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National Instrument Test Procedures for Automatic Packaging Conveyor 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 5-1) became NITP 6.7.

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 5-1.

NMI's Chief Metrologist has determined that NITP 6.7 contains the test procedures for the verification of automatic packaging conveyor weighers.

ABBREVIATIONS

e	verification scale interval
L	applied load
I	indication
Max	maximum capacity
Min	minimum capacity
MPE	maximum permissible error

CONTENTS

1. SCOPE

NITP 6.7 describes the test procedure for the verification of automatic packaging conveyor weighers (hereafter referred to as package weigher), class Y(a) and Y(b), to ensure that they measure within the maximum permissible errors (MPEs) specified in the National Measurement Regulations and that they comply with their certificate of approval.

These test procedures supersede *Test Procedure No. 20 for Weighing In-motion Weighing Instruments* found in Inspectors Handbook 3.

Certificates of approval are based on *NMI R 51-1. Automatic Catchweighing Instruments. Part 1: Metrological and Technical Requirements — Tests*. Refer to NMI R 51-1 for all metrological and technical requirements.

All instruments must comply with the National Measurement Act and National Trade Measurement Regulations.

2. EQUIPMENT

1. Certificate/s of approval.
2. Appropriate reference standards of measurement.

   Note: The reference standards of measurement are referred to as Inspectors' class 1, class 2 and class 3 standards, and they are often simply referred to as weights or standard weights. The permissible uncertainties associated with these standards are described in Schedule 9 of the *National Measurement Regulations 1999*.
3. Current Regulation 13 certificates for all reference standards of measurement. Uncertainties and variations must be in accordance with the National Measurement Regulations. The combined uncertainties and variations must not be greater than one-third of the MPE for the load applied to the instrument being tested.
4. Suitable material to make test objects for testing in accordance with clause 5.3.

   Note: Ensure a suitable quantity of material is available prior to testing.
5. A control instrument suitable for weighing the test objects (see clause 5.1) to determine suitability.
6. Test reports (see Appendix A).

3. VISUAL INSPECTION

Visually inspect the package weigher and record details of the required data and characteristics of the package weigher on Test Report 1.

3.1 Required Data

1. Test report reference number.
2. Date of test.
3. Name of owner/user.
4. Address of owner/user.
5. Name of contact on premises.
6. Address where package weigher is located, if applicable.
7. Description of package weigher.
8. Manufacturer/s.
9. Model.
10. Package weigher serial number.
11. Certificate/s of approval number.
12. Maximum capacity (Max).
13. Minimum capacity (Min).
14. Verification scale interval (e).
15. Accuracy class.

3.2 Characteristics of the Package Weigher

1. Does the package weigher comply with its certificate/s of approval?
2. Is the package weigher being used in an appropriate manner?
3. Are all mandatory descriptive markings clearly and permanently marked on a data plate?
4. Is the data plate fixed on the package weigher?
5. Is the package weigher complete?
6. Is the package weigher broken?
7. Is the package weigher clean?
8. Is the package weigher operational?
9. Is the level-indicating device (if fitted) secured and functional?
10. Is the package weigher level?
11. Are there any apparent obstructions to the operation of the package weigher?
12. Is the package weigher mounted on a firm base?
13. Is the package weigher adequately protected against abnormal dust, air movement, vibrations, atmospheric conditions and any other influence likely to affect its performance?
14. 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.

4. STANDARD PROCEDURES

This section contains a standard procedure which is referred to a number of times during dynamic testing.

4.1 Maximum Permissible Error

The maximum permissible errors for dynamic testing during verification are shown in Table 1.

To determine whether or not the indication is within the MPE for the applied load, the following procedure is conducted.

1. Determine the MPE for the applied load using Table 1.
2. Determine if the MPE is ± 2.0e. If yes then ensure that 0.5e is added to the test object and then placed onto the load transport system (comprising of a feed in belt, weighing component and feed out belt) as one load.
3. If the applied load (L) and the indication are the same, no further testing is required as the indication is within the MPE in all cases: **PASS**.

   If the applied load and the indication are **not** the same, then use Table 2 to determine if the indication will pass or fail.

   See Appendix B for a worked example.

Table 1. MPEs for dynamic testing

Maximum permissible errors	Load (m) expressed in verification scale intervals (e)	
	Class Y(a)	Class Y(b)
± 1.5e	0 < m ≤ 500	0 < m ≤ 50
± 2.0e	500 < m ≤ 2 000	50 < m ≤ 200
± 2.5e	2 000 < m ≤ 10000	200 < m ≤ 1 000

Table 2. Pass condition and applied load

Maximum permissible errors	The indication (I) will PASS if:	Applied load (L)
± 1.5e	$(L - 1e) \leq I \leq (L + 1e)$	Test object
± 2.0e	$(L - 1e) \leq I \leq (L + 2e)$	Test object + 0.5e
± 2.5e	$(L - 2e) \leq I \leq (L + 2e)$	Test object

5. TEST PROCEDURES

The following series of test procedures determine if the performance of the package weigher meets the requirements or whether the package weigher requires adjustment or service.

Each test procedure is explained as a discrete test. However tests can be combined to expedite the testing procedure. A suggested sequence for testing is shown in clause 6.

If the package weigher is going to be used in a different geographical location, correct the gravity setting for the intended location. The effects of gravity can be up to 0.3% depending on the variation in latitude and altitude between the location of calibration and the location of use. Refer to the manufacturer's instruction manual. Before certifying such a package weigher, it is advisable to check with the relevant trade measurement authority where the package weigher will be used to ensure you meet their requirements.

The test procedures involve static weighing, where the load transport system is stationary, see clause 5.2 (provided the package weigher can be operated statically) and dynamic weighing where the load transport system is in motion, see clause 5.4.

5.1 Control Instrument

A control instrument is used to determine the mass of the test objects used during dynamic weighing. Generally the package weigher operating in static mode is used as the control instrument.

The control instrument shall:

- be a non-automatic weighing instrument or a package weigher operating in static mode;
- be pattern approved, **or** have an approved load cell and indicator that comply with General Certificate 6B/0;

  Note: If an instrument meets all of the other criteria listed however it is not pattern approved or have a General Certificate then it still may be used as the control instrument. However, once the weight of each test objects is determined, then repeat the eccentricity, weighing performance and repeatability testing according to NITP 6.1 to 6.4.
- be at least three times more accurate then the package weigher;
- have a maximum MPE of ± 0.5e;
- be capable of having standard weights deposited on the load receptor; and
- have a maximum capacity equal to or greater than the weight of the heaviest load plus 10%.

Test the control instrument for compliance with *NITP 6.1 to 6.4 National Instrument Test Procedures for Non-automatic Weighing Instruments* and record the results on Test Report 4.

The control instrument should be tested immediately before testing the package weigher dynamically.

If the control instrument has zero tracking, disable the zero tracking function.

5.2 Static Testing

This test is only required when a control instrument other than the package weigher is used to determine the test objects.

Note: It is not necessary to carry out static testing if the package weigher in static mode is the control instrument, as the instruments performance will have already been tested in clause 5.1

A static test is completed in accordance with *NITP 6.1 to 6.4 National Instrument Test Procedures for Non-automatic Weighing Instruments* with the load transport system stationary. Include the test results in the Test Report 2.

5.3 Test Objects

The following procedure is conducted to determine the weight of each test object required for dynamic testing.

Test objects shall consist of similar types of articles to those generally weighed by the package weigher under normal operation.

At no time should the length or width of the test objects exceed one third the length or width of the load transport system.

Criteria for selecting the test objects:

- At least 5 different test objects.
- The test objects must span from Min to Max for the package weigher in approximately equal steps.
- Include a test object of 1/3 Max for the eccentricity (clause 5.4.1) and weighing performance testing (clause 5.4.2).
- Do not select Max if over-range blanking occurs at that point. If this occurs then it is recommended that the test object be 5e less than Max;
- Include a test object of Max plus 10e for the over-range blanking test (clause 5.4.2);

  Note: This is not included in the 5 different test objects listed in criteria 1 above.

- Include a test object at the MPE change points; and
- Do not select a test object at a point where the scale interval changes. It is recommended that a test object 5e less than this point be used.

5.3.1 Making the Test Objects

1. Set the control instrument to zero.
2. Apply the test material to the load receptor:
   (a) if the package weigher has a scale interval **greater or equal to** 10 times the scale interval of the control instrument then:
      (i) record the indication on the test report; and
      (ii) proceed to step 3.
   (b) if the package weigher has a scale interval **less** than 10 times the scale interval of the control instrument, then set the indication to centre e using change points:
      (i) apply 0.5e to the load receptor;
      (ii) apply additional standard weights of 0.1e with the test object until the indication changes up and stabilises;
      (iii) remove 0.5e leaving the additional standard weights with the load; and
      (iv) record the indication on the test report.

      Note: The standard weights added in step (ii) will remain with the test material to form the test object.
3. Record the indication on Test Report 3.
4. Remove the test material and additional standard weights (if required) as one load.
5. Ensure that the package weigher returns to zero. If the indication is not zero then repeat steps 1 to 4.
6. Repeat steps 1 to 5 for each test object.

5.4 Dynamic Testing

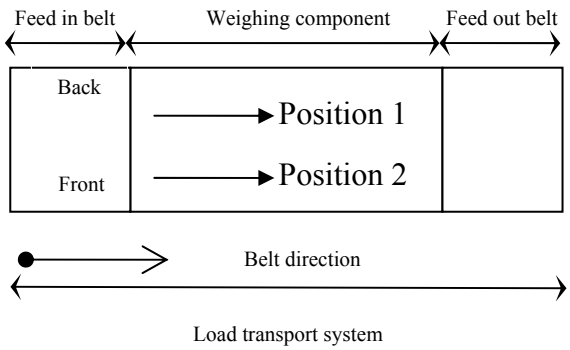
Dynamic testing of the package weigher requires test objects of known weight to be weighed with the package weigher's load transport system in operation.

5.4.1 Eccentricity

To determine the effect of eccentric loading an automatic weighing test shall be carried out with a test object of 1/3 Max (plus the additive tare capacity, if applicable) using the portion of the load transport system that is halfway between the center and the back, and repeated with the same test object using the portion of the load transport system that is halfway between the center and the front (NMI R51, clause 6.2).

1. Record the speed of the load transport system on Test Report 3.
2. Zero the package weigher.
3. Apply a test object of 1/3 Max (plus the additive tare capacity, if applicable) to the feed in belt at the centre of position 1, which is halfway between the centre and the back of the load transport system, as shown in Figure 1.
4. Record the indication on Test Report 3.
5. Ensure the indication returns to zero after the test object has been removed from the load transport system.

Figure 1. Location of test object on the load transport system



6. Determine if the indication in step 5 is within the MPE for the test object applied (see clause 4.1).
7. Record results on the Test Report 3.
8. Repeat steps 3 to 7 **twice** more.
9. Repeat steps 3 to 8 at the centre of position 2, which is halfway between the centre and the front of the load transport system.
10. If the load transport system has variable operating speeds then repeat steps 1 to 9 with the load transport system operating at minimum and approximately midway speeds.

5.4.2 Weighing Performance

This test procedure is used to establish the weighing performance of the package weigher with the load transport system in operation.

1. Zero the package weigher.
2. Apply a test object onto to the feed in belt and record the indication.
3. Ensure the indication returns to zero after the test object has been removed from the load transport system.
4. Determine if the indication is within the MPE for the load applied (see clause 4.1).
5. Record results on Test Report 3.
6. Repeat steps 2 to 5 **nine** more times using the same test object.
7. Repeat steps 2 to 6 for each test object determined in clause 5.3.
8. Apply a test object of Max + 10e to the feed in belt to ensure over-range blanking is correctly set.

   Note: The indication should blank or cause an error signal.

5.4.3 Separation of Items

Suitable means shall be provided to ensure that incorrect measurements do not occur due to items being provided to the package weigher without adequate spacing. This may be through the provision of in feed arrangements and/or detectors which identify and prevent inadequate spacing.

The following procedure shall be carried out to establish the operation of the package weigher when test objects are applied with no separation between them.

1. Zero the package weigher.
2. Apply two test objects whose combined weight is greater than ¾ Max and less than Max to the feed in belt with no separation.
3. Record the indication on Test Report 3.
4. Determine if the indications is within the MPE for the load applied (see clause 4.1).
5. Repeat steps 2 to 4 **twice** more.
6. Repeat steps 2 to 5 applying the test objects to the feed in belt in the reverse order.

6. SUGGESTED SEQUENCE FOR TESTING

1. Make sure any electronic instruments have been allowed to warm up for approximately half an hour.
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 package weigher and make a note of its metrological characteristics.
4. Determine if the package weigher in static mode will be the control instrument. If not, then determine if the control instrument meets the requirements of clause 5.1.
5. Test the control instrument for compliance with *NITP 6.1 to 6.4 National Instrument Test Procedures for Non-automatic Weighing Instruments* (clause 5.1). If the package weigher is **not** used as the control instrument, then complete static testing (clause 5.2).
6. Determine the weight of the test objects required and make them in accordance with clause 5.3.
7. Ensure the package weigher, feed in and feed out belts are ready for operation. Set the load transport system to the maximum operating speed.
8. Conduct an eccentricity test (clause 5.4.1).
9. Conduct a weighing performance test (clause 5.4.2).
10. Conduct an item separation test (clause 5.4.3).
11. Determine whether the package weigher has passed or failed.
12. Complete all relevant test reports.
13. Carry out anything else you need to do to complete the procedure. This may include:
    - obliterating verification, certification and control marks from the package weigher; and
    - stamping the package weigher (for more information on stamping see *General Information for Test Procedures*).

APPENDIX A. TEST REPORTS

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 of approval requires additional tests, attach pages that record the results of these tests.

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

Test Report 1 for Automatic Package Conveyor Weigher

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

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

Name of owner/user .....

Address of owner/user .....

Name of contact on premises .....

Address of package weigher location, if applicable .....

Description of package weigher.....

Manufacturer/s .....Model .....

Package weigher serial number.....Certificate/s of approval number .....

Max .....Min.....

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

Does the package weigher comply with its certificate/s of approval?	yes/no
Is the package weigher being used in an appropriate manner?	yes/no/na
Are all mandatory descriptive markings clearly and permanently marked on the data plate?	yes/no
Is the data plate fixed on the package weigher?	yes/no
Is the package weigher complete?	yes/no
Is the package weigher broken?	yes/no
Is the package weigher clean?	yes/no
Is the package weigher operational?	yes/no
Is the level-indicating device (if fitted) secured and functional?	yes/no/na
Is the package weigher level?	yes/no
Are there any apparent obstructions to the operation of the package weigher?	yes/no
Is the package weigher mounted on a firm base?	yes/no
Is the package weigher adequately protected against abnormal dust, air movement, vibrations, atmospheric conditions and 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?	yes/no/na

Test Report 2 for Static Testing of an Automatic Package Conveyor Weigher

Repeatability (NITP 6.1 to 6.4, clause 5.1)	Load			
	First reading			
	Second reading			
	Third reading			
	Difference			
	☐ Pass ☐ Fail			
Eccentricity (NITP 6.1 to 6.4, clause 5.2)	Number of supports:		Load used:	
	Position 1		Position 2	
	Position 3		Position 4	
	Position 5			
	☐ Pass ☐ Fail			
Zero setting (NITP 6.1 to 6.4, clause 5.3)	☐ Pass ☐ Fail			
Weighing performance (NITP 6.1 to 6.4, clause 5.4.1)	Loads applied (minimum 5)		Up	Down
	Over-range blanking ☐ Pass ☐ Fail			
	☐ Pass ☐ Fail			

Discrimination (NITP 6.1 to 6.4, clause 5.5)	☐ Pass ☐ Fail
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/verifier's name ..... Identification number .....

Signature .....

Comments .....

.....

Test Report 3 Dynamic Testing of an Automatic Package Conveyor Weigher

Test object weight:											
Eccentricity (clause 5.4.1)	Applied Load (1/3 Max):										
	Belt Speed	Max: m/s			Mid: m/s			Min: m/s			
	Position 1										
	Position 2										
	☐ Pass ☐ Fail										
Weighing performance (clause 5.4.2)		*L*	1	2	3	4	5	6	7	8	9	10
	Min											
	Over-range blanking ☐ Pass ☐ Fail											
	☐ Pass ☐ Fail											

Item separation (clause 5.4.3)	☐ Pass ☐ Fail
Overall result	☐ **Pass** ☐ **Fail**

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

Signature .....

Comments .....

Test Report 4 for Control Instruments

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 premises .....

Address where instrument located, if applicable .....

Description of instrument.....

Manufacturer/s .....Model.....

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

Max .....Min.....

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

Does the instrument comply with its certificate/s of approval?	yes/no
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
For overhead track weighing instruments: is the weigh rail of acceptable form and correctly aligned?	yes/no/na
For suspended weighing instruments: does it hang freely and are all transparent covers in good repair?	yes/no/na
For weighbridges: does it comply with the relevant Trade Measurement (Weighbridge) Regulations?	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 the General Supplementary Certificates (see clause 3.2.19)?	yes/no/na

Repeatability (NITP 6.1 to 6.4, clause 5.1)	Load			
	First reading			
	Second reading			
	Third reading			
	Difference			
	☐ Pass ☐ Fail			
Eccentricity (NITP 6.1 to 6.4, clause 5.2)	Number of supports:			
	Load used:			
	Position 1		Position 7	
	Position 2		Position 8	
	Position 3		Position 9	
	Position 4		Position 10	
	Position 5		Position 11	
	Position 6		Position 12	
	☐ Pass ☐ Fail			
Zero setting (NITP 6.1 to 6.4, clause 5.3)	☐ Pass ☐ Fail			
Weighing performance (NITP 6.1 to 6.4, clause 5.4.1)	Loads applied (minimum 5)		Up	Down
	Over-range blanking ☐ Pass ☐ Fail			
	☐ Pass ☐ Fail			

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
Overall result	☐ **Pass**	☐ **Fail**	

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

Signature .....

Comments .....

APPENDIX B. WORKED EXAMPLE

How to Determine if an Indication is within MPE

Package Weigher

Accuracy class	Y(a)
Maximum capacity (Max)	6.00 kg
Minimum capacity (Min)	0.04 kg
Verification scale interval (e)	0.002 kg
Test object	3.000 kg
Indication (I_1)	3.008 kg
Indication (I_2)	3.006 kg
Indication (I_3)	2.998 kg

Determine the MPE and conditions for the indication to pass using Table 1 and Table 2 respectively.

Determine the MPE for an applied load of 3.000 kg and scale interval of 0.002 kg.

First test an MPE of ± 1.5e:

$$0e < \quad m \quad \leq 500e$$

$$0.000 \text{ kg} < 3.000 \text{ kg} \leq 1.000 \text{ kg}$$

As the above statement is false, the MPE is not ± 1.5e. Next test an MPE of ± 2.0e:

$$500e < 1\,500e \leq 2\,000e$$

$$1.000 \text{ kg} < 3.000 \text{ kg} \leq 4.000 \text{ kg}$$

As the above statement is true, the MPE is ± 2.0e and as such the applied load shall be the test load + 0.5e, see table 2, which is 3.001 kg. Would an indication of I_1=3.008 kg pass?

Construct the condition for the indication to pass:

$$(L - 2e) < \quad I \quad < (L + 3e)$$

$$(3.000 - 0.004) < 3.008 \quad < (3.000 + 0.006)$$

$$2.996 \text{ kg} < 3.008 \text{ kg} < 3.006 \text{ kg}$$

The first indication I_1 fails as 3.008 kg is greater than 3.006 kg.

Likewise, the second indication of 3.006 kg fails as it is not less than 3.006 kg.

However the third indication of 2.998 kg will pass as the following statement is true:

$$2.996 \text{ kg} < 2.998 \text{ kg} < 3.006 \text{ kg}$$