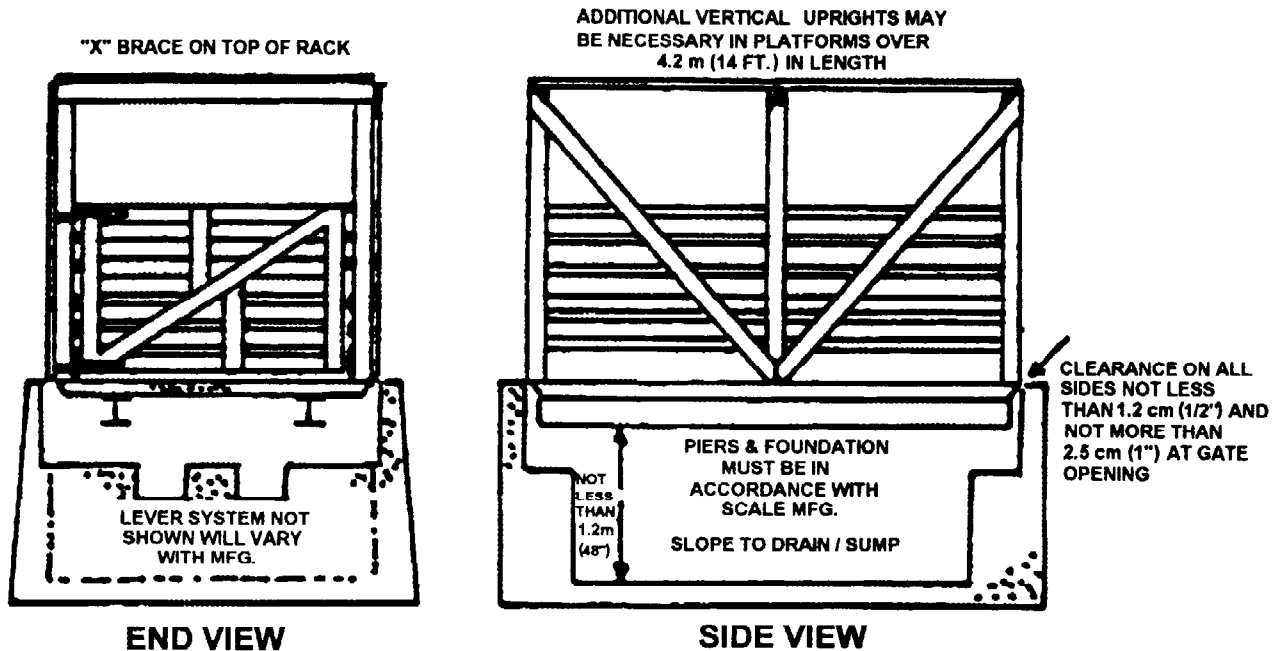


Illustration 5. Livestock Scale

position cannot change easily in normal use. With total electronic scales the load cells should be installed so that they may be readily accessed for inspection, repair, or replacement. An electro-mechanical scale with the load cell in the steelyard should be installed in the scale pit. The load cell cable should be installed and routed in a manner to prevent it from interfering or binding with live parts such as levers, steelyards, etc.

6. SUITABILITY OF LOAD CELLS.

Electronic livestock and animal scales are either total electronic or electro-mechanical systems. Load cells must be adequate for the intended use. NTEP load cells will be marked with a V_{min} value and "S" or "M" for single-cell or multiple-cell application. Single ("S") cells can be used in both single-cell or mul-

tiple-cell applications but multiple ("M") cells can be used only in multiple-cell applications.

The load cell is appropriate for use without levers if it meets the following formula:

$$V_{min} \leq \frac{d}{\sqrt{N}}$$

d = the scale division

N = the number of load cells

The load cell is appropriate for use with levers if it meets the following formula:

$$V_{min} \leq \frac{d}{\sqrt{N \times (\text{scale-multiple})}}$$

d = the scale division

N = the number of load cells

SIDE WALLS

SCALE DECK

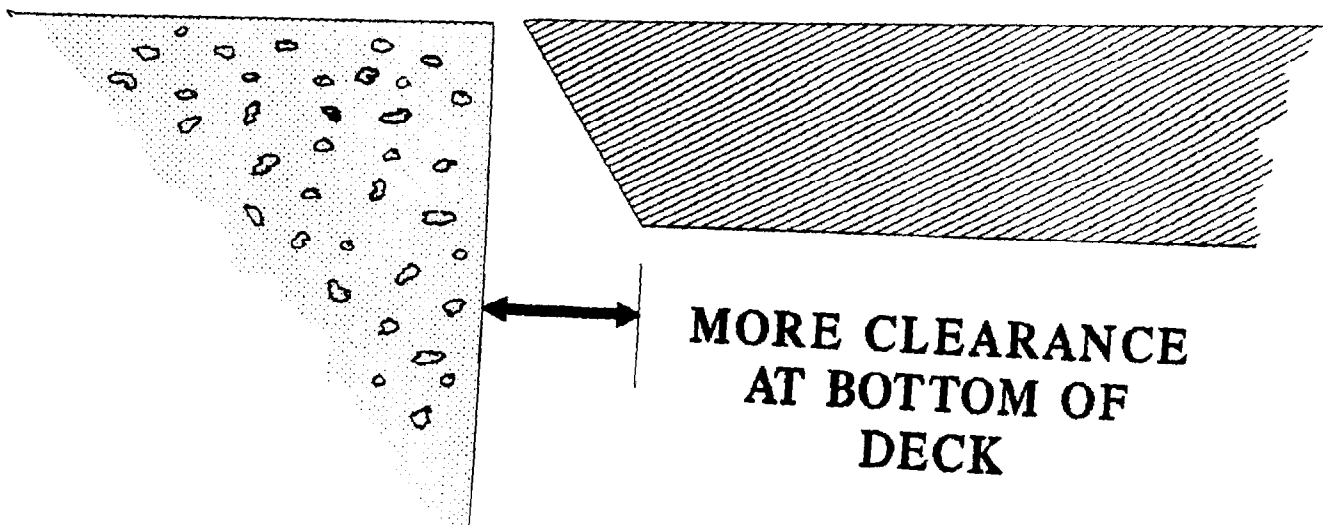


Illustration 6. Scale Deck is Undercut to Prevent Binding

7. MAINTENANCE, USE, and ENVIRONMENTAL FACTORS. Inspection should verify that the scale is being maintained in proper operating condition and is operated only in the manner for which it is designed. None of the design or operational features of the scale should facilitate the perpetration of fraud. It should be suitable for the intended use and adequately protected from the effects of environmental factors. The installation should be according to the manufacturer's specification. The scale system should be kept clean and free of dirt, debris, and standing water in the pit. Faulty or worn parts must be replaced and the scale should always be maintained in proper operating condition. The scale should not be modified in a manner different than recommended by the manufacturer or other competent engineering authority.

8. ASSISTANCE. In some situations, it may be necessary to ask the owner or operator of the scale to supply labor, accessories, or special equipment in order to properly conduct the scale test. Assistance may be necessary because of the construction or location of the scale. You may require a forklift, front-end loader, or the manpower necessary to position and remove test weights. The owner may make modifications to the facility to correct the situation by replacing nailed-down cleats with a hinged grid for cattle traction, or by installing additional gates or doors for easier access to the scale.

Pretest Determinations

Pretest determinations identify tolerances and other appropriate test factors to be applied to the scale. A scale that would always weigh without error would be ideal. Since perfection is not often attained, regulations set a limit on the amount of error allowed. The amount of error allowed is the tolerance for commercially

used scales. All tolerances apply equally to over-registration (weighing heavy) and to under-registration (weighing light).

Tolerances were established primarily for use by regulatory officials. They should not be used to adjust a scale so buyers or sellers benefit from scale errors. Handbook 44 requires adjustments be made to bring the scale as close as possible to zero error. It also requires owners and users to properly maintain the scale. Tolerances are applied to all indications and recorded representation of the scale. Recorded representations include printed and recorded weight values that might be found on scale tickets, automatically recorded invoices, computer-generated electronic records, etc.

ACCEPTANCE and MAINTENANCE TOLERANCES. New scales and recently repaired scales should have smaller errors than those that have been in service for a period of time. The accuracy of a scale usually deteriorates with use.

Acceptance Tolerances apply to: (1) new scales not yet in service, (2) the first official test of a scale put in service within the past 30 days, (3) the first test on a scale returned to service in the past 30 days following an official rejection and repair, and (4) the first test on a scale returned to service in the past 30 days following major reconditioning or overhaul.

Maintenance Tolerances apply to all other tests. Generally, Acceptance Tolerances are one-half ($\frac{1}{2}$) the Maintenance Tolerance.

Absolute Maintenance Tolerances apply to shift tests on livestock and animal scales. When you compare the error in one section to the others or when you compare one corner to the others, the difference between them cannot be greater than the Maintenance Tolerance for that test load.

TOLERANCE TESTING and ERROR WEIGHT TESTING. There are two methods of determining if a scale is in or out of tolerance.

Tolerance Testing is conducted when maintenance tolerances are applied to dial-printer and digital-printer scales. Tolerance testing does not determine the actual error in the scale, it determines if the error is within the prescribed tolerance. Since acceptance tolerances are one-half the maintenance tolerance, their values are not always whole numbers. They are combinations of whole numbers and/or fractions, such as $\frac{1}{2}$ (d), $1\frac{1}{2}$ (d), $2\frac{1}{2}$ (d), etc. When fractions of a division are part of the tolerance, error weight testing procedures must be followed to determine the fractional error.

Error Weight Testing determines the actual amount of error in the scale and we compare it to the tolerance. If the error is less than the tolerance, the scale is accurate; if not, the scale is inaccurate. By adding small-denomination error weights to the platform, the amount of under-registration is determined. By removing small-denomination error weights from the platform, the amount of over-registration is determined. Error weight testing is conducted on beam scales and dial scales without a printer and on automatic indicating or recording scales when applying acceptance tolerances.

Tolerances. Scales manufactured after January 1, 1986, are required to be marked with an accuracy class of III for animal scales and III L for livestock scales. There are different tolerances for Non-Marked, Marked Class III, and Marked Class III L animal and livestock scales.

You must be alert to the type of scale prior to determining the correct tolerance that will be applied. **Tolerances are not reprinted in this publication. Refer to the currently adopted version of Handbook 44 for correct tolerances, or contact the nearest P&S regional office.**

Test

The test determines if the scale complies with performance requirements. P&S regulations define a proper test as one which "...fully discloses the accuracy and other performance characteristics of the scale under all conditions which may prevail during actual use..." This at the very least implies that any method of test which simulates actual use may be conducted when testing a scale for accuracy and performance. The following test procedures have been developed based on critical areas where scales have frequently failed to yield accurate weights or perform as intended. Weighing of live animals is not the same as weighing static loads. Since the load is dynamic, special considerations are given to this weighing application. Additionally, these procedures correspond to scale repair calibration procedures; for example, all sections or corners must have the same error prior to making any other adjustments to the scale.

The following procedures are the minimum necessary to meet the requirements of a proper test:

1. ZERO-LOAD BALANCE TEST is conducted each time the test load is removed from the scale platform. The zero-load balance should not change by more than the minimum tolerance for this scale. Repeatability is important at all test points. It is particularly important at zero because zero is the reference point from which all measurements and adjustments are made. It should be conducted at the beginning with a zero load, after the Shift Test and at the end of the Scale Test. Regardless of the type of scale being tested, balance weights equal to or greater than the maximum tolerance that may be applied are placed on the scale and the scale is balanced to zero. These balance weights will be used for the sensitivity test or the discrimination test at zero-load and at the maximum test load. The balance weights

are necessary to determine the amount of under-registration at zero-load or the amount of over-registration at maximum load on automatic indicating scales. They are used to determine the actual amount of error on beam scales.

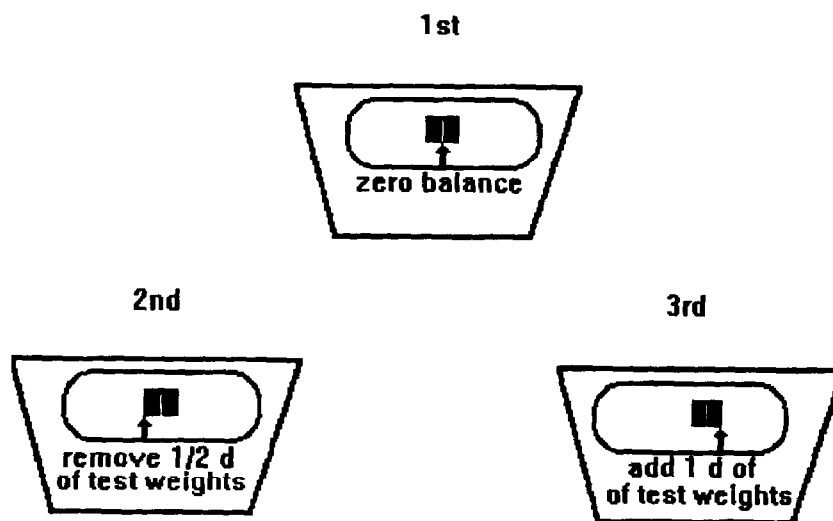
2. SENSITIVITY TEST is conducted on beam scales only. This test is conducted at zero-load balance and maximum test load. The sensitivity requirement (SR) is the load that will produce a specified minimum change in the position of the indicating element (weighbeam or balance indicator). It displays the sensitivity of the scale. A scale that is too sensitive is difficult, if not impossible, to weigh live animals on. A scale that is not sensitive may not weigh to its minimum scale division. The test is conducted with the scale in a balance condition.

On scales without a balance indicator, balance weights are added or removed to bring the beam

to rest at the top or bottom of the trig loop. A maximum of two divisions of test weight should produce the required change.

On scales with a balance indicator, as balance weights equal to one division are added or removed from the scale platform, the indicator should move to the opposite edge from one end to the other of the central target area or move one division on a graduated scale.

3. DISCRIMINATION TEST is to dial and digital scales as SR is to beam scales. It is a test to determine the amount of load change required to change the indication from one division to another. It is a test for "rounding" capability, and for verification of the "Zone-of-Uncertainty." The test is required on automatic indicating scales manufactured after January 1, 1986. The test is conducted when environmental conditions such as wind and weather will not affect the results obtained.



SR equals the amount of weight to cause the indicator to move from one edge to the other edge of the indicator.

Illustration 7. Sensitivity Test

It is conducted on digital scales below the edge of the zone-of-uncertainty for increase load tests or above the zone-of-uncertainty for decrease load tests. The test is conducted at zero-load balance and at maximum test load. Small-denomination weights are added or removed until the displayed weight changes and is stable; the scale is now at the upper or lower edge of the Zone-of-Uncertainty. A load of 1.4 divisions, either added or removed, should cause a change in the indicated weight by two divisions. This is an important test to determine suitability for weighing animals to the nearest scale division.

4. SHIFT TEST is conducted to verify the weighing performance of a scale under off-center loading conditions. There are three types of Shift Test:

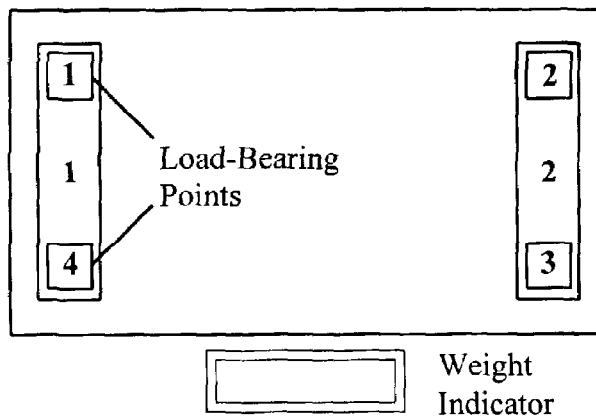


Illustration 8. Two-Section Scale

End Tests are done on animal scales with half capacity test loads on each end of the scale deck. Corner Tests may be difficult but may be conducted at $\frac{1}{4}$ capacity.

Corner Tests or **Main Bearing Tests** are made on two section scales. A test load of $\frac{1}{4}$ of scale capacity is successively placed on each of the four corners or over the main bearings.

Section Tests are made on scales with more than two sections. Each section is tested with at least two different test loads on each section of the scale. For example, load and test each section at $\frac{1}{2}$ Concentrated Load Capacity (CLC), which might be 5,000 kg (10,000 lbs). Then load and test each section at CLC, which might be 10,000 kg (20,000 lbs). The test loads are distributed in an area at least 1.2 m (4 ft.) long and the width of the platform. The maximum test load in the Section Test should not exceed the CLC marked on the scale. It should not exceed the marked sectional capacity on scales installed prior to January 1, 1989.

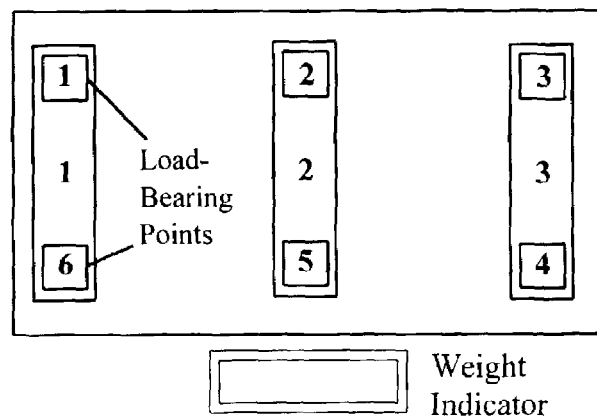


Illustration 9. Three-Section Scale

5. INCREASING LOAD TEST is conducted on all scales with the test load centered or distributed evenly on the deck. **The scale should be tested to its used capacity.** Test weights should be distributed so that sectional load limits are not exceeded.

GIPSA Scale Co.
 MODEL 1995A
 Serial Number 3414S
 Capacity 13,600 kg x 2 kg
 CLC 9,000 kg
 (Capacity 30,000 lbs x 5 lbs.)
 (CLC 20,000 lbs)
 CLASS III/IIIL

Illustration 10. Do Not Exceed Capacities

Beam scales: Begin by testing the fractional poise at zero, then at $\frac{1}{2}$ capacity and at full capacity, on a 2 kg (5 lb.) division scale this would be at zero, 25 kg (50 lb.), and at beam capac-

ity. Next, test each 50 kg (100 lb.) notch through 500 kg (1000 lbs.). Testing each of the notches through 500 kg (1000 lbs.) should not be compromised on beam scales. These notches are the most frequently used and are subject to the most wear. It is suggested that you test other notches based on the year. For example, in 1998 test the 1800, 2800, 3800 etc., notches, then in 1999, test the 1900, 2900, 3900, etc., notches. If this recommendation is followed, every 10 years all of the main notches will be tested.

Dial scales: The test should be made every 50 kg (100 lb.) through 500 kg (1000 lbs.) and then each quarter of the dial should be tested. If drop weights or unit weights are in use, test at least the first unit weight. Tare bars are not always considered appropriate on livestock and animal scales, but if they exist they should be tested at zero, $\frac{1}{2}$ capacity, and full capacity.

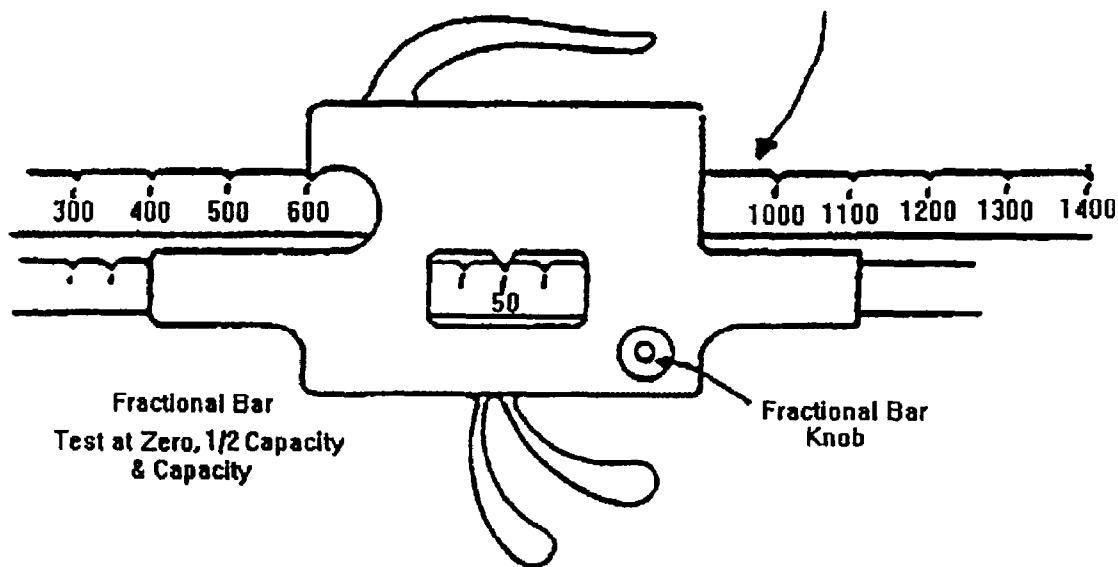


Illustration 11. Notched Weighbeam

Digital scales: Several tests (at least three) should be made between zero and 500 kg (1,000 lbs.) and then at larger test loads to determine linear errors, for example, 2500, 5000, 7500, 10,000, 15,000, 20,000, etc.

6. DECREASING LOAD TEST is made on all dial and digital scales with test loads distributed equally or centered on the scale platform in the following manner:

On scales manufactured after January 1, 1986, marked with an Accuracy Class III and with 1,000 or more scale divisions, the test is made at each tolerance break point. For example, an animal scale marked Class III with a capacity of 2,500 kg (5,000 pounds) with ½ kg (1 lb.) scale divisions, the decreasing load test is conducted at 2,000 kg (4,000 pounds), 1,000 kg (2,000 pounds), and 250 kg (500 pounds).

All other scales are tested at one-half of the maximum test load applied during the increasing load test.

7. RADIO FREQUENCY INTERFERENCE TEST (RFI) is made to determine if Radio Frequency will adversely affect weighing accuracy. Under the same conditions, tests for electro-magnetic Interference may be conducted. These tests are conducted only if this type of equipment is in use at or near the scale.

8. MOTION-DETECTION TEST is made to determine if the range of motion detection is within prescribed limits and that its operation is suitable for the intended use. The test is conducted by putting a known weight on the scale deck and causing motion. The test can be conducted using test weight and, if possible, live animals. If livestock is used, the live animals are weighed individually in a static condition. Their individual weights are obtained and totaled. Next, they are weighed as a group in a static condition. Last, they are put in mo-

tion and weighed repeatedly on the digital scale. Either with test weights or live animals, when changes in the displayed weight are greater than the motion-detection requirement, the printer is activated. No printed weight values should be obtained greater than plus or minus one scale division on animal scales and plus or minus three scale divisions on livestock scales.

NOTE: Motion detection capabilities do not relieve the weighmaster of the responsibility to “weigh accurately to the nearest weight value that can be recorded.”

The weighmaster is required to print the weight after the load has stabilized. Motion detection circuits have been installed, in order to limit the amount of false weight that can be printed. The weighmaster's duty begins when the load has stabilized and is within the range of motion detection. Scale operators are then required to determine and print the accurate weight of the load, not plus or minus 3 divisions of the actual weight. Therefore, printing devices which remove this ability by automatically printing when the load is within the range are not considered suitable for weighing livestock.

9. SPECIAL TESTS should be made when unusual conditions exist that cannot be checked by following normal test procedures. These conditions may be due to a special design or an unusual condition of use. Computers interfaced with weighing devices frequently require special tests to determine if the system renders accurate weights or the design is such that it does not facilitate fraud. When conducting special tests follow the definition: “A Proper test is one which fully discloses the accuracy and other performance characteristics of the scale under all conditions which may prevail during actual use.”

Evaluation

Upon completion of the inspection, pretest determination, and test, an evaluation is made to determine if the scale is suitable (correct) or not suitable (incorrect) for commercial weighing. Only the regulatory official is authorized to approve or reject a scale from commercial use. Scale owners are required to have their scales tested semiannually. These tests are conducted by Weights and Measures officials and/or the owner hires a private test agency to conduct the test “as found” and submit the report to P&S for approval or rejection. If the “as found” test discloses that the scale is “incorrect,” it will be rejected until repairs have been made. It shall not be used until it has been inspected and tested and found to be “correct.” Normally, the private test agency is also a scale repair company and capable of correcting the scale. In such cases the scale test report might display:

- (1) the “as found” condition of the scale;
- (2) the adjustments or repairs made to the scale; and
- (3) the retesting showing it is now “correct” and suitable for commercial use.

Private test agencies that have been hired to sell, install, repair, or maintain the scale need to know if a scale meets or does not meet the requirements for commercial use.

The evaluation will result in action being taken to approve, reject, repair, remove, or condemn. The action taken is based on the test report information submitted.

1. APPROVAL of a scale means all appropriate inspection and tolerance requirements have been met. Such a device is considered “correct.” The scale may be used for commercial weighing, subject to semiannual testing.

2. REJECTION of a scale means it does not meet one or more of the inspection and tolerance requirements. Such a device is considered “incorrect” and is rejected until it has been found “correct.” If the scale does not meet any performance requirement and it gives inaccurate weight, it is rejected and must be removed from commercial use until it has been repaired and found “correct.”

3. REPAIR is required before an “incorrect” scale can be used for commercial purposes. Repairs may be made to correct accuracy or performance requirements, or they may be made to correct a specification or user requirement. Repair of a scale is the responsibility and duty of qualified technicians; repairs should not be made by the regulatory officials, scale owners, or users.

4. REMOVAL may be necessary for a scale that is “incorrect,” since it could be used either by mistake or intentionally to obtain an incorrect weight.

5. CONDEMNATION of a scale is the final official action to reflect that a scale is beyond suitable repair. Such scales are either removed, destroyed, or confiscated by the regulatory official.

Test Reports

Test reports are required to be completed on official forms supplied by P&S or other exempt forms that supply substantially the same information. Copies of the forms are supplied free of charge to scale test personnel. An original and two carbon copies of the report must be prepared. A copy should be forwarded to the P&S regional office. One copy is for the scale owner and one is for the scale testing agency.

Separate test report forms should be completed for each indicator, when multiple indicators are attached to a single platform or when a single indicator is attached to multiple platforms. Backup scales should be tested each time the primary scale is tested. If they are not tested, they should be lead wire sealed to prevent use.

The following explains each block of information to be completed on the scale test report forms:

1. The page number is normally 1 of 1. If additional space is needed or when testing multiple indicator/platform installations, number pages 2 of 2, etc.
2. Complete the name, address, city, state, and ZIP code of the scale test agency; you may wish to include phone numbers.
- 3-7. Fill in the name of the scale owner and the address, city, county, and state where the scale is located. Directional addresses may be helpful in rural locations.

8. List the name of the scale manufacturer of the beam, dial, or digital indicator.

9. Identify, from the I.D. plate, the model number of the indicator as designated by the manufacturer.

10. Copy the serial number of the indicator found on the I.D. plate.

11. Check the block as to the type of indicator and if it has printing capabilities.

12. Fill in the name of the manufacturer of the balance indicator installed on beam scales.

13. Determine the pit depth of the scale.

14. List the type or design of the lever system or load cell. Examples: "S" or straight; "A" or truss; pipe; pipe and load cell; 4-cells; 6-cells; etc.

15. Determine the scale capacity (maximum nominal capacity).

16. Determine the minimum scale division.

17. Check the block if the scale is non-marked, or marked III or III L. It may be marked as both III and III L.

18-20. Inside the rack, measure and multiply the length times the width for platform size in square meters or square feet. Use this chart with the platform size to determine the used capacity:

Livestock Scales Used Capacity		
	1 square meter (m ²)	1 square foot (sq. ft.)
Cattle	540 kg.	110 lbs.
Hogs and Calves	340 kg.	70 lbs.
Sheep and Lambs	240kg.	50 lbs.

Examples:

$$4m \times 2\frac{1}{2}m = 10 m^2$$

$$10 \times 540 \text{ kg} = 5,400 \text{ kg Used Capacity}$$

$$14' \times 8' = 112 \text{ sq. ft.}$$

$$112 \times 110 \text{ lb.} = 12,320 \text{ lbs. Used Capacity}$$

21. Check each of the accessories as part of the scale.
22. Fill in your observation and opinion as to the access to the scale for testing.
23. The date you are testing the scale.
24. The date the scale was last tested.
25. The housekeeping and maintenance condition of the scale.
26. This is for use by Weights and Measures officials only.
27. Fill in the SR on beam scales or the discrimination on dial and digital scales, at zero and maximum test loads.
28. Complete the range (plus - minus) at

which motion detection prevents printing of weight values.

29. Complete the range (plus - minus) at which the scale will automatically re-zero minor balance changes.

30. It is important that you fill out the test report in the sequence and in the manner you conducted the test. If you begin a test and determine that the scale is defective, and then correct the defective condition, record this in sequence on the test report.

(1) The location or position on the platform of the test weights.

(2) The amount of test weights on the scale.

(3) The amount of correction weights used to balance the scale at zero load.

(4) On beam scales: the amount of error weights, added or removed, to balance the scale. On dial and digital scales: the indicated or printed weight.

31. Use the "Remarks" section for needed explanations, comments, adjustment you made, recommendations needed to correct a defective condition, etc.

32. Obtain the signature of the owner or responsible person acknowledging that they have received a copy of the "Test Report."

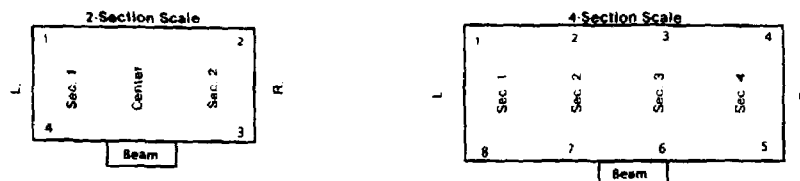
33. The signature of the scale inspector or person(s) testing the scale.

You were hired by the scale owner to follow established test procedures.

EXPLANATION OF TERMS AND ABBREVIATIONS

1. TEST WEIGHT POSITION (Corners and Sections).

The corners and sections of a scale platform are designated as shown in diagrams below when an observer is standing in the weighing position facing the scale platform.



2. SR (Sensitivity Response).

SR is a measure of the sensitiveness of a scale and is defined as the change in load required to change the position of rest of the indicator a definite amount. The term SR does not apply to automatic indicating scales.

3. ERRORS.

If the scale indication exceeds the value of the applied test load (*overregistration*) the error is designated as plus (+). If the scale indication is less than the value of the applied test load (*underregistration*) the error is designated as minus (-).

SUGGESTIONS TO OWNERS OF LIVESTOCK SCALES

The following suggestions and recommendations are offered in the interest of improving maintenance and livestock weighing practices.

1. VISIBILITY.

The weighbeam, dial or digital instrument should be located so that the weighmaster has a full and unobstructed view of the platform, stockracks and gates.

The weighbeam, dial, or digital instrument should be located so that the weighing will be done in full view of the interested parties.

2. INSTALLATION.

Careful installation by a competent scale mechanic will tend to reduce maintenance costs and improve weighing accuracy. Scales are precision devices and require regular maintenance to assure continued accuracy.

Ready access to the scale pit should be provided through the neck of the pit or by an outside entrance.

For a fully electronic load cell scale, access to the weighing elements (load cells) must be provided for the purpose of inspection and maintenance of the weighing elements.

3. APPROACHES.

Approaches should be level and on the same plane as the scale platform.

4. SCALE PLATFORM.

The scale platform should be waterproof.

Concrete platforms, scored or well roughened, are recommended.

Where cleats are used, they should be of metal or sturdy wooden construction in the form of a hinged grid.

Clearance around edges of platform should be not less than 1/2 inch, and edges should be undercut.

5. STOCK RACKS.

Stock racks should be of substantial wooden or steel construction, and be firmly anchored to the platform.

Stock racks should have a clearance of at least 3 inches from all adjacent structures and have adequate side protection to prevent interference during the weighing.

Entrance and exit gates on stock racks should swing freely and have positive latches. The preferred location of gates is at the ends of the platform rather than the sides.

6. MAINTENANCE.

The scale should be regularly serviced by a competent scale mechanic.

The lever system and structural steel in the pit should be kept well painted.

Pivots and bearings should be packed with a protective grease. Periodically this grease should be removed and the pivots repacked.

Weighbeam notches and poises should be kept clean.

The weighbeam should be protected by a fabric cover when not in use.

7. TESTING.

Scales must be tested at least twice a year by a competent scale testing agency.

Adequate provision should be made for access of the testing equipment to the scale.

U.S. DEPARTMENT OF AGRICULTURE
GRAIN INSPECTION, PACKERS AND STOCKYARDS ADMINISTRATION
PACKERS AND STOCKYARDS PROGRAMS
LIVESTOCK SCALE TEST REPORT

Public reporting burden for this collection of information is estimated to average .25 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the form. Send comments regarding this burden estimate or any other aspects of this collection of information, including suggestions for reducing the burden, to USDA, OIRM, Clearance Officer, Room 404-N, Washington, DC 20250. When replying refer to the OMB Number and Form Number in your letter.

PAGE NO.

141

TEST AGENCY (Name, address, city, state, zip code)
OVERLOAD SCALE & REPAIR Co.
PIPE LEVER, NE
(402) 1BR-549

SCALE OWNER
LEVER BROTHERS MEAT PACKERS INC.

ADDRESS
12300 CHECK LINK RD

CITY
READING COUNTY
ARMSTRONG STATE
KS

SCALE MANUFACTURER (Indicator)
RICE LAKE MODEL NO.
HMC 8000 SERIAL NUMBER
RL 20207 TYPE INDICATOR
 Beam Dial Digital Printer BALANCE INDICATOR (Name)
N/A

PIT DEPTH
4 FT. TYPE LEVERS
4 10K SCALE CAPACITY
10,000 Lbs. SCALE DIVISION (d)
5 Lbs. CLASS OF SCALE
 Not Marked Marked III Marked III L PLATFORM SIZE
16 x 9 PLATFORM CAPACITY
10,000 Lbs.

SPECIES WEIGHED
CATTLE ACCESSORIES: AZSM (auto-zero) Scoreboard or Video Displays Scale & Computer are Interfaced
 Motion Detection Computes: Head/Average Weight

TEST DATE
MO DA YR
1 2 10 9 6 DATE LAST TESTED
MO DA YR
6 2 4 9 7 CONDITION OF:
1. Gates and Racks **ON GATE DRAGS**
2. Scale Deck **GOOD**
3. Scale Pit **CLEAN AND DRY**

ACCESS TO SCALE FOR TESTING
GOOD

TEST RESULTS
 APPROVED CONDEMNED
 REJECTED OTHER

TEST DATA

SR (Sensitivity Response) OR DISCRIMINATION TEST
ZERO LOAD = **1.4(4) = 10** Lb. MAXIMUM LOAD = **1.4(4) = 10** Lb.

MOTION DETECTION RANGE = **+/- 15** Lb. AZSM (auto-zero) RANGE = **+/- 3** Lb.

TEST WEIGHTS		BALANCE WEIGHTS (Pounds)	ERROR WEIGHTS OR INDICATED WT. (4)	ERROR COL. 3-4 (Pounds)	TEST WEIGHTS		BALANCE WEIGHTS (Pounds)	ERROR WEIGHTS OR INDICATED WT. (4)	ERROR COL. 3-4 (Pounds)
POSITION (1)	POUNDS (2)	(3)	(4)	(5)	POSITION (1)	POUNDS (2)	(3)	(4)	(5)
BALANCE	0	As Found		0	CENTER	800	20	800	0
BAL	0	20	0	0	↑	900	↑	900	0
AZSM	ZERO'S	3 LBS Plus Found			✓	1000	↑	995	-5
DISCRIMINATION	- 7LB CHANGED Display +/- 10 LB.				DISTRIBUTED	2500	↑	2495	-5
CORNER #4	2500	20	2500	0	↑	5000	↑	4990	-10
#1	2500	↑	2495	-5	↓	7500	✓	7485	-15
#2	2500	↑	2500	0	DISTRIBUTED	10,000	20	9985	-15
CORNER #3	2500	✓	2495	-5	DISCRIMINATION	7LB CHANGED Display +/- 10 LB.			
BALANCE	0	20	20	0	DISPLAY	BLANKS AT 10,500			
CENTER	100	↑	100	0					
	200	↑	195	-5					
	300	↑	300	0					
	400	↑	400	0					
	500	↑	500	0					
	600	✓	600	0	Dist.	5,000	20	4995	-5
CENTER	700	20	700	0	BALANCE	0	20	0	0

DECREASING LOAD TEST (Dial and Digital Scales Only)

REMARKS

1. REQUIRED ON-GATE THAT DRY WHEN OPENED.
2. RECOMMEND SCALE BE SERVICED PRIOR TO NEXT TEST ALSO P&S DOES NOT RECOMMEND AZSM BE OPERATIONAL ON LIVESTOCK SCALES.

RECEIPT OF REPORT ACKNOWLEDGE (Signature)
[Signature]

SCALE INSPECTOR (Signature)
M. W. Stephens

U.S. DEPARTMENT OF AGRICULTURE
GRAIN INSPECTION, PACKERS AND STOCKYARDS ADMINISTRATION
PACKERS AND STOCKYARDS PROGRAMS

Public reporting burden for this collection of information is estimated to average 25 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the form. Send comments regarding this burden estimate or any other aspects of this collection of information, including suggestions for reducing the burden, to USDA, OIRM, Clearance Officer, Room 404-W, Washington, DC 20250. When replying refer to the OMB Number and Form Number in your letter.

PAGE NO.
1 OF 1

LIVESTOCK SCALE TEST REPORT

TEST AGENCY (Name, address, city, state, zip code)
Equal Arm Scale Company
RT 2 Box 46
APEX, N.C.

SCALE OWNER
Godwin Livestock Inc

ADDRESS
HWY 17 EAST

CITY
Widdfall

COUNTY
Chowan

STATE
NC

SCALE MANUFACTURER (Indicator)
CARDINAL

MODEL NO
XYZ 789

SERIAL NUMBER
12654

TYPE INDICATOR
 Beam Dial Digital Printer

BALANCE INDICATOR (Name)
SPARKS

PIT DEPTH
4 Ft.

TYPE LEVERS
P.P.E

SCALE CAPACITY
10,000 Lbs

SCALE DIVISION (d)
5 Lbs

CLASS OF SCALE
 Not Marked Marked III Marked III L

PLATFORM SIZE
14 x 8

PLATFORM CAPACITY
7840 Lbs.

SPECIES WEIGHED
HOGS

ACCESSORIES: AZSM (auto-zero) Scoreboard or Video Displays Scale & Computer are Interfaced
 Motion Detection Computes: Head/Average Weight

ACCESS TO SCALE FOR TESTING
Good

TEST DATE
MO: **1** DA: **2** YR: **17** 9/6

DATE LAST TESTED
MO: **7** DA: **2** YR: **3** 9/7

CONDITION OF:
1. Gates and Racks **Good**
2. Scale Deck **Good**
3. Scale Pit **NEEDS CLEANING ***

TEST RESULTS
 APPROVED CONDEMNED
 REJECTED OTHER

TEST DATA

SR (Sensitivity Response) OR DISCRIMINATION TEST
ZERO LOAD = **5 = 3/8"** Lb MAXIMUM LOAD = **5 = 3/8"** Lb

MOTION DETECTION
RANGE = **N/A** Lb

AZSM (auto-zero)
RANGE = **N/A** Lb

TEST WEIGHTS					TEST WEIGHTS					
POSITION (1)	POUNDS (2)	BALANCE WEIGHTS (Pounds) (3)	ERROR WEIGHTS OR INDICATED WT. (4)	ERROR COL 3-4 (Pounds) (5)	POSITION (1)	POUNDS (2)	BALANCE WEIGHTS (Pounds) (3)	ERROR WEIGHTS OR INDICATED WT. (4)	ERROR COL 3-4 (Pounds) (5)	
BALANCE	0	0	3	-3 **	CENTER	700	25	26	-1	
Balance	0	25	25	0	DISTRIBUTED	800		25	0	
SR	0	25	22 1/2 / 27 1/2	5 LB SR		900		25	0	
CORNER #4	2500	25	27	-2		CENTER	1000		25	0
" #1	1	25	25	0		2000		26	-1	
" #3	1	25	28	-3		3000		26	-1	
" #2	2500	25	25	0		4000		27	-2	
Balance	0	25	25	0		5000		28	-3	
CENTER	50	25	25	0		6000		29	-4	
1	95	20	21	-1		7000		31	-6	
	100	25	25	0		8000		33	-8	
	200	25	24	+1	SR	8000	33	30 1/2 / 35 1/2	5 LB SR	
	300	25	25	0	DECREASING LOAD TEST (Dial and Digital Scales Only)					
	400	25	25	0						
	500	25	25	0						
CENTER	600	25	25	0	BALANCE	0	25	24	+1 B.C.	

REMARKS
* KEEP SCALE PIT CLEAN ON A REGULAR BASIS.
** SCALE WAS FOUND WITH A -3 LB. BALANCE CONDITION.

RECEIPT OF REPORT ACKNOWLEDGE (Signature)
J.C. Harris

SCALE INSPECTOR (Signature)
Charles Oakley

FORM P&SP 212 (3-96) (Edition of 16-89 may be used)

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