Australian Government
National Measurement Institute

# NITP 6.5
# National Instrument Test Procedures for Continuous Totalising Automatic Weighing Instruments (Belt Weighers)

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## PREFACE

On 30 June 2010 the uniform test procedures (i.e. relevant NMI V documents) were deemed to be national instrument test procedures (NITPs) for the purposes of section 18GG of the *National Measurement Act 1960* (Cth).

In 2011 the NITPs were renumbered to better align the numbers with the classes of pattern approval and servicing licensee. As a result this document (NMI V 7) became NITP 6.5.

The only changes that have been made to the latest edition of this document are it has been rebranded, renumbered, renamed and its cross-references have been updated. In all other respects it is identical with NMI V 7.

NMI's Chief Metrologist has determined that NITP 6.5 contains the test procedures for the verification of continuous totalising automatic weighing instruments (belt weighers).

## ABBREVIATIONS

| | |
|---|---|
| d | totalisation scale interval (used to verify/certify a belt weigher) |
| e | verification scale interval (used to test a control instrument) |
| E | error (E = P – L) |
| $E_c$ | possible error of the control instrument |
| $I_1$ | totaliser indication at start of zero load test |
| $I_2$ | totaliser indication at end of zero load test |
| $I_{max}$ | maximum totaliser indication during zero load test |
| $I_{min}$ | minimum totaliser indication during zero load test |
| L | load |
| $L_{sub}$ | actual calculated value of the substitution load |
| $\Delta L$ | additional load to next changeover point |
| Max | maximum capacity |
| Min | minimum capacity |
| MPE | maximum permissible error |
| $\sqrt{N}$ | adjustment for the probable error of N partial weighings |
| P | indication prior to rounding ($P = I + 0.5d - \Delta L$) |
| $Q_{max}$ | maximum flow rate |
| $Q_{min}$ | minimum flow rate |
| $T_f$ | totaliser indication at finish of weighing performance and repeatability test |
| $T_s$ | totaliser indication at start of weighing performance and repeatability test |
| $\Sigma_{min}$ | minimum totalised load |
| $\Sigma_t$ | minimum test load |
| $\leq$ | less than or equal to |

## CONTENTS

## EXPLANATION OF TERMS

For explanations of other terms see *General Information for Test Procedures*.

### Adjustment

Alteration of the measurement parameters to bring the instrument within the allowable MPEs for an instrument in use.

### Calibration

The set of operations that (under specified conditions) establishes the relationship between the indicated or nominal value of an instrument and the corresponding known value of the measured quantity.

### Certification

The examination of an instrument by a **certifier** (the holder, or an employee of the holder, of a servicing licence) in order to mark the instrument indicating that it conforms with the relevant test procedures.

- **Initial certification** is the certification of a new instrument by a certifier, which does not bear a verification or certification mark and has never been verified or certified before.
- **Subsequent certification** is any certification of an instrument by a certifier because the mark is no longer valid due to such reasons as:
  - repairs or adjustments have been made that affect metrological performance; or
  - the mark has been defaced or removed.

### In-service Inspection

The examination of an instrument by an **inspector or certifier** to check that:

- the verification or certification mark is valid; and
- the errors do not exceed the MPEs permitted for in-service inspection.

In-service inspection does not permit the instrument to be marked with a verification or certification mark.

### Verification

The examination of an instrument by an **inspector** in order to mark the instrument indicating that it conforms with the relevant test procedures.

- **Initial verification** is the verification of a new instrument by an inspector, which does not bear a verification or certification mark and has never been verified or certified before.
- **Subsequent verification** is any verification of an instrument by an inspector because the mark is no longer valid due to such reasons as:
  - repairs or adjustments have been made that affect metrological performance; or
  - the mark has been defaced or removed.
- **Re-verification** is the examination of an instrument by an inspector to check that:
  - the verification or certification mark is valid; and
  - the instrument has not been modified in any way since verification or certification;

  in order to mark the instrument indicating that it conforms with the relevant test procedures.

## 1. SCOPE

NITP 6.5 describes the test procedures for the verification, certification and in-service inspection of continuous totalising automatic weighing instruments (belt weighers) to ensure that they measure to within the maximum permissible errors specified in the National Measurement Regulations and that they comply with the certificate/s of approval.

These test procedures supersede *Test Procedure 2. Belt Conveyor Weighing Instruments* found in Inspectors Handbook Number 3.

Certificates of approval are based on *NMI R 50. Continuous Totalising Automatic Weighing Instruments (Belt Weighers)*. Refer to NMI R 50-1 for all metrological and technical requirements.

All belt weighers must also comply with the relevant Trade Measurement Act and Regulations.

Refer to *NITP 6.1 to 6.4 National Instrument Test Procedures for Non-automatic Weighing Instruments* when testing the control instrument.

## 2. EQUIPMENT

1. Certificate/s of approval.
2. Test loads of suitable product (see clause 4.4).
3. Control instrument (see clause 4.1).
4. Previous device, used to control the application of the test load in one continuous application **onto** the belt weigher. A previous device is normally a hopper fitted with a suitable device such as a gate mechanism or a vibrating feeder. It should be able to deliver product at a rate equal to the maximum flow rate for the belt weigher. However when this is not possible the data plate on the weighing system must be corrected to reflect the achievable maximum flow rate.
5. Holding bin, used to receive the test load from the belt conveyor in one continuous application **after** it has passed over the belt weigher.
6. Transfer vehicles, if required.
7. Test reports (see Appendix A).

## 3. VISUAL INSPECTION

Visually inspect the belt weigher and record the following details on Test Report 1.

### 3.1 Required Data

1. Test report reference number.
2. Date of the test.
3. Type of test: verification, certification or in-service inspection (for in-service inspection ensure that the verification/ certification mark is in place).
4. Name of owner/user.
5. Address of owner/user.
6. Name of contact on site.
7. Address where belt weigher is located.
8. Manufacturer/s name or mark.
9. Importer’s name or mark (if applicable).
10. Model.
11. Serial number.
12. Certificate/s of approval number.
13. Belt conveyor number (if applicable).
14. Controller/integrator number (if applicable).
15. Load cell number (if applicable).
16. Basework model number (if applicable).
17. Accuracy class.
18. Maximum flow rate.
19. Minimum flow rate.
20. Minimum totalised load.
21. Minimum test load.
22. Maximum capacity.
23. Totalisation scale interval.
24. Belt speed/s.
25. Weigh length.
26. Temperature range (if applicable).
27. Designation of product/s.
28. Number of whole belt revolutions required for zero testing.

### 3.2 Characteristics of the Instrument

1. Does the belt weigher comply with its certificate/s of approval?
2. Is the belt weigher being used in an appropriate manner?
3. Are all mandatory descriptive markings clearly and permanently marked on the data plate?
4. Is the data plate fixed on the weighing system?
5. Is the belt weigher in a suitable operational condition?
6. Are there any apparent obstructions to the operation of the belt weigher?
7. Is the indicating device accessible during normal operation?
8. Is the belt weigher fully assembled?
9. Is the belt weigher fixed into the position for its intended use?
10. Is the belt weigher adequately protected against any other influence likely to affect its performance? (Consideration should be given to the normal environment in which the belt weigher will operate.)
11. For additional indicating devices: do they exactly repeat the information on the primary indication and does any device for price computation and/or ticket/label printing comply with the requirements of General Supplementary Certificate S1/0/A (or General Supplementary Certificates S1/0 for devices initially verified or certified prior to March 1992)?

## 4. TEST PROCEDURES

See Appendix B for a checklist to assist with preparation and planning.

Before testing begins you must:

- discuss the test procedures with the administering authority;
- ensure that adequate skilled personnel are available;
- establish appropriate communication procedures between personnel;
- ensure that all equipment is available and operational; and
- ensure that enough time has been allowed for the testing.

During testing you should:

- avoid any unnecessary commitment of resources; and
- restrict unauthorised access.

The following series of test procedures determine if the performance of a belt weigher meets requirements and whether the belt weigher requires adjustment or service. When adjustment or service is required the testing procedure must be recommenced.

The sequence for testing (also see clause 5) is:

- determine if the control instrument is suitable for determining the mass of the test load, and then test the control instrument for compliance with NITP 6.1 to 6.4 (see clause 4.1);
- determine the maximum and minimum flow rates appropriate for the site (see clause 4.2), the minimum totalised load (see clause 4.3) and the minimum test load and test load (see clause 4.4);
- calculate the number of whole belt revolutions required for the minimum totalised load to pass over the belt at maximum flowrate in a period as close as possible to 3 min, and then conduct the zero load test (see clause 4.5); and
- test the belt weigher for weighing performance (see clause 4.6) and repeatability (see clauses 4.7) in all modes.

Discrimination testing is not recommended for occupational health and safety reasons.

See Appendix C.4 for worked examples of the calculations required for a typical belt weigher.

## 4.1 Control Instrument

A control instrument is used to determine the mass of a test load which will be used to test the belt weigher.

You should test the belt weigher within 24 hours of testing the control instrument. However, if more than 24 hours elapses you must consult the administering authority. Generally within 28 days it is acceptable to use the control instrument if the tests for repeatability and eccentricity are repeated.

The control instrument shall:

- be a non-automatic weighing instrument;
- be pattern approved, **or** have an approved load cell and indicator that comply with General Certificate 6B/0, **or** have a letter of approval from NMI; and
- be capable of having standard masses deposited on the load receptor easily and in total safety.

A control instrument may:

- determine the test load either before or after it passes over belt weigher;
- be used as a previous device or a holding bin;
- be used in a single draught (one operation) or multiple draughts (more than one operation), but if multiple draughts are used it cannot be used as a previous device;
- be configured in a variety of ways but it is normally a hopper, a single or a multi-platform weighbridge.

Typical relationships between a control instrument and the test load include, but are not limited to, the following applications.

1. The control instrument is a hopper and a previous device.
    - The control instrument determines the test load in a single draught before it is fed onto the belt conveyor.
    - The control instrument deposits the test load in one continuous application onto the belt conveyor.
2. The control instrument is a hopper and also a holding bin.
    - The previous device deposits the test load in one continuous application onto the belt conveyor.
    - After passing over the belt weigher the test load is deposited into the hopper/holding bin, which is the control instrument.
    - The control instrument determines the test load in a single draught.
3. The control instrument is a weighbridge.
    - The control instrument determines the test load before it is transferred to the previous device in single or multiple draughts.
    - The previous device deposits the test load in one continuous application onto the belt conveyor.
4. The control instrument is a multi-platform weighbridge. When the control instrument is a multi-platform weighbridge each platform is assessed as an individual control instrument and must meet the accuracy requirement for each gross weight applied.
    - The previous device deposits the test load in one continuous application onto the belt conveyor.
    - The holding bin contains the test load after it passes over the belt weigher.
    - The test load is then transferred from the holding bin to the control instrument in single or multiple draughts.
    - The control instrument determines the test load after it has been transferred.

**First**, use one of the two methods in Test Report 2 (method 1 calculation NOT using change points **or** method 2 calculation using change points) to determine if the control instrument is suitable, and meets the accuracy requirements required for it to determine the mass of the test load. The control instrument shall be at least three times more accurate than the belt weigher. Complete:

- section A when the test load is either fed directly onto the belt conveyor or transferred in a single draught to or from the control instrument (see Appendix C.5.1 method 1 and Appendix C.5.2 for worked examples);
- section B when the test load is transferred in multiple draughts to or from the control instrument which is a single-platform weighbridge (see Appendix C.5.3 for a worked example);
- section C when the test load is transferred in multiple draughts to or from a control instrument which is a multi-platform weighbridge (see Appendix C.5.4 for a worked example);
- section D when the test load is transferred in a single draught to or from a control instrument which is a multi-platform weighbridge (see Appendix C.5.5 for a worked example);
- section E when the appropriate calculation in sections A to D has shown that the control instrument is bordering on being suitable and you need to use a more precise calculation (see Appendix C.5.6 for a worked example); and
- section F when you need to determine suitability using change points (see Appendix C.5.1 method 2 for a worked example).

**Then** test the control instrument for compliance with NITP 6.1 to 6.4. The control instrument may be tested:

- to a suitable capacity (mass of the test load plus tare of any transfer vehicle); or
- to full capacity allowing it to be verified or certified.

Record your results on Test Report 2.

### 4.2 Maximum and Minimum Flow Rates

Site operational conditions may limit the ability to achieve the maximum flow rate in the certificate of approval. The maximum flow rate used to calculate the minimum totalised load (see clause 4.3) must not be more than the maximum flow rate achieved at the site.

The owner/user may determine the flow rates applicable for the operation of the site. Careful selection of the appropriate flow rate for the site can reduce the time required to test the belt weigher.

Record the values of the maximum and minimum flow rates of the belt weigher on Test Report 1, and if required (always required for initial verification/certification and when site conditions change) mark these values on the data plate.

### 4.3 Minimum Totalised Load

The minimum totalised load is the value of the load below which the weighing results may be subject to an excessive relative error. Record the value of the minimum totalised load on Test Report 1. You may have to calculate this value (always required for initial verification/ certification and when site conditions change) in which case you also have to mark this value on the data plate. See Appendix C.1 for a worked example.

The minimum totalised load shall not be less than the greatest of the following values:

(a) 2% of the load totalised in 1 hour at maximum flow rate;
(b) load obtained at maximum flow rate in one revolution of the belt;
(c) load corresponding to the appropriate number of totalisation scale intervals from Table 1.

Table 1. Number of totalisation scale intervals for each accuracy class

| Accuracy class | Totalisation scale intervals (d) |
|---|---|
| 0.5 | 800 |
| 1 | 400 |
| 2 | 200 |

### 4.4 Minimum Test Load and Test Load

The product used for testing is referred to as the test load. The owner/user has to provide an appropriate test load, namely the product described on the data plate or a product with similar physical characteristics, e.g. wheat and maize. If the belt weigher is used to weigh different types of product, then appropriate test loads are required for each of the products.

Test loads must be protected during transfer in order to ensure that there is no loss or gain of product.

Record the value of the **minimum test load** on Test Report 1. You may have to calculate this value (always required for initial verification/certification and when site conditions change) in which case you also have to mark this value on the data plate.

The minimum test load shall not be less than the greatest of the following values:

(a) 2% of the load totalised in 1 hour at maximum flow rate;

(b) load obtained at maximum flow rate in one revolution of the belt — this value can be discarded when the duration of the performance test is equal to one whole belt revolution and the loads in (a) and (c) are measured as one continuous load as part of the whole belt revolution, i.e. step 5 in clause 4.6 must be measured over one whole belt revolution;

(c) load corresponding to the appropriate number of totalisation scale intervals from Table 1;

(d) load corresponding to three times the MPE of the control instrument.

The **test load** is a nominated value equal to, or greater than, the minimum test load. Record the value of the test load on Test Report 1.

See Appendix C.2 for a worked example showing how to determine minimum test load and test load, and Appendix C.4.1 for a worked example showing how changing the value of the test load can make a control instrument suitable after it has been found to be unsuitable.

### 4.5 Zero Load Test

The zero load test simultaneously checks that the MPE for the **variation of the indication at zero**, and if necessary the **maximum variation of the totalisation indicator**, are within acceptable limits.

The duration of the zero load test is equal to the number of whole belt revolutions marked on the data plate.

Record all calculations and results on Test Report 1, and see Appendixes C.3 and C.4.2 to C.4.7 for worked examples.

1. If required, calculate the number of whole belt revolutions required for the:
   - belt to operate for 3 min at maximum speed; and
   - minimum totalised load to pass over the belt at maximum flowrate.

   Mark the data plate with the larger number of whole belt revolutions.

   Note: This step is always required for initial verification/certification and when site conditions change.

2. Calculate, in terms of mass, the allowable MPE for the **variation of the indication at zero** by multiplying the amount of product that will pass over the belt during the test by the appropriate percentage from Table 2.

Table 2. MPEs for variation of indication at zero

| Accuracy class | Percentage of the load totalised at maximum flow rate |
|---|---|
| 0.5 | ±0.05% |
| 1 | ±0.10% |
| 2 | ±0.20% |

3. If the number of whole belt revolutions in step 1 is less than or equal to three, calculate in terms of mass, the allowable MPE for **maximum variation of the totalisation indicator** by multiplying the amount of product that will pass over the belt during the test by the appropriate percentage from Table 3.

Table 3. MPEs for maximum variation of the totalisation indicator

| Accuracy class | Percentage of the load totalised at maximum flow rate |
|---|---|
| 0.5 | ±0.18% |
| 1 | ±0.35% |
| 2 | ±0.70% |

4. Mark or determine a starting point on the stationary belt.
5. Where practical, disable the automatic zero-setting device.
6. Operate the belt weigher unloaded for at least 30 min.
7. Record the totaliser indication at the start of the test run ($I_1$). This indication can be zero if a resettable zero totalisation indicating device is fitted.
8. Run the belt conveyor at maximum flow rate for the duration required to complete the whole number of belt revolutions marked on the data plate.
9. If the number of whole belt revolutions calculated in step 1 is less than or equal to three, record the maximum ($I_{max}$) and minimum indication ($I_{min}$) observed during the test. This will enable you to calculate the errors for the **maximum variation of the totalisation indicator**, namely $I_1 – I_{max}$ and $I_1 – I_{min}$.
10. Record the totaliser indication at the end of the test run ($I_2$). This will enable you to calculate the error for the **variation of the indication at zero** ($I_2 – I_1$).
11. If the belt weigher fails, repeat the test(s). The results from both runs must be shown on the test report.
12. Determine if the belt weigher has passed or failed.

### 4.6 Weighing Performance

The purpose of this test is to record the weighing performance of the belt weigher at a range of feeding flow rates (see below) and in all modes described on the data plate (i.e. direction, belt speed, designation of product) and to compare the results with the mass of the test load when weighed on the control instrument.

All tests shall be carried out in situ, with the belt weigher fully assembled, fully operational and fixed in the position in which it is intended to be used. The belt conveyor may be empty for part of the run but it shall not be stopped during a run.

Tests shall be run in pairs that use, as near as practical, the same feeding flow rate, belt speed and test load:

- **two** pairs of test runs shall be conducted at both maximum and minimum feeding flow rates marked on the data plate; and
- **one** pair of test runs shall be conducted at the mid point or at 20% intervals between maximum and minimum flow rate.

Note: If the minimum flow rate is within 20% of the maximum flow rate, test runs are only required at maximum and minimum flow rates.

Consideration shall be given to aligning the feeding flow rate with any linerisation adjustment points.

When testing exceeds one day, the zero load test shall be repeated at the end of each day and the beginning of each subsequent day.

Consult the administering authority:

- if the test is interrupted by more than 4 hours;
- if the test is not conducted within 24 hours of testing the control instrument (generally within 28 days it is acceptable to use the control instrument if the tests for repeatability and eccentricity are repeated);
- if you want to use the results of tests performed for pattern approval.

Record all results on Test Report 1.

1. If required, conduct the zero load test (see clause 4.5).
2. Record the totaliser indication at the start of the test run ($T_s$). This indication can be zero if a resettable zero totalisation indicating device is fitted.
3. At the specified feeding flow rate, deliver the test load from the previous device to the belt conveyor in one continuous application.
4. Record the totaliser indication at the finish of the test run ($T_f$). Ensure that the belt conveyor is empty.
5. Calculate and record the mass of the test load weighed by the belt weigher (A) ($A = T_f – T_s$).
6. Record the mass of the test load weighed by the control instrument (B).
7. Calculate the percentage error for weighing performance (A – B)/B ×100.
8. Conduct points 3 to 7:
   - four times (two pairs) at maximum feeding flow rate;
   - four times (two pairs) at minimum feeding flow rate; and
   - twice (one pair) at all other feeding flow rates.
9. Repeat points 3 to 8 for all modes described on the data plate.
10. Determine if the belt weigher has passed or failed.

Table 4. MPEs for weighing performance and repeatability

| Accuracy class | Percentage of totalised load | |
|---|---|---|
| | Verification/ certification | In-service inspection |
| 0.5 | ±0.25% | ±0.5% |
| 1 | ±0.50% | ±1.0% |
| 2 | ±1.00% | ±2.0% |

### 4.7 Repeatability

The difference between the relative errors for several results obtained at practically identical flow rates, for approximately the same quantities of product and under the same conditions, shall not exceed the absolute value of the appropriate MPE. See Appendix C.4.8 for a worked example.

1. For each test pair calculate and record the difference between the relative errors by subtracting the smaller error from the larger error.
2. Determine if the belt weigher has passed or failed.

## 5. SUGGESTED SEQUENCE FOR TESTING

1. Before testing begins:
   - discuss the test procedures with the administering authority;
   - ensure that adequate skilled personnel are available;
   - establish appropriate communication procedures between personnel;
   - ensure that all equipment is available and operational; and
   - ensure that enough time has been allowed for the testing.

   Remember to avoid any unnecessary commitment of resources, and to restrict unauthorised access.
2. Check the certificate/s of approval for any additional tests required. Make provision for including these tests in the testing sequence.

3. Visually inspect the belt weigher and record the required details on Test Report 1.
4. Determine if the control instrument is suitable, and meets the accuracy requirements required for it to determine the mass of the test load (see clause 4.1). Record the results on Test Report 2.
5. Test the control instrument for compliance with NITP 6.1 to 6.4 (see clause 4.1) and record the results on Test Report 2. Test the belt weigher within 24 hours of testing the control instrument.
6. If applicable (always required for initial verification/certification and when site conditions change) determine and record the following values on Test Report 1:
   - maximum and minimum flow rates (see clause 4.2);
   - minimum totalised load (see clause 4.3);
   - minimum test load (see clause 4.4); and
   - number of whole belt revolutions required for zero testing (see clause 4.5).

   Mark these values on the data plate.
7. Determine the value of the test load (see clause 4.4) and record this value on Test Report 1
8. Test the belt weigher for zero load (see clause 4.5) and record the results on Test Report 1.
9. Calculate the allowable MPEs for weighing performance (see clause 4.6) and repeatability (see clause 4.7) and record the results on Test Report 1.
10. Test the weighing performance of the belt weigher in all modes (see clause 4.6) and record the results on Test Report 1.
11. Compare the error for each run with the allowable MPE for weighing performance (see clause 4.6) and record the results on Test Report 1.
12. Compare the differences between the relative errors of the test pairs with the allowable MPE for repeatability (see clause 4.7) and record the results on Test Report 1.
13. Determine whether the belt weigher has passed or failed.
14. Complete Test Report 1 and Test Report 2.
15. Carry out anything else you need to do to complete the procedure. This may include:
    - obliterating verification, certification and control marks from the belt weigher; and
    - stamping the belt weigher (for more information on stamping see *General Information for Test Procedures*).

## APPENDIX A. TEST REPORTS

Appendix A contains two test reports:

- Test Report 1 is for belt weighers; and
- Test Report 2 is for control instruments.

Although the format of the test reports may vary according to the individual needs and requirements of trade measurement authorities and licensees, the following test reports contains the minimum amount of information that must be recorded.

If the certificate/s of approval requires additional tests, attach pages that record the results of these tests.

Number each page of the test report in the style shown at the top of each page.

## Test Report 1 for Belt Weighers

Test report reference number .................................................... Date of test.......................................

Type of test (tick one) ☐ Verification ☐ Certification ☐ In-service inspection

For in-service inspection record the verification/certification mark.....................................................

Name of owner/user ......................................................................................................................

Address of owner/user ...................................................................................................................

Name of contact on site..................................................................................................................

Address where belt weigher is located...........................................................................................

Manufacturer's name or mark............................ Importer's name or mark (if applicable)...............

Model ........................ Serial number .............. Certificate/s of approval number...........................

Belt conveyor number (if applicable) ................ Controller/integrator number (if applicable)..........

Load cell number (if applicable)......................... Basework model number (if applicable)...............

Accuracy class (circle correct one) 0.5 1 2

Maximum flow rate ($Q_{max}$) ..................................................................................... kg/h or t/h

Minimum flow rate ($Q_{min}$)........................................................................................ kg/h or t/h

Minimum totalised load ($\Sigma_{min}$) .............................................................................. kg or t

Minimum test load ($\Sigma_t$) ............................................................................................ kg or t

Maximum capacity (Max)................................................................................................ kg or t

Totalisation scale interval (d)..........................................................................................

Belt speed/s ..................................................................................................................... m/s

Weigh length ....................................................................................................................... m

Temperature range (if applicable).......................................................................................

Designation of product/s .....................................................................................................

Number of whole belt revolutions required for zero testing...............................................

**Test Report 1 for Belt Weighers**

| | |
|---|---|
| Does the belt weigher comply with its certificate/s of approval? | yes/no |
| Is the belt weigher used in an appropriate manner? | yes/no |
| Are all mandatory descriptive markings clearly and permanently marked on data plate? | yes/no |
| Is the data plate fixed on the weighing system? | yes/no |
| Is the belt weigher in a suitable operational condition? | yes/no |
| Are there any apparent obstructions to the operation of the belt weigher? | yes/no |
| Is the indicating device accessible during normal operation? | yes/no |
| Is the belt weigher fully assembled? | yes/no |
| Is the belt weigher fixed into the position for its intended use? | yes/no |
| Is the belt weigher adequately protected against any other influence likely to affect its performance? | yes/no |
| For additional indicating devices: do they exactly repeat the information on the primary indication and does any device for price computation and/or ticket/label printing comply with the requirements of the General Supplementary Certificates S1/0/A or S1/0? | yes/no/na |

**Determining the Value of the Minimum Totalised Load (clause 4.3)**
(calculations required for initial verification/certification and when site conditions change)

The minimum totalised load is not less than the greatest value below, namely ............. t or kg

| | |
|---|---|
| 2% of the load totalised in 1 hour at maximum flow rate = 0.02 × $Q_{max}$ = 0.02 × | = ............ t or kg |
| Load obtained at maximum flow rate in one revolution of the belt<br>= $Q_{max}$ × [belt length (m) / speed (m/s)] / 3600 = ....... × [........... / .......... ] / 3600 | = ............ t or kg |
| Load corresponding to the appropriate number of totalisation scale intervals from Table 1 = number totalisation scale intervals × value of totalisation scale interval<br>= .................... × ...................... | = ............ t or kg |

**Determining the Value of the Minimum Test Load and the Test Load (clause 4.4)**
(calculations required for initial verification/certification and when site conditions change)

The minimum test load is the greatest value below, namely ............. t or kg

The test load is a nominated value equal to, or greater than, the minimum test load ............. t or kg

| | |
|---|---|
| 2% of the load totalised in 1 hour at maximum flow rate = 0.02 × $Q_{max}$ = 0.02 × | = ............ t or kg |
| Load obtained at maximum flow rate in one revolution of the belt<br>= $Q_{max}$ × [belt length (m) / speed (m/s)] / 3600 = ....... × [........... / .......... ] / 3600<br>Not applicable when the larger of the values above and below are obtained over a whole number of belt revolutions | = ............ t or kg |
| Load corresponding to the appropriate number of totalisation scale intervals from Table 1 = number totalisation scale intervals × value of totalisation scale interval<br>= .................... × ...................... | = ............ t or kg |
| Load corresponding to three times the MPE of the control instrument<br>= scale interval of the control instrument × 3 / percentage MPE from Table 4 =<br>...................... × 3 / .................... | = ............ t or kg |

# Test Report 1 for Belt Weighers

**Weighing Performance (clause 4.6) and Repeatability (clause 4.7)**

Copy this page for each mode being tested

Test load ☐ Coal ☐ Grain ☐ Other.................................... Direction....................................... Belt speed................. m/s

Allowable MPE for weighing performance from Table 4 ............................................................................ %

Allowable MPE for repeatability (the absolute MPE for weighing performance) .................................................. %

| | Feeding flow rate (kg/h or t/h) | Test pairs and run number | Control instrument (t or kg) | | | | | | | | | | Belt weigher (t or kg) | | | Weighing performance | | Repeatability | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mass of each draught if transfer vehicle used | | | | | | | | | Mass test load (B) | $T_s$ | $T_f$ | Mass test load ($T_f – T_s$) (A) | Error (A – B)/ B × 100 (%) | Pass/ fail | Difference between relative errors (%) | Pass/ fail |
| | | | Draught 1 | | | Draught 2 | | | Draught 3 | | | | | | | | | | |
| | | | Gross | Tare | Mass | Gross | Tare | Mass | Gross | Tare | Mass | | | | | | | | |
| $Q_{max}$ | | 1 | | | | | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 1 | | | | | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | | | | | |
| $Q_{min}$ | | 1 | | | | | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | | | | | |
| | | 1 | | | | | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | | | | | |
| $Q_{50\%}$ | | 1 | | | | | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | | | | | |
| $Q_{80\%}$ | | 1 | | | | | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | | | | | |
| $Q_{60\%}$ | | 1 | | | | | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | | | | | |
| $Q_{40\%}$ | | 1 | | | | | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | | | | | |
| $Q_{20\%}$ | | 1 | | | | | | | | | | | | | | | | | |
| | | 2 | | | | | | | | | | | | | | | | | |

# Test Report 1 for Belt Weighers

## Zero Load Test (clause 4.5)

Time (in min) for one revolution of the belt = [belt length (m) / speed (m/s)] / 60 = ( … / … ) / 60 = … min

Therefore the number of whole belt revolutions that would occur in a period close to 3 min is … whole belt revolutions

The number of whole belt revolutions required to weigh the minimum totalised load at maximum flowrate = [ minimum totalised load (t) / maximum flowrate (t/h) ] / time per revolution (h) = ( … / … ) / … = …

| Allowable MPE for variation of the indication at zero .................... t or kg<br>(amount of product that will pass over the belt during test × appropriate percentage from Table 2) | | | | | |
|---|---|---|---|---|---|
| Test number | Number of whole belt revolutions | Duration of test | Initial indication ($I_1$) | Final indication ($I_2$) | Difference ($I_2 – I_1$) |
| 1 | | | | | |
| 2 | | | | | |

| Allowable MPE for variation of the totalisation indicator .................... t or kg<br>(amount of product that will pass over the belt during test × appropriate percentage from Table 3)<br>Note: Only applies when the number of whole belt revolutions is less than or equal to three | | | | | |
|---|---|---|---|---|---|
| Test number | Initial indication ($I_1$) | Maximum indication ($I_{max}$) | Minimum indication ($I_{min}$) | $I_1 – I_{max}$ (A) | $I_1 – I_{min}$ (B) |
| 1 | | | | | |
| 2 | | | | | |
| Result | ☐ Pass | ☐ Fail | | | |

### Test Results

| | | |
|---|---|---|
| Zero load test (clause 4.5) | ☐ Pass | ☐ Fail |
| Weighing performance (clause 4.6) | ☐ Pass | ☐ Fail |
| Repeatability (clause 4.7) | ☐ Pass | ☐ Fail |
| **Overall result** | ☐ **Pass** | ☐ **Fail** |

Inspector’s/certifier’s name............................................................ Identification number..................

Signature ..........................................................................................................................................

Comments .........................................................................................................................................

.........................................................................................................................................................

.........................................................................................................................................................

## Test Report 2 for Control Instruments

### Calculation to Determine if the Control Instrument is Suitable for Use and Meets the Accuracy Requirements

Complete:

- section A when the test load is either fed directly onto the belt conveyor, or transferred in a single draught, to or from the control instrument;
- section B when the test load is transferred in multiple draughts to or from the control instrument, which is a single-platform weighbridge;
- section C when the test load is transferred in multiple draughts to or from a control instrument, which is a multi-platform weighbridge;
- section D when the test load is transferred in a single draught to or from a control instrument, which is a multi-platform weighbridge;
- section E when the appropriate calculation in sections A to D has shown that the control instrument is bordering on being suitable and you need to use a more precise calculation; and
- section F when you need to determine suitability using change points.

Table 5. MPEs for loads, m, expressed in verification scale intervals, e

| MPEs | Class 3 | Class 4 |
|---|---|---|
| ±0.5e | 0 ≤ m ≤ 500 | 0 ≤ m ≤ 50 |
| ±1e | 500 < m ≤ 2 000 | 50 < m ≤ 200 |
| ±1.5e | 2 000 < m ≤ 10 000 | 200 < m ≤ 1 000 |

### Method 1 — Calculations NOT using Change Points

**Section A** When the test load is either fed directly onto the belt conveyor, or transferred in a single draught, to or from the control instrument ($\Sigma_t$ is the minimum test load)

| Part 1. Accuracy requirements for the control instrument [(MPE% / 100) × $\Sigma_t$ × ⅓] | | | | |
|---|---|---|---|---|
| Test load (not less than $\Sigma_t$) | Accuracy class of belt weigher | MPE from Table 4 | MPE mass value | Accuracy requirement (⅓ MPE of belt weigher) |
| | | ± | ± | ± |
| **Part 2. MPE of the control instrument** | | | | |
| Mass of test load or total load | Verification scale interval (e) | Number of verification scale intervals | MPE from Table 5 | MPE mass value |
| | | | ± | ± |
| **Does the control instrument meet the accuracy requirements?** Note: MPE of control instrument must be ≤⅓ MPE of belt weigher | | | | **yes/no** |

## Test Report 2 for Control Instruments

**Section B** When the test load is transferred in multiple draughts to or from the control instrument, which is a single-platform weighbridge ($\Sigma_t$ is the minimum test load)

| Part 1. Accuracy requirements for the control instrument [(MPE% / 100) × $\Sigma_t$ × ⅓] | | | | |
|---|---|---|---|---|
| Test load (not less than $\Sigma_t$) | Accuracy class of belt weigher | MPE from Table 4 | MPE mass value | Accuracy requirement (⅓ MPE of belt weigher) |
| | | ± | ± | ± |

| Part 2. MPE of the control instrument | | | | | |
|---|---|---|---|---|---|
| Mass of resultant load for each draught | | Verification scale interval (e) | Number of verification scale intervals | MPE from Table 5 | MPE mass value for each draught |
| 1 | | | | ± | ± |
| 2 | | | | ± | ± |
| 3 | | | | ± | ± |
| 4 | | | | ± | ± |
| 5 | | | | ± | ± |
| 6 | | | | ± | ± |
| Total MPE of the control instrument | | | | | ± |
| **Does the control instrument meet the accuracy requirements?**<br>Note: MPE of control instrument must be ≤⅓ MPE of belt weigher | | | | | **yes/no** |

**Section C** When the test load is transferred in multiple draughts to or from a control instrument, which is a multi-platform weighbridge ($\Sigma_t$ is the minimum test load)

| Part 1. Accuracy requirements for the control instrument [(MPE% / 100) × $\Sigma_t$ × ⅓] | | | | |
|---|---|---|---|---|
| Test load (not less than $\Sigma_t$) | Accuracy class of belt weigher | MPE from Table 4 | MPE mass value | Accuracy requirement (⅓ MPE of belt weigher) |
| | | ± | ± | ± |

| Part 2. MPE of the control instrument | | | | | |
|---|---|---|---|---|---|
| Mass of total load for each draught (dr) and platform (plat) | | Verification scale interval (e) | Number of verification scale intervals | MPE from Table 5 | MPE mass value for each draught and platform |
| Dr 1, plat 1 | | | | ± | ± |
| Dr 1, plat 2 | | | | ± | ± |
| etc | | | | ± | ± |
| Dr 2, plat 1 | | | | ± | ± |
| Dr 2, plat 2 | | | | ± | ± |
| etc | | | | ± | ± |
| Dr 3, plat 1 | | | | ± | ± |
| Dr 3, plat 2 | | | | ± | ± |
| etc | | | | ± | ± |
| Dr 4, plat 1 | | | | ± | ± |
| Dr 4, plat 2 | | | | ± | ± |
| etc | | | | | |
| Total MPE of the control instrument | | | | | ± |
| **Does the control instrument meet the accuracy requirements?**<br>Note: MPE of control instrument must be ≤⅓ MPE of belt weigher | | | | | **yes/no** |

**Test Report 2 for Control Instruments**

**Section D** When the test load is transferred in a single draught to or from a control instrument, which is a multi-platform weighbridge ($\Sigma_t$ is the minimum test load)

| Part 1. Accuracy requirements for the control instrument [(MPE% / 100) × $\Sigma_t$ × ⅓] | | | | | |
|---|---|---|---|---|---|
| Test load (not less than $\Sigma_t$) | | Accuracy class of belt weigher | MPE from Table 4 | MPE mass value | Accuracy requirement (⅓ MPE of belt weigher) |
| | | | ± | ± | ± |
| Part 2. MPE of the control instrument | | | | | |
| Mass of total load for each platform | | Verification scale interval (e) | Number of verification scale intervals | MPE from Table 5 | MPE mass value for each platform |
| 1 | | | | ± | ± |
| 2 | | | | ± | ± |
| 3 | | | | ± | ± |
| 4 | | | | ± | ± |
| 5 | | | | ± | ± |
| Total MPE of the control instrument | | | | | ± |
| **Does the control instrument meet the accuracy requirements?**<br>Note: MPE of control instrument must be ≤⅓ MPE of belt weigher | | | | | **yes/no** |

**Section E** When the appropriate calculation in sections A to D has shown that the control instrument is bordering on being suitable and you need to use a more precise calculation ($\Sigma_t$ is the minimum test load, $E_c$ is the possible error of the control instrument and $\sqrt{N}$ is an adjustment for the probable error of N partial weightings)

| Part 1. Accuracy requirements for the control instrument [(MPE% / 100) × $\Sigma_t$ × ⅓] | | | | |
|---|---|---|---|---|
| Test load (not less than $\Sigma_t$) | Accuracy class of belt weigher | MPE from Table 4 | MPE mass value | Accuracy requirement (⅓ MPE of belt weigher) |
| | | ± | ± | ± |
| Part 2.Theoretical accuracy of the control instrument ($\sqrt{N} \times E_c$) | | | | |
| Number of weighings (N) (one gross, one tare for each load)<br>N = 2 × $\Sigma_t$ / vehicle capacity = 2 ×............ / ............ = | | | | |
| Load expressed in verification scale intervals (m)<br>m = vehicle gross load / verification scale interval......... / ....... = | | | | |
| Possible error of the control instrument ($E_c$) for class 3 instruments:<br>if 0 ≤ m ≤ 500 then $E_c$ = ±0.5 × e = ± ........ × ........ =<br>if 500 ≤ m ≤ 2000 then $E_c$ = ±1.0 × e = ± ........ × ........ =<br>if 2 000 ≤ m then $E_c$ = ±1.5 × e = ± ........ × ........ = | | | | ± |
| Theoretical mass value ($\sqrt{N} \times E_c$) = √....... × ± ........ = | | | | ± |
| **Does the control instrument meet the accuracy requirements?**<br>Note: (MPE% / 100) × $\Sigma_t$ × ⅓ ≥ $\sqrt{N} \times E_c$ | | | | **yes/no** |

## Test Report 2 for Control Instruments

### Method 2 — Calculation using Change Points

**Section F** When you need to determine suitability using change points

Note: When change points are used to determine the suitability of the control instrument then the actual value of each test load shall also be determined using change points.

| Test load or partial test load ID | P = I + 0.5e – ΔL | | | E = P – L | | | % of L (t or kg) | Maximum error acceptable (⅓) |
|---|---|---|---|---|---|---|---|---|
| | I | 0.5e | ΔL | P | L(=I) | E | | |
| | | | | | | | ± | ± |
| | | | | | | | ± | ± |
| | | | | | | | ± | ± |
| | | | | | | | ± | ± |
| | | | | | | | ± | ± |
| **Does the control instrument meet the accuracy requirements?** | | | | | | | **yes/no** | |

Test load value = (I + 0.5e – E) – ΔL

| Test load ID | (I + 0.5e – E) – ΔL | | | | Test load value (t or kg) |
|---|---|---|---|---|---|
| | I | 0.5e | E | ΔL | |
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## Test Report 2 for Control Instruments

### Refer to NITP 6.1 to 6.4 for the test procedure

Test report reference number .................................................... Date of test.......................................

Type of test (tick one) ☐ Verification ☐ Certification

☐ Other (attach **either** a 6B/0 analysis **or** a letter of approval from NMI)

Name of owner/user ..............................................................................................................

Address of owner/user ..............................................................................................................

Name of contact on premises ..............................................................................................................

Address where belt weigher is located..............................................................................................

Description of instrument..............................................................................................................

Manufacturer ...................................... Model .......................... Serial number .................................

Certificate/s of approval number (if applicable) ..............................................................................

Maximum capacity (Max)......................... Minimum capacity (Min) .................................................

Verification scale interval (e)......................................Accuracy class ..............................................

| | |
|---|---|
| Does the instrument comply with its certificate/s of approval? | yes/no/na |
| Is the instrument being used in an appropriate manner? | yes/no |
| Are all mandatory descriptive markings clearly and permanently marked on the data plate? | yes/no |
| Is the data plate fixed on the instrument? | yes/no |
| Is the instrument complete? | yes/no |
| Is the instrument broken? | yes/no |
| Is the instrument clean? | yes/no |
| Is the instrument operational? | yes/no |
| Is the level-indicating device (if fitted) secured and functional? | yes/no/na |
| Is the instrument level? | yes/no |
| Are there any apparent obstructions to the operation of the instrument? | yes/no |
| Is the instrument mounted on a firm base? | yes/no |
| Does the operator (and where applicable, the customer) have a clear and unobstructed view of the indicating device and the whole weighing operation? | yes/no |
| Is the instrument adequately protected against abnormal dust, air movement, vibrations, atmospheric conditions and any other influence likely to affect its performance? | yes/no |
| If applicable, does the steelyard, tare bar or proportional weight comply with the mandatory requirements in respect to design and marking? | yes/no/na |
| If applicable, does the weighbridge comply with the relevant Trade Measurement (Weighbridge) Regulations and the *Code of Practice for Weighbridge Installations*? | yes/no/na |
| For additional indicating devices: do they exactly repeat the information on the primary indication and does any device for price computation and/or ticket/label printing comply with the requirements of General Supplementary Certificate S1/0/A (or General Supplementary Certificates S1/0 and S2/0 for devices initially verified or certified prior to March 1992)? | yes/no/na |

**Test Report 2 for Control Instruments**

**Test Results**

<table>
<tr><td rowspan="6">Repeatability (NITP 6.1 to 6.4, clause 5.1)</td><td>Load</td><td colspan="3"></td></tr>
<tr><td>First reading</td><td colspan="3"></td></tr>
<tr><td>Second reading</td><td colspan="3"></td></tr>
<tr><td>Third reading</td><td colspan="3"></td></tr>
<tr><td>Difference</td><td colspan="3"></td></tr>
<tr><td colspan="4">☐ Pass ☐ Fail</td></tr>
<tr><td rowspan="9">Eccentricity<br>(NITP 6.1 to 6.4, clause 5.2)</td><td colspan="4">Number of supports:</td></tr>
<tr><td colspan="4">Load used:</td></tr>
<tr><td>Position 1</td><td></td><td>Position 7</td><td></td></tr>
<tr><td>Position 2</td><td></td><td>Position 8</td><td></td></tr>
<tr><td>Position 3</td><td></td><td>Position 9</td><td></td></tr>
<tr><td>Position 4</td><td></td><td>Position 10</td><td></td></tr>
<tr><td>Position 5</td><td></td><td>Position 11</td><td></td></tr>
<tr><td>Position 6</td><td></td><td>Position 12</td><td></td></tr>
<tr><td colspan="4">☐ Pass ☐ Fail</td></tr>
<tr><td>Zero setting (NITP 6.1 to 6.4, clause 5.3)</td><td colspan="4">☐ Pass ☐ Fail</td></tr>
<tr><td rowspan="11">Weighing performance<br>not using substitution load<br>(NITP 6.1 to 6.4, clause 5.4.1)<br>Note: For weighing performance using substitution load refer to the next page</td><td colspan="2">Loads applied (minimum 5)</td><td>Indication up</td><td>Indication down</td></tr>
<tr><td colspan="2"></td><td></td><td></td></tr>
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<tr><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="4">Over-range blanking ☐ Pass ☐ Fail ☐ na</td></tr>
<tr><td colspan="4">☐ Pass ☐ Fail ☐ na</td></tr>
</table>

## Test Report 2 for Control Instruments

| Weighing performance using substitution load (NITP 6.1 to 6.4, clause 5.4.2) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Method used | ☐ Method A | | ☐ Method B | | | | | | | |
| MPE change points | | | | | | | | | | |
| Available standard weights | | | | | | | | | | |
| First substitution load | | | | | | | | | | |
| Second substitution load | | | | | | | | | | |
| Third substitution load | | | | | | | | | | |
| Up | L | Makeup of load | MPE | I | ½e | ΔL | E | $L_{sub}$ | $L_{sub}$ (rounded) | Pass/fail/ na |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Over-range blanking | ☐ Pass | ☐ Fail | ☐ na | | | | | | | |

| Down | L | Makeup of load | MPE | I | Pass/fail |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
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| | | | |
|---|---|---|---|
| Discrimination (NITP 6.1 to 6.4, clause 5.5) | ☐ Pass | ☐ Fail | |
| Sensitivity (NITP 6.1 to 6.4, clause 5.6) | ☐ Pass | ☐ Fail | ☐ na |
| Accuracy of tare setting (NITP 6.1 to 6.4, clause 5.7) | ☐ Pass | ☐ Fail | ☐ na |
| Price computation (NITP 6.1 to 6.4, clause 5.8) | ☐ Pass | ☐ Fail | ☐ na |
| **Overall result** | ☐ **Pass** | ☐ **Fail** | |

Inspector's/certifier's name............................................................ Identification number..................

Signature ........................................................................................................................................

Comments .......................................................................................................................................

.........................................................................................................................................................

## APPENDIX B. CHECKLIST FOR PREPARATION AND PLANNING

| | |
|---|---|
| Does the belt weigher comply with its certificate of approval? | yes/no |
| Does the certificate of approval contain any special conditions? | yes/no |
| Does the certificate of approval contain any additional tests? | yes/no |
| Is written confirmation from NMI required for the belt weigher? | yes/no |
| Is written confirmation from NMI required for the control instrument? | yes/no |
| Has the relevant administering authority been advised? | yes/no |
| Have arrangements been made with the site operator to ensure exclusive availability of the belt weigher during testing? | yes/no |
| Have arrangements been made with the site operator to ensure exclusive availability of the control instrument during testing? | yes/no |
| Is there sufficient availability of reference standards of measurement to test the control instrument to the minimum test load? | yes/no |
| Do the reference standards of measurement have a current Regulation 13 certificate for inspectors' reference standards class 3? | yes/no |
| Have arrangements been made to test the control instrument within the prescribed time? | yes/no |
| Has the suitability of the control instrument been determined? | yes/no |
| Have arrangements been made to ensure the test results for the control instrument are included in the test report for the belt weigher? | yes/no |
| Has the minimum totalised load been determined and marked on the data plate? | yes/no |
| Has the minimum test load been determined and marked on the data plate? | yes/no |
| Has the test load been determined? | yes/no |
| Is the test load ≥ the minimum test load shown on the data plate? | yes/no |
| Have the number of whole belt revolutions required for the zero load test been determined and marked on the data plate? | yes/no |
| Has the MPE for the zero load test been calculated? | yes/no |
| Has the MPE for the maximum variation during the zero load test been calculated? | yes/no/na |
| Has maximum flow rate been determined and marked on the data plate? | yes/no |
| Has minimum flow rate been determined and marked on the data plate? | yes/no |
| Is the minimum flow rate ≥20% of the maximum flow rate? | yes/no |
| Is an adequate quantity of product/s available to prepare for all test runs? | yes/no |
| Is a suitable previous device available? | yes/no |
| Is the previous device able to achieve a feeding flow rate equal to the maximum flow rate? | yes/no |
| Is a holding bin required? | yes/no |
| Are transfer vehicles required? | yes/no |
| Have the required number of skilled personnel been scheduled to assist? | yes/no |
| Are suitable communication systems in place? | yes/no |
| Is all the required equipment operational and available? | yes/no |
| Is the incremental value of the indicating device for the belt weigher suitable to determine the MPE value? | yes/no |

# APPENDIX C. WORKED EXAMPLES

## C.1 How to Determine Minimum Totalised Load

**Belt Weigher**

| | |
|---|---|
| Accuracy class | 1 |
| Belt speed | 3.5 m/s |
| Belt length | 640 m |
| Maximum flow rate | 1000 t/h |
| Minimum flow rate | 200 t/h |
| Totalisation scale interval | 0.1 t |

The minimum totalised load shall not be less than the largest of the following values:

- 2% of the load totalised in 1 hour at maximum flow rate = 0.02 × $Q_{max}$ = 20 t
- load obtained at maximum flow rate in one revolution of the belt
  = $Q_{max}$ × [(belt length / speed) / 3600]
  = 1000 × [(640 / 3.5) / 3600] = 50 t
- load corresponding to the appropriate number of totalisation scale intervals from Table 1 = 400 × 0.1 = 40 t

Therefore the minimum totalised load to be marked on the data plate is 50 t.

## C.2 How to Determine Minimum Test Load and Test Load

**Belt weigher**

| | |
|---|---|
| Accuracy class | 1 |
| Belt speed | 3.5 m/s |
| Belt length | 640 m |
| Maximum flow rate | 1000 t/h |
| Minimum flow rate | 200 t/h |
| Totalisation scale interval | 0.1 t |
| Minimum totalised load | 50 t |

**Control instrument, a hopper**

| | |
|---|---|
| Maximum capacity | 100 t |
| Scale interval | 0.1 t |

The minimum test load shall not be less than the largest of the following values:

- 2% of the load totalised in 1 hour at maximum flow rate
  = 0.02 × $Q_{max}$ = 20 t
- load obtained at maximum flow rate in one revolution of the belt
  = $Q_{max}$ × [(belt length / speed) / 3600]
  = 1000 × [(640 / 3.5) / 3600] = 50 t

  Note: When this answer is the largest value it is eliminated when the results above and below are obtained over a whole number of belt revolutions.
- load corresponding to the appropriate number of totalisation scale intervals from Table 1 × totalisation scale interval = 400 × 0.1 = 40 t
- load corresponding to three times the MPE of the control instrument
  = scale interval of the control instrument × 3 / percentage MPE from Table 4
  = 0.1 × 3 / 0.5% = 60 t

According to these calculations the minimum test load must be at least 60 t.

The test load is a nominated value equal to, or greater than, the minimum test load, and so the test load can be any value from 60 t to the maximum capacity of the hopper which is 100 t.

In this example the minimum totalised load is not equal to the minimum test load.

## C.3 Calculations Required for Zero Load Test

| | |
|---|---|
| Accuracy class | 1 |
| Belt speed | 3.5 m/s |
| Belt length | 640 m |
| Maximum flow rate | 1000 t/h |
| Minimum totalised load | 50 t |
| Number of revolutions required for zero testing | 1 |

### C.3.1 How to calculate the number of revolutions required for the zero load test

Calculate the time (in minutes) for one revolution of the belt
= [belt length (m) / speed (m/s)] / 60
= (640 / 3.5) / 60 = 3 min.

Therefore the number of whole belt revolutions that would occur in a period close to 3 minutes is one whole belt revolution.

### C.3.2 How to calculate the MPE for the variation of the indication at zero

(a) Calculate the time (in hours) for one revolution of the belt
= [belt length (m) / speed (m/s)] / 3600
= 0.05 h (3 min).

(b) Calculate the amount of product that would pass over the belt in one revolution at maximum flow rate.

Flow rate at maximum flow rate multiplied by the time required for one revolution in hours
= 1 000 t/h × 0.05 h = 50 t

(c) Calculate the number of whole belt revolutions required.

Since 50 t passes over the belt at $Q_{max}$ in one revolution and takes 3 min, the number of whole belt revolutions required for the test is one.

The MPE for the maximum variation of the totalisation indicator will also need to be calculated because the number of belt revolutions is less than three belt revolutions. See clause C.3.3 for calculation.

(d) Determine the MPE for the variation of the indication at zero by multiplying the amount of product that will pass over the belt during the test by the appropriate percentage from Table 2.

The amount of product that will pass over the belt is 50 t.

The appropriate percentage from Table 2 is ±0.1%.

50 t × ±0.1% = ±0.05 t

(e) Record the value of the MPE for checking of zero
MPE for checking of zero = ±0.05 t

### C.3.3 How to calculate the MPE for the maximum variation of the totalisation indicatior

(a) Determine the MPE for the maximum variation of the totalisation indicatior by multiplying the amount of product that will pass over the belt during the test by the appropriate percentage from Table 3.

The amount of product that will pass over the belt is 50 t.

The appropriate percentage from Table 3 is ±0.35%
50 t × ±0.35% = ±0.18 t

(b) Record the value of the maximum variation during the zero load test
= ±0.18 t

In this example the belt weigher has a totalisation scale interval of 0.1 t. Therefore it would be acceptable to round the value for the maximum variation during the zero load test to ±0.2 t.

## C.4 Calculations Required for a Typical Belt Weigher

This example uses a question and answer technique to demonstrate the calculations required in order to verify/certify a typical belt weigher.

| **Belt weigher** | |
|---|---|
| Accuracy class | 0.5 |
| Maximum flow rate | 2 200 t/h |
| Belt length | 340 m |
| Belt speed | 3.5 m/sec |
| Weigh length | 4.5 m |
| Totalisation scale interval | 0.1 t |
| Minimum totalised load | 80 t |
| Minimum test load | 80 t |
| Number of revolutions required for zero testing | 1 |

| **Control instrument (hopper)** | |
|---|---|
| Maximum capacity | 130 t |
| Scale interval | 0.1 t |

### C.4.1 How do you make a control instrument suitable after it has been found to be unsuitable?

Changing the value of the minimum test load can make a control instrument suitable after it has been found to be unsuitable. The revised minimum test load shall be marked on the data plate.

Note: The accuracy of the control instrument must be at least three times better than that of the belt weigher.

**Minimum test load**

MPE for the belt weigher is the minimum test load × appropriate percentage from Table 4 = 80 × 0.25 = 0.2 t.

Required accuracy of the control instrument is the MPE for the belt weigher divided by three = 0.2 / 3 = 0.066 t.

MPE for the control instrument is minimum test load / scale interval = 800 e; MPE at 800 e × scale interval = 1.0 × 0.1 t = 0.1 t.

At a minimum test load of 80 t the control instrument is not acceptable because the accuracy of 0.1 t is greater than the requirement of 0.066 t.

**Revised minimum test load**

To determine a revised minimum test load that will allow the available control instrument to be suitable, multiply the scale interval of the control instrument by three and then divide by the appropriate percentage from Table 4 for the belt weigher = 0.1 × 3 / 0.25 = 120 t.

The control instrument has a maximum capacity of 130 t and the revised minimum test load of 120 t makes the control instrument suitable. The original minimum test load of 80 t shown on the data plate shall be changed to 120 t.

Note: The minimum totalised load remains 80 t.

### C.4.2 How long does it take to complete one belt revolution?

Time (in **minutes**) for one revolution of the belt = [belt length (m) / speed (m/s)] / 60 = (340 / 3.5) / 60 = 1.62 min.

Time (in **hours**) for one revolution of the belt = [belt length (m) / speed (m/s)] / 3600 = (340 / 3.5) / 3600 = 0.027 h.

### C.4.3 How many whole belt revolutions are required for the minimum totalised load to pass over the belt?

Minimum totalised load divided by the amount of product that passes over in one revolution = 80 / 59.4 = 1.3 revolutions = two whole revolutions.

### C.4.4 How much product will pass over the belt in one revolution at maximum flow rate?

Maximum flow rate multiplied by the time (in hours) for one revolution = 2 200 × 0.027 = 59.4 t.

### C.4.5 How many whole belt revolutions are required for the checking of zero?

One belt revolution takes 1.62 min, two belt revolutions take 3.24 min.

Since two belt revolutions takes more than 3 min the belt weigher will only require two revolutions in order to test the checking of zero.

### C.4.6 What is the MPE mass value for the variation of the indication at zero?

Amount of product that passes over the belt in one revolution × number of whole revolutions close to 3 min × appropriate percentage from Table 2 = 59.4 × 2 × ±0.05 = ±0.06 t.

### C.4.7 What is the MPE mass value for the maximum variation of the totalisation indicator?

Amount of product that passes over the belt in one revolution × number of whole revolutions close to 3 min × appropriate percentage from Table 3 = 59.4 × 2 × ±0.18 = ±0.21 t.

Note: In this example the value for the maximum variation is required because the zero load test is carried out in less than three revolutions.

### C.4.8 What are the MPE mass values for weighing performance and repeatability?

MPE for **weighing performance** — test load multiplied by the appropriate percentage from Table 4 = 120 × ±0.25 = ±0.3 t.

MPE for **repeatability** — the difference between each pair of test runs must not exceed the absolute MPE for weighing performance, therefore the error for repeatability = 0.3 t.

### C.5 How to Determine the Suitability of the Control Instrument

#### C.5.1 Test load is fed directly onto the belt conveyor from a previous device (a hopper) which is also the control instrument

For a single draught the maximum error acceptable for the control instrument must be equal to or less than one-third the MPE value of the belt weigher.

In this example the control instrument is a hopper of 120 000 kg capacity, verification scale interval of 100 kg and accuracy class 3.

The accuracy class of the belt weigher is 0.5 (MPE of ±0.25%) with a minimum test load of 100 000 kg. Therefore only a single draught is required.

The hopper will be tested within 24 hours of the belt weigher certification.

This example provides two different methods to determine the suitability of the control instrument. If method 1 does not show the control instrument is suitable then method 2 can be employed to ensure the control instrument is suitable.

**Method 1 — Calculation NOT using Change Points**

Table 6 outlines the calculations required to determine the suitability of the control instrument without the need to use change points. In part 1 the belt weigher specifications are used to calculate the maximum error acceptable; and in part 2 the control instrument specifications are used to calculate the MPE mass value for the control instrument. The results from parts 1 and 2 are used to determine if the control instrument is suitable.

The calculations in Table 6 are performed as follows:

In part 1 the mass of the test load is multiplied by the absolute MPE for the belt weigher from Table 4 to obtain the MPE of the belt weigher at the test load. The result is then divided by three to obtain a value for the maximum error acceptable for the accuracy requirement for the control instrument.

In part 2 the mass of the test load is divided by the verification scale interval of the control instrument to determine the number of verification scale intervals. Refer to Table 5 to determine the appropriate MPE for the number of verification scale intervals. The MPE is multiplied by the verification scale interval to provide the MPE mass value of the control instrument.

Using this method determines that the hopper is unacceptable as a control instrument because the MPE mass value of ±100 kg, is greater than the maximum error acceptable of ±83.3 kg determined in part 1. Refer to method 2 on the next page which uses change points to determine the actual error of the control instrument at the test load.

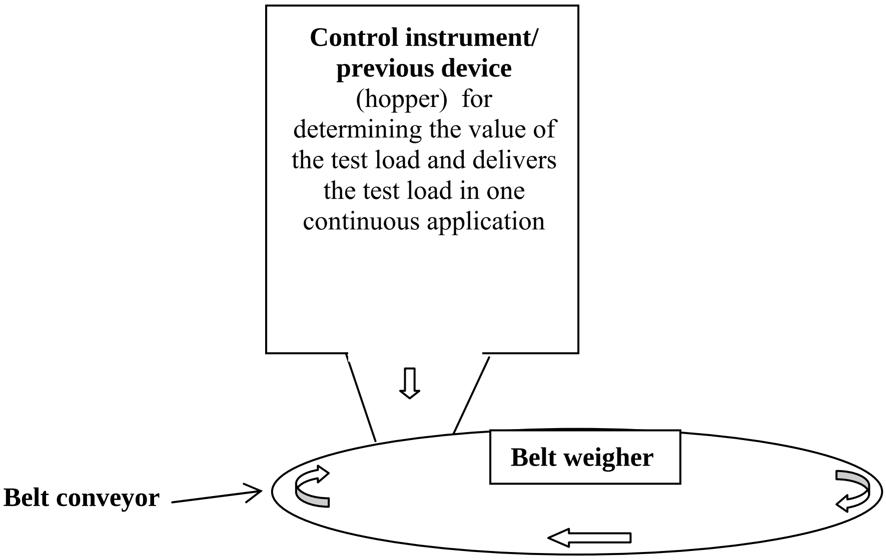

Table 6. Calculation to determine the suitability of the control instrument (a hopper) NOT using change points

| Part 1. Accuracy requirements for the control instrument [(MPE% / 100) × $\Sigma_t$ × ⅓] | | | | |
|---|---|---|---|---|
| Test load (not less than $\Sigma_t$) | Accuracy class of belt weigher | MPE from Table 4 | MPE mass value | Accuracy requirement (⅓ MPE of belt weigher) |
| 100 000 kg | 0.5 | ±0.25% | ±250 kg | ±83.3 kg |
| Part 2. MPE of the control instrument | | | | |
| Mass of test load | Verification scale interval (e) | Number of verification scale intervals | MPE from Table 5 | MPE mass value |
| 100 000 kg | 100 kg | 1 000 | ±1e | ±100 kg |
| **Does the control instrument meet the accuracy requirements?**<br>Note: MPE of control instrument must be ≤⅓ MPE of belt weigher | | | | **no** |

Table 7. Calculation to determine the suitability of the control instrument (a hopper) using change points

| Test load ID | P = I + 0.5e – ΔL | | | E = P – L | | | % of L (t or kg) | Maximum error acceptable (⅓) |
|---|---|---|---|---|---|---|---|---|
| | I | 0.5e | ΔL | P | L(=I) | E | | |
| 1 | 100 000 kg | 50 kg | 20 kg | 100 030 kg | 100 000 kg | 30 kg | ±250 kg | ±83.33 kg |
| **Does the control instrument meet the accuracy requirements?** | | | | | | | **yes** | |

**Method 2 — Calculation using Change Points**

Change points are used to obtain greater resolution of the control instrument when the MPE mass value of the control instrument does not meet the one-third accuracy requirement. Record your results in a table similar to Table 7.

This example demonstrates how change points can be applied using the same data used in method 1. If change point weights are used they must be used to determine all loads involved in preparing the test load, i.e. each draught, single or multiple, and be recorded as part of the test report.

The error is determined by following the same basic principal used for substitution load as outlined in NITP 6.1 to 6.4.

At a certain load, L, the indicated value, I, is noted.

Additional standard weights of 0.1e are successively added to the load receptor until the indication of the instrument is increased unambiguously by one scale interval (I + e). The total mass of the additional weights is ΔL.

The true indication, P, prior to rounding is found by using the following formula:

$P = I + 0.5e - \Delta L$

The error, E, prior to rounding is $E = P - L$.

Thus $E = (I + 0.5e - \Delta L) - L$

For a test load of 100 000 kg: after adding successive standard weights of 10 kg, the indication changes up 1e from 100 000 kg to 100 100 kg at an additional load of 20 kg. Inserted in the above formula these observations give:

P = (100 000 + 50 – 20) kg = 100 030 kg

Thus the true indication prior to rounding is 100 030 kg and the error is:

E = (100 030 – 100 000) kg = 30 kg

The MPE from Table 4 is ±0.25%. The allowable error for a 100 000 kg test load is:

±0.25% of 100 000 kg = ±250 kg

The accuracy requirement for the control instrument is ±250 ÷ 3 = ±83.3 kg. Since the error in the control instrument is known and is less than ±83.3 kg the control instrument is suitable.

The error of the control instrument shall be taken into account when determining the actual value of each test load. Do this for each test load by taking the control instrument to the next indication changeover point by adding small weights (ΔL). The additional weights are not included in the test load. The actual value of the test load is the indication changeover point less the error minus the value of the addition weights.

Test load = (I + 0.5e – E) – ΔL.

#### C.5.2 Test load is transferred in a single draught from the control instrument (a single-platform weighbridge) to the previous device (a holding bin)

For a single draught on a single-platform weighbridge the maximum error acceptable for the control instrument must be equal to or less than one-third the MPE value of the belt weigher.

In this example the control instrument is a single-platform weighbridge of 80 000 kg capacity, verification scale interval of 50 kg and accuracy class 3.

The accuracy class of the belt weigher is 1 (MPE of ±0.50%) with a minimum test load of 40 000 kg.

The transfer vehicle used has a tare of 25 000 kg. The mass of the total load (test load plus tare of transfer vehicle) is 65 000 kg.

The weighbridge will be tested within 24 hours of the belt weigher certification.

Table 8 outlines the calculations required to determine the suitability of the control instrument. In part 1 the belt weigher specifications are used to calculate the maximum error acceptable; and in part 2 the control instrument specifications are used to calculate the MPE mass value for the control instrument. The results from parts 1 and 2 are used to determine if the control instrument is suitable.

The calculations in Table 8 are performed as follows:

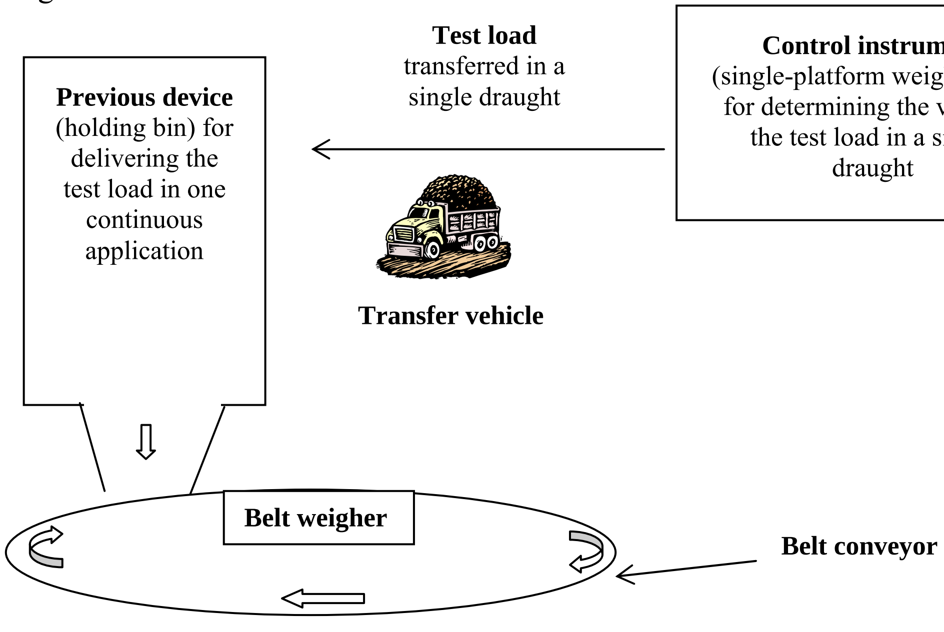

Table 8. Calculation to determine the suitability of the control instrument (a single-platform weighbridge) NOT using change points

| Part 1. Accuracy requirements for the control instrument [(MPE% / 100) × $\Sigma_t$ × ⅓] | | | | |
|---|---|---|---|---|
| Test load (not less than $\Sigma_t$) | Accuracy class of belt weigher | MPE from Table 4 | MPE mass value | Accuracy requirement (⅓ MPE of belt weigher) |
| 40 000 kg | 1 | ±0.50% | ±200 kg | ±66.6 kg |
| Part 2. MPE of the control instrument | | | | |
| Mass of test load | Verification scale interval (e) | Number of verification scale intervals | MPE from Table 5 | MPE mass value |
| 65 000 kg | 50 kg | 1 300 | ±1e | ±50 kg |
| **Does the control instrument meet the accuracy requirements?** Note: MPE of control instrument must be ≤⅓ MPE of belt weigher | | | | **yes** |

In part 1 the mass of the test load is multiplied by the absolute MPE for the belt weigher from Table 4 to obtain the MPE of the belt weigher at the test load. The result is then divided by three to obtain a value for the maximum error acceptable for the accuracy requirement for the control instrument.

In part 2 the mass of the total load (test load plus tare of transfer vehicle) is divided by the verification scale interval of the control instrument to determine the number of verification scale intervals. Refer to Table 5 to determine the appropriate MPE for the number of verification scale intervals. The MPE is multiplied by the verification scale interval to provide the MPE mass value of the control instrument.

This single-platform weighbridge is acceptable as a control instrument because the MPE mass value of ±50 kg is less than the maximum error acceptable of ±66.6 kg determined in part 1.

### C.5.3 Test load is transferred in multiple draughts from the control instrument (a single-platform weighbridge) to the previous device (a holding bin)

For multiple draughts on a single-platform weighbridge the sum of the MPE mass values for each draught (partial test load) must be equal to or less than one-third the MPE value of the belt weigher.

In this example the control instrument is a single-platform weighbridge of 30 000 kg capacity, verification scale interval of 10 kg and accuracy class 3.

The accuracy class of the belt weigher is 1 (MPE of ±0.50%) with a minimum test load of 60 000 kg.

The transfer vehicle has a capacity of 20 000 kg thus requiring three draughts to achieve the minimum test load of 60 000 kg. The transfer vehicle has a tare of 10 000 kg. The mass of each resultant load (partial test load plus the tare of the transfer vehicle) is 30 000 kg.

The weighbridge will be tested within 24 hours of the belt weigher certification. Table 9 outlines the calculations required to determine the suitability of the control instrument. In part 1 the belt weigher specifications are used to calculate the maximum error acceptable; and in part 2: the control instrument specifications are used to calculate the MPE mass value for the control instrument. The results from parts 1 and 2 are used to determine if the control instrument is suitable.

The calculations in Table 9 are performed as follows:

In part 1 the mass of the test load is multiplied by the absolute MPE for the belt weigher from Table 4 to obtain the MPE of the belt weigher at the test load. The result is then divided by three to obtain the maximum error acceptable for the accuracy of the control instrument.

In part 2 the mass of each draught is divided by the verification scale interval of the control instrument to determine the number of verification scale intervals.

Refer to Table 5 to determine the appropriate value of the MPE for the number of verification scale intervals. The MPE is multiplied by the verification scale interval to provide the MPE mass value for each draught, and these are added together to determine the MPE mass value for the control instrument.

This single-platform weighbridge is acceptable as a control instrument because the MPE mass value of ±45 kg is less than the maximum error acceptable of ±100 kg determined in part 1.

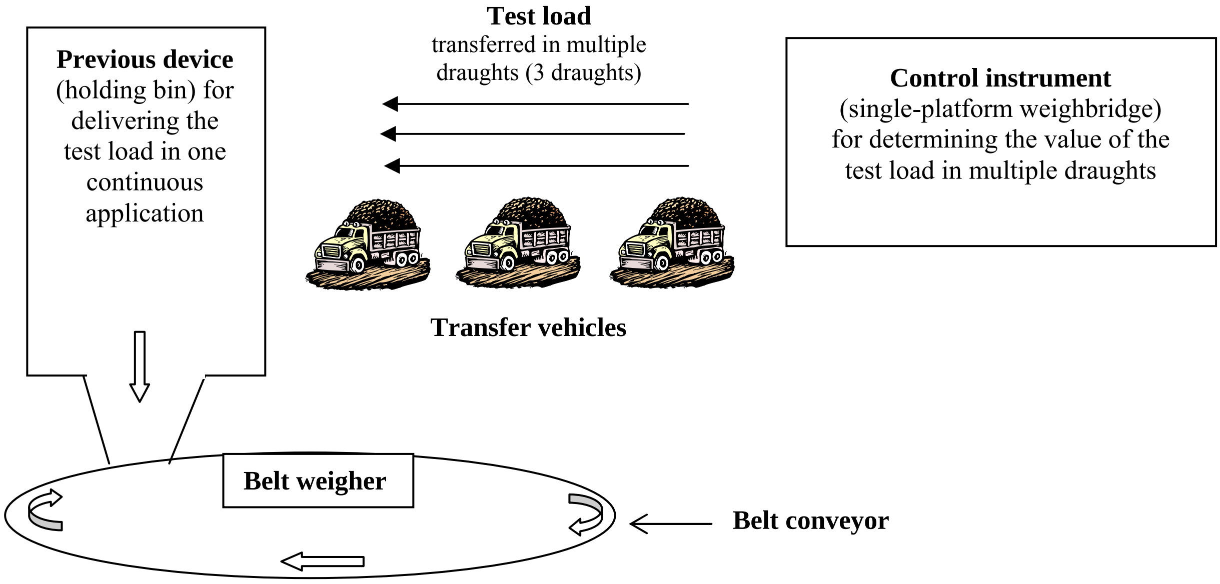


Table 9. Calculation to determine the suitability of the control instrument (a single-platform weighbridge) when the test load is transferred in multiple draughts, NOT using change points

| Part 1. Accuracy requirements for the control instrument [(MPE% / 100) × $\Sigma_t$ × ⅓] | | | | | |
|---|---|---|---|---|---|
| Test load (not less than $\Sigma_t$) | | Accuracy class of belt weigher | MPE from Table 4 | MPE mass value | Accuracy requirement (⅓ MPE of belt weigher) |
| 60 000 kg | | 1 | ±0.50% | ±300 kg | ±100 kg |
| Part 2. MPE of the control instrument | | | | | |
| Mass of resultant load for each draught | | Verification scale interval (e) | Number of verification scale intervals | MPE from Table 5 | MPE mass value for each draught |
| 1 | 30 000 kg | 10 kg | 3 000 | ±1.5e | ±15 kg |
| 2 | 30 000 kg | 10 kg | 3 000 | ±1.5e | ±15 kg |
| 3 | 30 000 kg | 10 kg | 3 000 | ±1.5e | ±15 kg |
| Total MPE of the control instrument | | | | | ±45 kg |
| **Does the control instrument meet the accuracy requirements?** Note: MPE of control instrument must be ≤⅓ MPE of belt weigher | | | | | **yes** |

### C.5.4 Test load is transferred in multiple draughts from the control instrument (a multi-platform weighbridge) to the previous device (a holding bin)

For multiple draughts on a multi-platform weighbridge the sum of the MPE mass values for each draught (partial test load) and the sum of the MPE mass values for each platform combined must be equal to or less than one-third the MPE value of the belt weigher.

In this example the control instrument is a multi-platform weighbridge of 60 000 kg total capacity with two platforms of 30 000 kg capacity, verification scale interval of 10 kg and accuracy class 3.

The accuracy class of the belt weigher is 1 (MPE of ±0.50%) with a minimum test load of 40 000 kg.

The transfer vehicle used has a capacity of 20 000 kg thus requiring two draughts to achieve the minimum test load of 40 000 kg. The transfer vehicle used has a tare of 15 000 kg. The mass of each resultant load (partial test load plus the tare of the transfer vehicle) is 35 000 kg.

Distribution of the resultant load is 18 000 kg on platform 1 and 17 000 kg on platform 2.

Note: The load applied to each platform must be kept within the MPE range calculated in order to meet the accuracy requirements for the weighbridge to be suitable as a control instrument.

The weighbridge will be tested within 24 hours of the belt weigher certification.

Table 10 outlines the calculations required to determine the suitability of the control instrument. In part 1 the belt weigher specifications are used to calculate the maximum error acceptable; and in part 2 the control instrument specifications are used to calculate the MPE mass value for each draught distributed over each platform. The MPE mass values for each draught and platform are added to determine the MPE mass value for the control instrument. The results from parts 1 and 2 are used to determine if the control instrument is suitable.

The calculations in Table 10 are performed as follows:

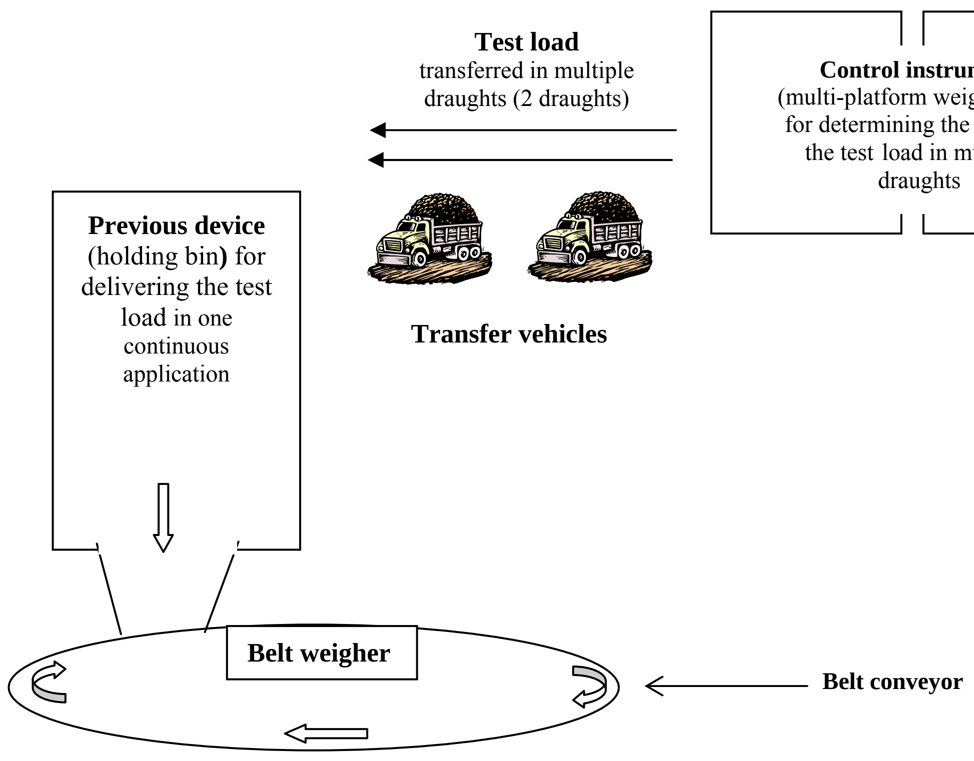

Table 10. Determining the suitability of the control instrument
(a multi-platform weighbridge using multiple draughts)

| Part 1. Accuracy requirements for the control instrument [(MPE% / 100) × $\Sigma_t$ × ⅓] | | | | | |
|---|---|---|---|---|---|
| Test load (not less than $\Sigma_t$) | | Accuracy class of belt weigher | MPE from Table 4 | MPE mass value | Accuracy requirement (⅓ MPE of belt weigher) |
| 40 000 kg | | 1 | ±0.50% | ±200 kg | ±66.6 kg |
| Part 2. MPE of the control instrument | | | | | |
| Mass of total load for each draught (dr) and platform (plat) | | Verification scale interval (e) | Number of verification scale intervals | MPE from Table 5 | MPE mass value for each draught and platform |
| Dr 1, plat 1 | 18 000 kg | 10 kg | 1 800 | ±1e | ±10 kg |
| Dr 1, plat 2 | 17 000 kg | 10 kg | 1 700 | ±1e | ±10 kg |
| Dr 2, plat 1 | 18 000 kg | 10 kg | 1 800 | ±1e | ±10 kg |
| Dr 2, plat 2 | 17 000 kg | 10 kg | 1 700 | ±1e | ±10 kg |
| Total MPE of the control instrument | | | | | ±40 kg |
| **Does the control instrument meet the accuracy requirements?** Note: MPE of control instrument must be ≤⅓ MPE of belt weigher | | | | | **yes** |

In part 1 the mass of the test load is multiplied by the absolute MPE for the belt weigher from Table 4 to obtain the MPE of the belt weigher at the test load. The result is then divided by three to obtain the maximum error acceptable for the accuracy of the control instrument.

In part 2 the mass of each draught on each platform is divided by the verification scale interval of the control instrument to provide the number of verification scale intervals. Refer to Table 5 to determine the appropriate MPE for the number of verification scale intervals. The MPE is multiplied by the verification scale interval to provide the MPE mass value for each platform.

The MPE mass values for each draught and platform are added to determine the total MPE mass value for the control instrument.

This multi-platform weighbridge using two draughts is acceptable as a control instrument because the MPE mass value of ±40 kg is less than the maximum error acceptable of ±66.6 kg determined in part 1.

### C.5.5 Test load is transferred in a single draught from a holding bin to the control instrument (a multi-platform weighbridge)

For a single draught on a multi-platform weighbridge the sum of the MPE mass values for each platform must be equal to or less than one-third the MPE value of the belt weigher.

In this example the control instrument is a multi-platform weighbridge of 80 000 kg total capacity with two platforms of 40 000 kg, verification scale interval of 20 kg and accuracy class 3.

The accuracy class of the belt weigher is 1 (MPE of ±0.50%) with a minimum test load of 40 000 kg.

The transfer vehicle used has a tare of 25 000 kg. The mass of the total load (test load plus tare of transfer vehicle) is 65 000 kg. Distribution of the mass of the total load is 30 000 kg on platform 1 and 35 000 kg on platform 2.

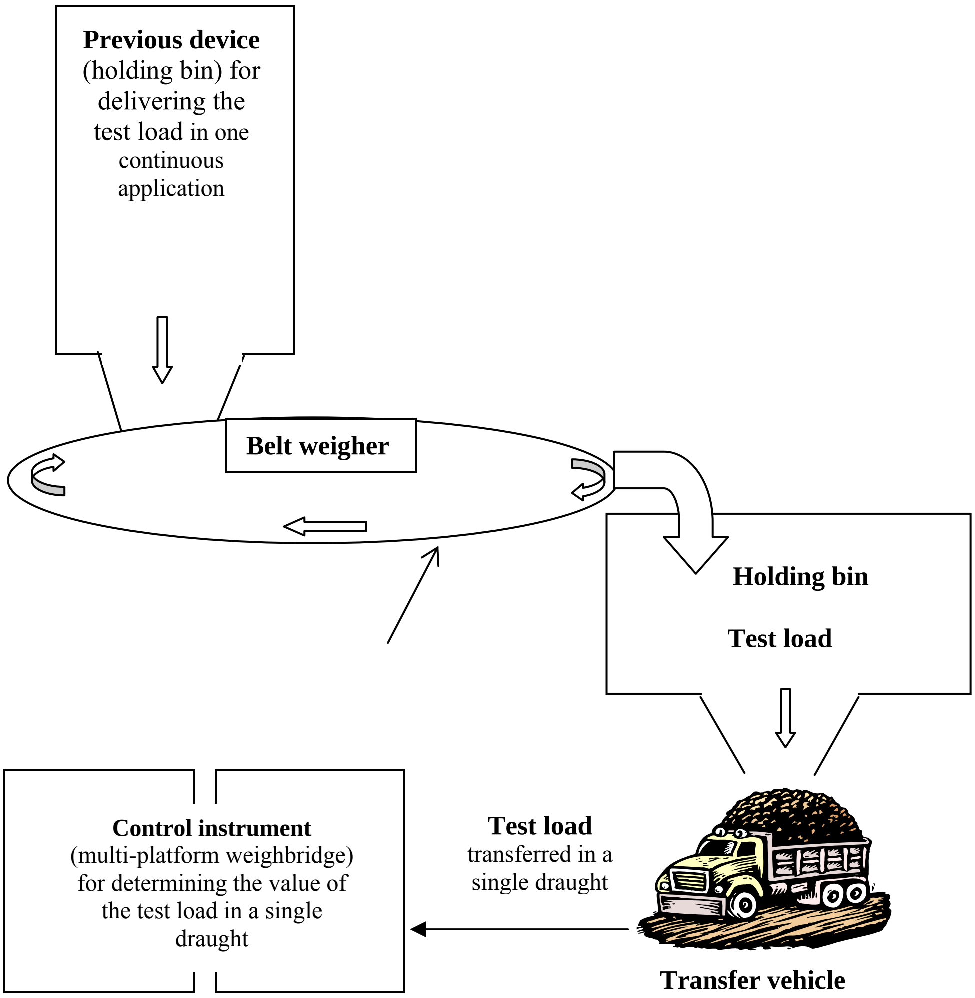


Table 11. Determining the suitability of the control instrument (a multi-platform weighbridge)

| Part 1. Accuracy requirements for the control instrument [(MPE% / 100) × $\Sigma_t$ × ⅓] | | | | | |
|---|---|---|---|---|---|
| Test load (not less than $\Sigma_t$) | | Accuracy class of belt weigher | MPE from Table 4 | MPE mass value | Accuracy requirement (⅓ MPE of belt weigher) |
| 40 000 kg | | 1 | ±0.50% | ±200 kg | ±66.6 kg |
| Part 2. MPE of the control instrument | | | | | |
| Mass of total load for each platform | | Verification scale interval (e) | Number of verification scale intervals | MPE from Table 5 | MPE mass value for each platform |
| 1 | 30 000 kg | 20 kg | 1 500 | ±1e | ±20 kg |
| 2 | 35 000 kg | 20 kg | 1 750 | ±1e | ±20 kg |
| Total MPE of the control instrument | | | | | ±40 kg |
| **Does the control instrument meet the accuracy requirements?** Note: MPE of control instrument must be ≤⅓ MPE of belt weigher | | | | | **yes** |

Table 11 outlines the calculations required to determine the suitability of the control instrument. In part 1 the belt weigher specifications are used to calculate the maximum error acceptable; and in part 2 the control instrument specifications are used to calculate the MPE mass value for the control instrument. The results from parts 1 and 2 are used to determine if the control instrument is suitable.

The calculations in Table 11 are performed as follows:

In part 1 the mass of the test load is multiplied by the absolute MPE for the belt weigher from Table 4 to obtain the MPE of the belt weigher at the test load. The result is then divided by three to obtain the maximum error acceptable for the accuracy of the control instrument.

In part 2 the mass on each platform is divided by the verification scale interval of the control instrument to provide the number of verification scale intervals. Refer to Table 5 to determine the appropriate MPE for the number of verification scale intervals. The MPE is multiplied by the verification scale interval to provide the MPE mass value for each platform. These values are added to determine the MPE mass value for the control instrument.

This multi-platform weighbridge is acceptable as a control instrument because the MPE mass value of ±40 kg is less than the maximum error acceptable of ±66.6 kg determined in part 1.

### C.5.6 When the appropriate calculation in sections A to D has shown that the control instrument is bordering on being suitable and you need to use a more precise calculation

The following example uses a formula to derive a theoretical maximum error for the control instrument. This error must be equal to or less than the one-third the MPE value of the belt weigher. The following formula expresses this relationship:

$(MPE\% / 100) \times \Sigma_t \times ⅓ \geq \sqrt{N} \text{ x } E_c$

In this example the control instrument is a single-platform weighbridge of 30 000 kg capacity, verification scale interval of 10 kg and accuracy class 3.

The accuracy class of the belt weigher is 1 (MPE of ±0.50%) with a minimum test load of 60 000 kg.

The transfer vehicle has a tare weight of 10 000 kg and a capacity of 20 000 kg.

The weighbridge will be tested within 24 hours of the belt weigher certification.

Table 12 outlines the calculations required to determine the suitability of the control instrument. In part 1 the belt weigher specifications are used to calculate the maximum error acceptable; and in part 2 a theoretical maximum error for the control instrument is determined. The results from parts 1 and part 2 are used to determine if the control instrument is suitable.

This single-platform weighbridge is acceptable as a control instrument because the theoretical maximum error of ±36.74 kg is less than the accuracy requirement of ±100 kg determined in part 1.

Table 12. Calculation when the control instrument is bordering on being suitable

| Part 1. Accuracy requirements for the control instrument [(MPE% / 100) × $\Sigma_t$ × ⅓] | | | | |
|---|---|---|---|---|
| Test load (not less than $\Sigma_t$) | Accuracy class of belt weigher | MPE from Table 4 | MPE mass value | Accuracy requirement (⅓ MPE of belt weigher) |
| 60 000 kg | 1 | ±0.50% | ±300 kg | ±100 kg |

| Part 2.Theoretical accuracy of the control instrument (√N × $E_c$) | |
|---|---|
| Number of weighings (N) (one gross, one tare for each load)<br>N = 2 × $\Sigma_t$ / vehicle capacity = 2 × 60 000 / 20 000 = | 6 |
| Load expressed in verification scale intervals (m)<br>m = vehicle gross load / verification scale interval = 30 000 / 10 = | 3 000 |
| Possible error of the control instrument ($E_c$) for class 3 instrument<br>when m = 3 000, $E_c$ = ±1.5 × e = ±1.5 × 10 = | ±15 |
| Theoretical mass value (√N × $E_c$) = √6 × ±15 = | ±36.74 kg |
| **Does the control instrument meet the accuracy requirements?**<br>Note: (MPE% / 100) × $\Sigma_t$ × ⅓ ≥ √N × $E_c$ | **yes** |