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SPECIFICATIONS FOR THE REPAIR OF SCALES OF LARGE CAPACITY.

FOREWORD

Practice in maintenance repairs to scales of large capacity has not kept pace with improvement in types of scales and weighing methods. That the discreditable practice of renewing pivots in scales of large capacity without "sealing" the levers is still followed to a remarkable extent is common knowledge. To protect owners from being victimized when placing orders and accepting deliveries, the need of a code of rules covering large capacity scale repairs has been pressing for some years. To serve as such a code is the essential purpose of these specifications.

A committee was organized within the National Scale Men's Association* in 1928 to prepare specifications for overhauling and repair of large capacity scales. The committee report was formally adopted at the meeting of the Association at Chicago, March 12, 1930, and later published as the Association's Bulletin No. 1. As given here the code differs only in editorial detail from that adopted by the Association.

The specifications describe what are considered minimum requirements for a satisfactory job of scale repair and are intended primarily to be submitted with requests for bids or estimates covering costs. Owners of large capacity scales needing repair should view with suspicion any statements to the effect that something less than the specification requirements will suffice.

*The National Scale Men's Association, C. L. Richard, Secretary, 5800 West 69th Street, Clearing Station, Chicago, Illinois.

SPECIFICATIONS

I. GENERAL

1. Application. These specifications apply to repairs to scales of large capacity, particularly repairs intended to restore the scale to its original condition.

2. Definition. A large capacity scale is one designed to weigh loads which by nature of size, constituents or other circumstances can not be, or are not ordinarily, handled over the scale manually; particularly, railroad track scales, motor-truck scales, and hand-operated hopper scales.

II. PIVOTS AND BEARINGS

1. General. Whenever, because of wear or for any other reason, it becomes necessary to renew the pivots and bearings in a large capacity scale, the entire lever system shall be taken to a shop or to some other point where adequate facilities are available for the creditable performance of such work.

2. Stock and Dimensions Required. Pivots and bearings removed on account of breakage, wear, or corrosion shall be replaced with parts made of new steel stock of identical lengths and substantially equivalent in other dimensions to those removed.

3. Material. Pivots and bearings shall be made of high carbon steel or of steel known to the scale trade as "Special Alloy Pivot Steel."

4. Design. Pivots shall be so designed and manufactured that the sides joining to form the knife-edge shall make an angle that will not exceed 90 degrees and that the offset of the knife-edge as figured from the center line of the pivot at its base shall be within 10 per cent of the width of the pivot for "machined-in" pivots and 15 per cent of the width of the pivot for "cast-in" pivots.

5. Mounting.

(a) Fastening: All pivots shall be firmly fastened in place without swedging, caulking, or the use of liners.

(b) Continuous Contact: All pivots shall be mounted so as to secure equal and continuous contact of the knife-edges with their respective bearings for the full length of the parts designed to be in contact; in loop bearings the knife-edges shall project slightly beyond the bearings in the loops.

(c) Position: The pivots shall be so mounted that each knife-edge in a given lever will be maintained in a horizontal plane under any load and so that planes bisecting the knife-edge angles in a given lever will be parallel to each other.

6. Support for Projecting Pivots. The reinforcement on the levers to support projecting pivots shall be tapered off to prevent lodgment of dirt next to the pivots and to provide proper clearances.

7. Accuracy Required in Setting Pivots.

(a) Levers without Nose Irons, Except Main Levers: In levers such as extension levers and shelf levers, not equipped with nose irons, the designed multiple of the lever shall be maintained within 0.1%. The distance between end knife-edges shall not differ from the nominal, or designed distance by more than 1/16 inch.

(b) Levers Equipped with Nose Irons: Levers equipped with nose irons shall be sealed with each nose iron so located that 1/2 inch movement in either direction is possible, and when sealed the multiple shall be correct with 0.1% of the designed multiple. The distance between end knife-edges shall not differ from the designed distance by more than 1/16 inch. The position of each nose iron as determined by the shop adjustment shall be accurately, clearly, and permanently indicated by marks on the lever and nose iron which shall meet on a common line.

(c) Main Levers: The multiple of main levers shall be maintained correctly within 0.15% of the designed multiple. The distance between end knife-edges shall not differ from the designed distance by more than 1/16 inch.

8. Range. In scales not equipped with some form of automatic-indicating device, the range in the scale levers with the exception of the shelf lever and weighbeam should be 1/16 inch plus 1/16 inch per foot of distance between end knife-edges. In shelf levers and weighbeams the range should be 1/16 inch per foot of distance between end knife-edges. In the shop repair of large capacity scales a variation of 25% from the above figures will be allowed. Levers in scales equipped with an automatic device are designed to be built without range and this requirement shall be rigidly observed.

9. Hardness. High carbon steel pivots shall have a Shore hardness of not less than 85, or Rockwell C number of not less than 60. Special alloy steel pivots shall have a Shore hardness of not less than 75, or Rockwell C number of not less than 56. Bearings shall be at least as hard as opposing pivots.

10. Finish of Bearing Steels. The bearing surfaces shall be brought to a smooth, true, and accurate finish to provide continuity of contact with the opposing knife-edges.

III. LOOPS AND CONNECTIONS

1. Design Proportion. Loops which form bearings for projecting pivots may be of any type desired provided that continuous contact with the opposing knife edge is secured and that the radius of the portion of the bearing making immediate contact with the knife-edge equals at least five-eighths (5/8) of the greatest dimension of the cross section of the pivot to be used in the loop.

2. Length. All loops and links in like connections, except where made adjustable shall be of the same length.

3. Vertical Adjustment. When a shelf lever is used, means for vertical adjustment shall be provided between the lever system and the beam which shall permit the independent levelling of the shelf lever. The beam rod shall be adjustable only when the beam is disconnected. Screw adjustments shall be provided with lock nuts or equivalent device.

4. Finish. All surfaces in loops and connections designed to be in contact with other surfaces in the transmission of load to the weighbeam, or weight indicator, shall be symmetrical and smooth finished and the engaging parts shall have such relative dimensions as will result in reasonable flexibility in the assembly.

5. Clearances. The total clearance between faces of loops and sides of levers shall not exceed 1/8 inch.

IV. WEIGHBEAMS AND ACCESSORIES

1. Notches and Poise Track. Beams containing worn notches and worn spots in the poise track shall not be repaired except by milling the notches and machining the poise track to a smooth and true surface.
(Note: The economy of repairing a badly worn beam is questionable).

2. Shoulder Stop. If the shoulder stop at the zero graduation is worn or battered it shall be adjusted to hold the poise exactly at the zero notch. This shall not be done by peening or swedging. The stop may be cut back and a hardened liner fitted in place and dowelled or material may be welded on and finished smooth with a file or stone.

3. Main Poise. The main poise shall have all broken and rusted parts replaced with new parts of the same kind. Worn rollers, latches and latch pins shall be replaced. The freedom of movement of the poise along the beam shall be such that when the beam is held at the bottom of the trig loop, and with the poise latch disengaged, the poise will run toward the tip of the beam without being pushed.
(Note: Poises equipped with plain bearings are obsolete. When repairing beams fitted with such poises, it will be of advantage to substitute "frictionless" bearings).

4. Side Play. Side play in the main poise shall be eliminated.

5. Poise Latch. The poise latch shall be made to seat firmly in the beam notches and in any notch the face of the latch shall fit flush with the back of the notch. A line perpendicular to the face of the latch shall pass through the axis of the latch. The tip of the latch shall be rounded to clear the notch bottoms.

6. Latch Spring. The latch spring shall be of sufficient strengt that when the latch is placed in any notch the poise will automatic ly be drawn to the correct position for that notch.

7. Sealing.

(a) Beam: The beam shall be sealed as an individual lever to its correct multiple. Individual notches may be corrected by filing.

(b) Variation in Notch Spacing: Variation in the spacing of any two adjacent notches shall not introduce an error of weighing greater than one-fourth the value of the smallest graduation on the beam or fractional bar.

(c) Poises: The weight of the main poise shall be correctly adjusted to the beam graduations. The fractional poise shall check with the main poise.

8. Trig Loop. The trig loop shall be set so that when the beam is balanced in the middle of the loop the line of poise travel will be horizontal.

9. Type-Registering Beams. On type-registering beams the type shall be renewed and alined where necessary, and the registering mechanism shall be adjusted to give a legible impression upon weight tickets of standard form at all weight-indicating points along the beam.

V. CLEARANCES

The total clearance between levers and stands shall be not less than one-eighth (1/8) inch nor greater than one-fourth (1/4) inch measured along the line of knife edge. Except as otherwise provided in Sec. III-5, the clearance between fixed and live parts at all other points shall be at least three-fourths (3/4) inch.

VI. PROTECTION FROM CORROSION

1. Shop Painting. When no shop inspection is provided, or after inspection when it is provided, all parts of the mechanism shall be given one coat of red lead and linseed oil; in riveted work, parts shall be so painted before being riveted together. Such parts as will be inaccessible after erection shall be given a second coat.

2. Field Painting. All parts of the scale mechanism, except pivots and bearings, and all structural steel shall be cleaned and painted as specified by the owner, in the field before installation.

VII. SETTING OF SCALES

1. Foundation.

(a) Stand Footings: When reinstalling scales in old pits where the piers have been worn or ground by loose stands, or otherwise, the piers shall be hammer dressed to a common level, or the defective piers shall be cut away and renewed. In the latter case the depth of cut shall be according to the following table:

Capacity of Scale (Pounds)	Minimum Depth of Cut for New Concrete (Inches)
Not over 40,000	6
40,000 to 100,000	8
100,000 to 200,000	10
Over 200,000	12

In all cases the lateral clearance of the cut about each stand shall not be less than 4 inches.

(b) New Concrete: New concrete under stands shall be not leaner than 1:2:4 mixture. The gravel or stone used shall all be small enough to pass a one-inch ring.

2. Fastening of Stands. The anchor bolt holes in the castings shall be filled to prevent lateral movement of the stands and the anchor bolt nuts shall be drawn down tight.

3. Alignment. All levers shall be level and connections plumb throughout the scale.

VIII. WEIGHING PERFORMANCE

The final basis of acceptance shall be that the reinstalled scale shall weigh loads applied according to customary methods of test with errors not to exceed one-half the recognized maintenance tolerances applicable. The beam shall be stable at all loads within the weighing range of the scale. The sensibility reciprocal at any load shall be within the maximum allowable value applicable. (See specifications listed in Section XII).

IX. NEW EQUIPMENT AND ACCESSORIES

The foregoing specifications apply to restoration repairs. Should equipment or features not contained in the original installation be required, these shall conform in every detail of design, workmanship and installation with the requirements of the recognized specifications for scales of the type being repaired or modified. (See Section XII).

X. GENERAL INSTALLATION REQUIREMENTS

Should the repairing or overhauling involve the deck, tracks, approaches, coping, superstructure, or other features additional to the scale proper, these shall be made to conform in all respects to the requirements of the recognized specifications for scales of the type being repaired or overhauled. The list of specifications given in Section XII will serve as a guide to the requirements.

XI. IDENTIFICATION OF RESPONSIBILITY

The person or firm making repairs shall attach to some conspicuous part of the scale a permanent record giving the name and business address of such person or firm and the date repairs were made.

XII. LIST OF SPECIFICATIONS FOR SCALES OF LARGE CAPACITY

1. Bureau of Standards Circular 83, Specifications for the Manufacture and Installation of Railroad Track Scales (applies to four-section scales of the knife-edge type). Superintendent of Documents, Washington, D. C., price 5 cents.

2. American Railway Association, Rules for the Location, Maintenance, Operation, and Testing of Railroad Track Scales (contains same specifications as item 1, and additional useful information). American Railway Association, 30 Vesey Street, New York City.

3. Bureau of Standards Circular 333, Specifications for the Manufacture and Installation of Two-Section Knife-edge Railroad Track Scales. Superintendent of Documents, Washington, D. C., price 10 cents.

These specifications are also published in Proceedings of the American Railway Engineering Association, Vol. 28, 1927, page 503. American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois.

4. Bureau of Standards Circular 199, Specifications for Hand-Operated Grain Hopper Scales. Superintendent of Documents, Washington, D. C., price 10 cents.

5. American Railway Association, Grain Circular No. 1 (applies to track and hopper scales for weighing grain). American Railway Association, 30 Vesey Street, New York City.

6. American Railway Engineering Association, Specifications for the Manufacture and Installation of Motor-Truck, Built-In, Self-Contained, and Portable Scales for Railway Service, published in Proceedings of the American Railway Engineering Association, Vol. 24 1923, page 815, and as revised in Vol. 28, 1927, page 613. American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois.

These specifications are also available as Bureau of Standards Letter Circular No. 152. Bureau of Standards, Washington, D. C.

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