Mettler Toledo North America Training Center

A basic introduction of how to calibrate and troubleshoot
the bench and portable 2000-Series scales.

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Introduction

The Toledo 2181

A basic introduction of how to calibrate and troubleshoot the bench and portable 2000-Series scales. A review of all checks and adjustments necessary for proper, friction-free operation of a scale.

In this training manual we will:

- Identify all calibration procedures for the base, cabinet, and head mechanism of the 2000-Series scales.
- Properly calibrate the total system.
- Identify, diagnose, and repair scale problems found while troubleshooting.

To effectively use this training module you should reference the following documents:

- Instructions - Setting Up & Adjusting Models 2181, 2881: Toledo Scale Form 4462
- Parts Catalog '2000' Series Heavy Capacity Industrial Dial Scales.

Test for Presence of Friction

Eliminate as much friction as possible before attempting to calibrate a scale.

With the scale on zero, press and release the tare beam lever. The indication should return to zero. If the indication does not return to zero, check for friction in the scale components

Check / Set the Stroke

The rod connecting the ribbon yoke to the pendulum lever governs the amount of stroke or the distance the indicator travels. Check the lower end of this connecting rod at the pendulum lever stirrup for proper clearance. The clearance between the end of the connecting rod and the top of the pivot should not exceed 1/8 in. If the stroke requires an adjustment, perform the following:

1. Press the left end of the tare beam lever until the pendulum lever rests against the stop on the locking mechanism.

2. Adjust the nuts on the top of the ribbon yoke until the indication is in the center of the free space on the dial chart.

3. Tightly lock the nuts. Additional adjustment of the nuts is not necessary.

4. Lock the scale and adjust the pendulum bumpers so both pendulums make contact at the same time and the indication is in the center of the free space.

Balance the Indicator

Before a scale can be calibrated, the indicator must be balanced. After it is balanced, the indicator will remain on the dial quarter location at which it is placed. Follow the instructions to balance the indicator:

1. Disengage the rack from the indicator pinion and allow the indicator to swing freely.

2. Hold the indicator at the first-quarter location and release it to observe the manner in which it tails off.

3. Adjust the small indicator tail weights on the back of the indicator until they remain, without tailing off, at the quarter location when released. Once accomplished, check the indicator balance at one-half capacity.

4. If an adjustment is required, adjust the large indicator tail weight until the indicator remains at the half location when released.

5. Re-check the quarter balance and adjust as needed.

6. Re-check the half, third-quarter, and first-quarter locations and adjust as needed until the indicator remains at all locations when released.

Pendulum Rail Gauge

For a 2000-Series dial scale to properly perform, the relationship between the pendulums and the indicator must be set by using the pendulum rail gauge. To make this adjustment, one-quarter scale capacity weight must be placed on the scale platform and the following steps must be performed:

1. Place the pendulum rail gauge over the pendulums, flush with the bottom of the pendulum rails.

2. Check the indication with the gauge in place. It should be zero within one-half of a graduation. If a disproportionate error exists, a tooth on the rack might need skipped.

3. If the indication is not on zero, use the rack adjustment screw to make a rack adjustment.4. Loosen the lock screw on the rack assembly and turn

the knurled rack adjustment until the indicator reaches the tolerance. Tighten the lock screw.

5. Remove the pendulum rail gauge and the test weights from the scale platform.

6. If the indication is not off zero, use the zero adjusting screw to adjust the indicator until zero is reached.

Platform Rock Test

Before calibrating a scale, perform a rock test and make adjustments accordingly. The rock test ensures the platform is properly setting on the load pivots and the load is correctly distributed. To check for platform rock, cross check the action of the platform from corner to corner. Do the following if rocking action exists: · On a Model 2181 Portable Scale, add or subtract the shims on the suspension bracket or brackets. This adjustment must be checked and all adjustments made before any further calibration is attempted. If this test is overlooked, the load applied to the scale will be offset at differing amounts and will depend on variable locations and will make other adjustments impossible.

Shift Test & Adjustments

The shift test is the first and most important calibration test for any scale. This test determines whether a commodity weighs the same at any location on the weighing platform. If this test fails, the scale will fail official testing and will be impossible to accurately calibrate.

To perform the shift test, place the test weights in succession, directly over the load pivots on the main lever system. Note the indication at each location.

The correct amount of test weight should be equal to dial capacity on scales with capacities that do not exceed 300 lb, and three-quarter capacity on scales with a capacity over 300 lb.

The indication at each corner must be the same (not necessarily correct) weight. If the indication is different at any corner location, an error exists in the measured distance between the fulcrum and load pivots of the lever system.

Remember, however, excessive wear can often be a problem. If the errors are large and the scale has been in use for a long time without parts replacements, check the condition of the load and fulcrum pivots and bearings. Replace these parts if necessary, and perform another shift test before making any adjustments.

LENGTHEN TO STRENGTHEN AND SHORTEN TO WEAKEN

The dimension between the load and fulcrum pivot knife edges is lengthened to increase (strengthen) the indication and shortened to decrease (weaken) the indication noted while testing.

If after or during adjustment, the two front corners indicate the same reading and the two back corners indicate the same reading, but are different from the front, a front-to-back calibration exists.

To calibrate this shift condition on a Model 2181 Portable Scale, twist the center connection pivot of the long lever toward the end of the platform with the smaller indication.

When all corners indicate the same reading, the lever system ratio is correct, and other calibrations can be performed.

Adjusting Balance Weight TIP Test (Portable Scales Only)

For a portable scale to properly weigh, it must weigh both level and non-level conditions. This requires the tip test and calibration for proper operation and accuracy when a non-level condition exists. To check this adjustment, perform the following:

1. While facing the scale, set it on zero and tip it to the right by placing 5/8-in. blocks under the left wheels. Note the indication at zero.

2. Tip the scale to the left, placing the 5/8-in. blocks under the left wheels. Note the indication at zero.

3. Evaluate the results of the test and adjust the back balance weight as needed.

If the lower indication was slow when the scale was tipped to the right, and fast when tipped to the left, lower the back balance weight located on the right end of the tare beam lever. If the indication was fast when tipped to the right and slow when tipped to the left, raise the back balance weight. After each adjustment, set the scale back on all four wheels, reset zero, and repeat the test procedure and adjustments until the indication does not change when the scale is tipped in either direction.

Beam Test

The tare and capacity beams must have the following characteristics for them to properly function: · They must be set in a straight line · They must be parallel to the pivot line of the tare beam lever Do the following to test the beams:

1. Place test weights equal to dial capacity on the scale platform and note the indication.

2. Leave weight equal to the combined capacity of the tare beam plus the capacity beam on the scale platform. (Remove or add weight as necessary to achieve this condition.)

3. Move the capacity poise to the right to the maximum locking notch and move the tare poise to the right until the scale reads zero even if it is less than or greater than the highest graduation on the beam. If the tare poise is at the end of the beam and the scale does not indicate zero, zero the scale with the zero adjusting screw.

4. Place additional weight on the scale platform equal to full dial capacity and note the indication. If this indication is not the same as noted in step 1, the beams are out of alignment and require adjustment.

Beam Adjustment.

If the reading noted in Step 3 is less than the reading in Step 1, raise the right-hand beam mounting bracket. If the reading noted in Step 3 is larger than the reading in Step 1, lower the right-hand beam mounting bracket. After each adjustment, remove all weight from the scale platform, reset zero, and repeat the beam test procedure until both indications are the same when tested.

Hint: When removing or adding weight to or from a poise, always correct for one-half of the actual error.

Poise Test

Check both the tare poise the capacity poise for correct weight. Begin this test by performing the following:

1. Zero the scale

2. Move the tare poise to the exact maximum indication.

3. Place weight equal to the tare beam capacity on the scale platform. The indication should be zero. If not, and the indication is slow, remove the lead from the inside of the tare poise. If the indication is fast, add lead to the inside of the tare poise.

After a correction is made, remove the test weights from the scale platform, reset zero, and repeat until the indication is correct. To calibrate the capacity poise, perform the test using the same procedure. To this point, the calibration of the scale has been exactly the same as a beam scale with the dial used as a reference reading only. The lever system ratio has proven to be correct with the proper equilibrium and weight for the poises. The dial may now be calibrated to coincide with the lever system.

Head Mechanism Calibration

The following dial calibration procedure must be followed:

Full Adjustment

When making this adjustment for an error of more than one graduation, split the adjustment between or distance the major weight adjustment between both the major weights.

1. Set the indication to zero using the zero adjusting screw (counterbalance weight).

2. Place weights on the scale platform equal to full-dial capacity.

3. If the indication is slow, raise the major weight assembly to correct the reading.

4. If the indication is fast, lower the major weight assembly to the correct reading.

5. After an adjustment is made, remove all test weights, correct zero with the zero adjusting screw (if necessary) and repeat the procedure. This procedure should be repeated until the relationship of zero and full capacity is correct.

Half Adjustment

When making the one-half-capacity adjustment, a ratio of 10:1 must be used to correct the error.

For each graduation of error, the minor weights must be adjusted 10 graduations in the opposite direction of the indicated error, adjusting one-half of the error with each minor weight.

To perform the one-half-capacity test and calibration, do the following:

1. Place weights on the scale platform equal to one-half dial capacity. Note the indication.

2. If the indication is slow or less than one-half capacity, move the minor weights toward the pendulum rail at a 10:1 ratio.

3. If the indication is fast or greater than one-half capacity, move the minor weights away from the pendulum rails at a 10:1 ratio.

After an adjustment is made, remove all test weights, correct zero with the zero adjusting screw (if necessary) and repeat the procedure. This procedure should be repeated until the relationship of zero and one-half capacity is correct. Once this relationship is accomplished, return to the full-capacity procedure and re-check the calibration.

Make any calibration adjustments that are required using the same procedure outlined above.

Re-check one-half capacity and make any necessary adjustments using the procedure outlined above.

Before proceeding, both the full and half capacity adjustments must be correct.

First Quarter Adjustment

Place test weights equal to the first-quarter capacity and make the following adjustments as required.

1. If the indication is in error, adjust the indicator tail weights which are parallel to the indication until the indication is correct.

2. Remove the test weights from the scale platform. Zero the scale with the zero adjustment screw and repeat the procedure.

3. Repeat the procedure until the zero first-quarter relationship has been established.

Once the zero first-quarter relationship is accomplished, re-check the full, half, and first-quarter capacities and make any corrections required.

Third Quarter Adjustment

At this time, two possible corrections can be made depending on the amount of error at third-quarter capacity.

Condition 1

If the error is greater than one graduation, remove the test weights from the scale platform.

1. Place the test weights equal to one-half capacity on the scale platform.

2. Adjust the indicator tail weight, which is at a right angle to the indication, until the exact error indicated at third-quarter capacity is indicated.

3. Remove all test weights from the scale platform, adjust zero with the zero adjusting screw, and completely start the dial calibration procedure over. Start with full-, then half-, then first-quarter, and then perform third-quarter capacity.

Condition 2

If the error is less than one graduation, remove one-half of the error with the indicator tail weights which are parallel to the indication.

1. Remove the test weights from the scale platform and zero the scale with the zero-adjustment screw.

2. Place first-quarter capacity test weights on the scale platform and correct one-half of the error using the indicator tail weights which are parallel to the indication.

3. Remove the test weights from the scale platform and zero the scale with the zero-adjustment screw.

4. Place third-quarter capacity test weights on the scale platform and correct one-half of the error using the indicator tail weights, which are parallel to the indication.

5. Remove the test weights from the scale platform and zero the scale with the zero-adjustment screw.

6. Place first-quarter capacity test weights on the scale platform and correct one-half of the error using the indicator tail weights, which are parallel to the indication.

Repeat the procedure between third and first quarter until the indicated error is less than the indicator width, exceeding all required tolerances.

After the third-quarter adjustment is complete, repeat the entire dial-calibration test one additional time (zero, full, half, first, and third quarters).

Now, all indications should be correct at each location that has been adjusted and at any other location or test weight value. If they are not, make the required adjustments as needed.

If the scale is not indicating correctly between quarter adjustments, check the following:

· Friction in the scale

· Bent or pulled ribbons in the head mechanism

· Dirt on the ribbons and pendulum cam surfaces

· Dirt in the gear mesh of the indicator rack and pinion.

A non-abrasive cleaner should be used to clean the above items.

Locking Mechanism Adjustments

When the tare beam lever is locked, the pendulums in the head mechanism should be resting and centered on the rubber pendulum bumpers. At the same time, the indicator should also be in the center of the free space located at the bottom of the dial chart. If either one of the two items mentioned are not true, make the following adjustments:

1. With the tare beam locked, equally adjust the nuts on the pendulum locking rods so there is 1/32-in. clearance between the lower nut and the lower oil seal cup. This sets the proper tension of the tension locks.

2. Adjust the pendulum rubber bumpers until the pendulums are hanging flush and are centered in the vee of the pendulum. At this time, the indicator should be centered in the free space of the dial chart.

Now that the scale calibration is complete, replace all covers and screws, clean the dial glass, and install, clean, and wipe down the entire scale.

Thanks for using this Mettler Toledo eBook training module. We hope it was beneficial.