

Chapter 5

Test Notes

Objectives

In this chapter you will study several scale performance factors that must be checked repeatedly throughout the Test portion of an official field examination of vehicle and axle-load scales. After studying this chapter, you should be able to:

1. Describe procedures for checking repeatability and agreement of indications.
2. Describe procedures for checking the zero-load balance condition each time all test load is removed.
3. Describe procedures for checking recorded representations, and, in the case of electronic systems, checking the effectiveness of motion detection.
4. Describe procedures for verifying the zone of uncertainty and the width of zero on electronic digital indicators.
5. Describe procedures for checking the operation and appropriateness of special operating features on electronic digital indicating scales.

Introduction

The Test Notes portion of the EPOs list a number of performance requirements which must be checked repeatedly during the course of the test or when indicated by abnormal performance. Although procedures differ for scales with mechanical and electronic indicating elements, the basic areas of performance are similar, including:

- the ability of the scale system to repeat indications for the same test load applied under the same conditions;
- proper agreement among indications and recorded representations;
- the ability of the system to return to a stable zero-load balance condition;
- the ability of an electronic indicator to maintain stable indications; and
- the operation of special features, especially on electronic systems.

In this chapter, we will look briefly at the criteria and procedures for each of these. Note that many of the requirements have already been discussed in previous chapters. If you are not familiar with them, you may wish to review these requirements before you proceed.

Setting Up the Scale for Tolerance Testing

The first item listed in the Test Notes section of EPO No. 13 relates to a test method involving small weights, known as **error weights**. These weights must be placed on the scale before the first test is begun. The technique of using error weights to determine if a scale meets specified tolerances, and the setup procedure, are described in Chapter 6.

Repeatability

References: T.N.5. (see Chapter 4) and G-S.5.4. (see Chapter 3)

Despite the fundamental importance of repeatability and the specific tolerance set forth in T.N.5., the EPOs do not include a systematic procedure for checking repeatability. Every time you repeat the application of the same test load under the same test and environmental conditions, you should compare results to determine whether the requirement of repeatability within the absolute value of the maintenance tolerance is being met. When conducting a repeatability test, it is important to duplicate the test conditions from test to test as closely as possible, including the placement and test pattern of the weights.

Such opportunities may occur when test results are close to the applicable tolerance and you need to verify them by repeating a test. If opportunities to check repeatability do not occur naturally, you should check repeatability by making at least two or three weighings of the same load under the same conditions.

Agreement of Indications and Recorded Representations

References: G-S.5.2.2.(a), (b), and (c), G-S.5.6., and S.2.5.1.(a) (see Chapter 3); UR.1.3. (see below); and T.N.4.2. and T.N.4.3. (see Chapter 4)

UR.1.3. Value of the Indicated and Recorded Scale Division. - *The value of the scale division as recorded shall be the same as the division value indicated.*

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(Added 1995) (Amended 1999)

Handbook 44, Scales Code, Paragraph UR.1.3.

At each weighing, you should check all indications and recorded representations. If the system is equipped with a ticket printer, a ticket should be produced at each weighing and at zero indication. An attempt to produce a ticket should also be made when the weight display is in a behind zero condition. In addition to verifying the correct operation of indicators and printers, the following requirements relating to agreement of indicated and recorded representations should be checked:

- All digital values within the system must agree exactly (G-S.5.2.2.(a)). Compare, for example, the readings of such components as a digital indicator, printer, and remote display. The ticket printer must print a zero indication and that recorded representation must include a printed zero for each zero in the displayed weight as shown on the digital indicator.
- Digital values must agree with associated analog values to the nearest minimum graduation (G-S.5.2.2.(b)). On a system with a mechanical indicator, such as a weighbeam or dial indicator, compare indicated values with those of a printer or remote digital display.

- Digital values round off to the nearest minimum unit (scale division) (G-S.5.2.2.(c)).
- Single indicating/recording elements — for example, a dial indicator with a tare bar — agree to within the absolute value of the applicable tolerance (T.N.4.2.). Note that a weighbeam used exclusively as a backup indicator on an electronic system should be tested, but is considered a separate element, and thus need not meet the specific requirement for agreement with the digital indicator. If the weighbeam and digital indicator are used in combination, however, the requirement of T.N.4.2. would apply (as explained in the previous chapter).
- Multiple indications on a single indicating element, such as a dial indicator with two faces, must agree to within one-half of a scale division (0.5 d) at all weight indications other than zero. Indications must agree exactly at zero load balance. (T.N.4.3.; also discussed in Chapter 4).
- Scale divisions for indications and recorded representations are the same (UR.1.3.).

One of the following conditions must be met when printing a behind zero indication. The printer shall either: not function; print an unreadable or illegible recording; or print a properly identified weight recording.

When printing a ticket on a system that has an electronic digital indicator, the printer should not print any value except when the indication is stable within plus or minus 3 scale divisions (S.2.5.1.(a)). The procedure for testing the operation of the motion detection feature of the printer will be described in Chapter 6.

Zero-Load Balance Change

References: N.1.9. and G-UR.4.2. (see below)

In accordance with N.1.9., the zero-load balance must be observed and recorded each time a test load is removed. Any change in the balance from one reading to the next must not exceed the minimum applicable tolerance, that is, for vehicle and axle-load scales, 1d on maintenance tests and 0.5d on acceptance tests. Paragraph G-UR.4.2 requires that the owner of the device correct such unstable indications.

N.1.9. Zero-Load Balance Change. - A zero-load balance change test shall be conducted on all scales after the removal of any test load. The zero-load balance should not change by more than the minimum tolerance applicable. (Also see G-UR.4.2.) (Renumbered 1988)

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G-UR.4.2. Abnormal Performance. - Unstable indications or other abnormal equipment performance observed during operation shall be corrected and, if necessary, brought to the attention of competent service personnel.
(Added 1976)

Handbook 44, Scales Code, Paragraph N.1.9. and General Code, Paragraph G-UR.4.2.

Zone Of Uncertainty And Width Of Zero

References: N.1.5. and N.1.5.1. (see Chapter 6); and S.1.1.1. (see Chapter 3)

During testing of a digital indicator, you may find that you are getting a number of unstable readings (the indicator alternates between two adjacent increments). This may be an indication that the scale's zone of uncertainty is too wide. If this occurs at zero load, the width of zero may exceed the requirements of S.1.1.1. as described in Chapter 3.

One way of determining if the zone of uncertainty or width of zero is a problem is to conduct a Discrimination Test as referenced in paragraphs N.1.5. and N.1.5.1. This test is also used to determine if a scale can sense small changes in weight. The test is usually performed in a laboratory (for example, during type evaluation); however, it may be conducted in the field if environmental factors can be reduced to the extent that they will not affect the results obtained. The requirements and procedures for conducting the Discrimination Test will be explained in Chapter 6.

Operation Of Special Features

You will need to check any special features, especially on electronic systems, for proper operation and appropriateness. Some features may need to be checked only once during the test, others may need to be checked periodically as the test progresses. Features to be checked include (but are not necessarily limited to):

- automatic and semi-automatic zero-setting mechanisms,
- various types of tare mechanisms (programmable, push-button, thumbwheel, or keyboard)
- tare auto-clear, and
- gross, net, and tare displays.

Issues relating to the appropriateness of these features in specific applications were discussed in Chapter 3. Procedures for testing the zero-setting mechanism and the tare auto-clear mechanism are given in Chapter 6. The EPO refers to the NTEP Type Evaluation Handbook for guidance. If the device you are inspecting has been type evaluated, you will find useful information relating to special features in the Certificate of Conformance.

If you do not know how to operate special features (or any other feature) found on a scale, talk to the operator about it. If you are not satisfied with the response, you should refer to the manufacturer's instruction manual (if available), or contact the manufacturer/service agency, or call your supervisor for assistance. An on-going duty of a weights and measures inspector is to keep abreast of new features introduced by scale manufacturers.

Summary

Certain procedures must be performed repeatedly during the testing of a scale or as indicated by abnormal performance. The procedures referenced in the EPOs for vehicle and axle-load scales are:

- check of zero-load balance change,
- checking repeatability of and agreement between indications and recorded representations,
- checking motion detection on a printer used with an electronic system,
- checking the zone of uncertainty and width of zero, and
- checking the operation and appropriateness of special operating features.

To check scale performance factors and special features, you must know how to operate all parts of the scale system to be examined. If you need additional information about a scale, first check with the operator; if the information you receive is not adequate, contact your supervisor for assistance before proceeding.