



**Australian Government**

**National Measurement  
Institute**



**NITP 2**

**National Instrument Test Procedures for Area Measuring Instruments**

## NMI V 12

First edition — December 2004  
First edition, first revision — September 2005

## NITP 2

First edition — December 2011  
First edition, first revision — December 2012

National Measurement Institute  
Bradfield Road, Lindfield, NSW 2070  
PO Box 264, Lindfield, NSW 2070

T (61 2) 8467 3600  
F (61 2) 8467 3610  
W [www.measurement.gov.au](http://www.measurement.gov.au)

## AMENDMENTS

Item no	Date	Page	Location	Details of change
1	01/12/2012	all	all	Deleted references to certification, updated information, clarified meaning, provided hyperlinks for all referenced documents and made minor editorial changes.
2	01/12/2012	1 to 2	clause 3.2	Reworded requirements for instrument characteristics to a statement (from a question).
3	01/12/2012	2	clauses 4.1 and 4.1.2	Revised the headings to better reflect the content within the sections.
4	01/12/2012	2	clause 4.1.1	Clarified the manner in which the MPE is calculated and applied for area measuring instruments with a digital indication.
5	01/12/2012	5	test report	Added a section to record details of equipment and reference standards.
6	01/12/2012	6	test report	Added a section to record results of the mean measurement error at the three reference points and incorporated section to record the overall result of the test.
7	01/12/2012	7	test report	Added a section to record results of the single measurement error at the five reference points and incorporated section to record the overall result of the test.

## 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 (previously NMI V 12) became NITP 2.

The amendments that have been made to the latest edition of this document include its rebranding, renumbering, renaming and updating of cross-references. In all other respects, this document is identical to NMI V 12.

NMI's Chief Metrologist has determined that NITP 2 contains the test procedures for the verification of area measuring instruments.

## ABBREVIATIONS

e	verification scale interval
Max	maximum
Min	minimum
MPE	maximum permissible error
MPE <sub>analog</sub>	maximum permissible error of an area measuring with analog indication
MPE <sub>digital</sub>	maximum permissible error of an area measuring instrument with digital indication
scale interval	scale interval of the area measuring instrument with digital indication

## CONTENTS

Amendments .....	ii
Preface .....	ii
Abbreviations .....	ii
Explanation of Terms .....	iv
1. Scope .....	1
2. Equipment .....	1
3. Visual Inspection .....	1
3.1 Required Data .....	1
3.2 Characteristics of the Instrument .....	1
4. Test Procedures .....	2
4.1 Measurement Error .....	2
4.2 Testing Procedure for Single Measurement Error .....	2
4.3 Testing Procedure for Mean Measurement Error .....	3
4.4 Additional Tests .....	3
5. Suggested Sequence for Testing Procedures .....	4
Appendix A. Test Report .....	4

## EXPLANATION OF TERMS

For explanations of other terms see [General Information for Test Procedures](#).

### **Adjustment**

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

### **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.

### **In-service Inspection**

The examination of an instrument by a **trade measurement inspector** to check that:

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

An in-service inspection does not permit the instrument to be marked with a verification mark.

### **Verification**

The examination of an instrument by a **trade measurement inspector, servicing licensee or employee of a servicing licensee** in order to mark the instrument indicating that it conforms with the relevant test procedures.

**Initial verification** is the verification of a new instrument that does not bear a verification mark and has never been verified before.

## 1. SCOPE

NITP 2 describes the test procedures for the verification and in-service inspection of area measuring instruments (some of which are commonly known as leather-measuring instruments) to assess if they measure within the maximum permissible errors (MPEs) specified in Schedule 1 of the *National Trade Measurement Regulations 2009* (Cth) and that they comply with the relevant certificate of approval.

Certificates of approval are based on [NMI M 3. Pattern Approval Specifications for Area Measuring Instruments](#). Refer to NMI M 3 for all metrological and technical requirements. All instruments must also comply with the *National Measurement Act 1960* (Cth), the *National Measurement Regulations 1999* (Cth) and the *National Trade Measurement Regulations 2009* (Cth).

The test procedures described in this document are for area measuring instruments in which the article to be measured:

- (a) remains in a stationary position on the measuring table while it is being measured; or
- (b) is conveyed beneath the measuring device while it is being measured.

## 2. EQUIPMENT

1. Certificate(s) of approval.
2. Appropriate reference standards of area measurement, namely standard area test templates as close as practical to the following denominations: 10, 20, 50 and 100 dm<sup>2</sup>.

Note: Test templates shall have values, which are an integral number of square decimetres (dm<sup>2</sup>).

The reference standards of measurement shall comply with the uncertainties and variations permitted in the *National Measurement Regulations 1999* (Cth). The combined uncertainties and variations shall be less than one-third the MPE of the area measuring instrument under test.

Record details of the reference standards of measurement used on the test report.

3. Current Regulation 13 certificates for all reference standards of measurement.
4. Test report (see Appendix A).

## 3. VISUAL INSPECTION

Visually inspect the area measuring instrument and record on the test report details of:

- the required data; and
- the applicable characteristics of the instrument.

### 3.1 Required Data

1. Test report number.
2. Date of test.
3. Verifier's name.
4. Type of test: verification or in-service inspection (ensure that the verification mark is in place for in-service inspection and reverification).
5. Name of owner/user.
6. Address of owner/user.
7. Name of contact person on premises.
8. Address of instrument location.
9. Description of instrument.
10. Manufacturer.
11. Model.
12. Serial number.
13. Certificate of approval number.
14. The non-metrological characteristics including: Max, Min and the verification (e) scale interval.

### 3.2 Characteristics of the Instrument

Where applicable, the area measuring instrument and its use shall comply with the following statements.

1. The area measuring instrument shall comply with its certificate(s) of approval.
2. The instrument shall be used in an appropriate manner.
3. All mandatory descriptive markings shall be clearly and permanently marked on a data plate that is fixed to the instrument.
4. The data plate shall be fixed on the instrument.
5. The instrument shall be complete, clean and in an operational condition.
6. The instrument shall be free of any apparent obstructions.
7. The instrument shall be securely mounted on a firm and level base.
8. The operator (and where applicable, the customer) shall have a clear and unobstructed view of the indicating device and the complete measuring process.

9. The instrument shall be adequately protected against abnormal dust, air movement, vibrations, atmospheric conditions and any other influence likely to affect its performance.

#### 4. TEST PROCEDURES

The following series of test procedures determine if the performance of an area measuring instrument meets the criteria and whether the instrument requires adjustment or service.

Each test procedure is explained as a discrete test. However, some tests may be combined to expedite the testing procedure. A suggested sequence for testing is shown in clause 5.

Record results on the test report.

##### 4.1 Measurement Error

The instrument is tested by measuring a known area template or a combination of known area templates and recording the indication for:

- the measurement of a single template and the mean reading of twenty measurements of a single template; and/or
- the measurement of a combination of templates and the mean reading of twenty measurements of the same combination of templates.

##### 4.1.1 Single Measurement Error

The MPEs for verification and in-service inspection of instruments with analog indication shall be in accordance with Table 1 or as specified in the certificate of approval, where the certificate is issued on or after 1 July 2007.

Table 1. Maximum permissible error

Area of template(s) (dm <sup>2</sup> )	MPE (dm <sup>2</sup> )	
	Verification	In-service inspection
Not exceeding 25	±0.5	±1
Exceeding 25	±0.5 (+1 for each additional 50 dm <sup>2</sup> or part thereof)	±1 (+2 for each additional 50 dm <sup>2</sup> or part thereof)

Instruments with digital indication may require rounding in some instances. These instances are specified in Table 2. Where rounding is applied to instruments with digital indication, the MPE shall be calculated using the following formula:

$$MPE_{digital} = MPE_{analog} + (0.5 \times \text{scale interval})$$

where

$MPE_{digital}$  is the MPE of the area measuring instrument with digital indication (dm<sup>2</sup>)

$MPE_{analog}$  is the MPE of the area measuring instrument with analog indication (dm<sup>2</sup>)

*Scale interval* is the scale interval of the area measuring instrument with digital indication (dm<sup>2</sup>)

For example the in-service inspection MPE for an analog instrument with a scale interval of 1 dm<sup>2</sup> at 20 dm<sup>2</sup> is: ±1 dm<sup>2</sup>.

The in-service inspection MPE for a digital instrument with a scale interval of 1 dm<sup>2</sup> at 20 dm<sup>2</sup> is:

$$MPE_{digital} = 1 \text{ dm}^2 + (0.5 \times 1 \text{ dm}^2) = 1.5 \text{ dm}^2.$$

Table 2. Adjustments to the MPE for digital displays

Scale interval	Verification	In-service inspection
0.1 dm <sup>2</sup>	No change	No change
1 dm <sup>2</sup>	No change	Add 0.5 scale interval

##### 4.1.2 Mean Measurement Error

On analog and digital indicating instruments, the mean of 20 measurements shall not differ from the denominated value of the template by more than one-half of the MPE specified in clause 4.1.1.

##### 4.1.3 Caution

When templates are placed on the instruments, care must be taken to ensure that:

- the templates do not extend beyond the limits of the measuring area of the conveyor or of the measuring table;
- when using a combination of templates, there is no over-lapping of the templates as they pass beneath the measuring device; and
- the templates are staggered across the field of measurement.

#### 4.2 Testing Procedure for Single Measurement Error

The instrument is tested at a minimum of five different reference points throughout the measuring range in approximately equal steps unless otherwise specified by the certificate of approval.

The reference points shall include minimum and maximum areas.

Each reference point may be achieved by use of one or a combination of area template(s).

#### **4.2.1 Measurement Sensors Test**

1. Select one area template that is approximately one-third the width of the measurement receptor.

Note: The area of this template must be greater than the minimum area.

2. Ensure zero is displayed or use zero preset.
3. Place the template on the extreme left of the measurement receptor.
4. Operate the instrument and take a reading.
5. Record the result on the test report.
6. Repeat steps 2 to 5 by placing the template centrally on the measurement receptor.
7. Repeat steps 2 to 5 by placing the template at the extreme right of the measurement receptor.

#### **4.2.2 Reference Points Test**

1. Select one or more area template(s) to test the instrument at one of the remaining reference points.
2. Ensure zero is displayed or use zero preset.
3. Place the template(s) centrally on the measurement receptor.
4. Operate the instrument and take a reading.
5. Record the result on the test report.
6. Repeat steps 2 to 5 for each of the remaining reference points.

#### **4.3 Testing Procedure for Mean Measurement Error**

The instrument is tested at a minimum of three different reference points in approximately equal steps unless otherwise specified by the certificate of approval.

Each reference point may be achieved by using one or a combination of multiple area templates.

1. Select one or more area templates to test the instrument at one of the three selected reference points.
2. Ensure zero is displayed or use zero preset.
3. Place the template(s) centrally on the measurement receptor.
4. Operate the instrument and take a reading.
5. Record the result on the test report.
6. Repeat steps 2 to 5 for a further 19 measurements.
7. Calculate the mean error.
8. Repeat steps 1 to 7 for each of the remaining selected reference points.

#### **4.4 Additional Tests**

1. Where the instrument is fitted with two or more measuring heads, repeat the tests described in clauses 4.1 to 4.3 for each head.
2. Where the instrument is fitted with a totaliser, ensure that it is operating correctly throughout the tests.
3. For additional indicating and printing devices, ensure that they exactly repeat the information on the primary indication and/or ticket/label-printing device, and that they comply with the applicable general supplementary certificate of approval.
4. Where the instrument is fitted with a stamper, ensure that it is operating correctly.
5. Apply any further tests required by the certificate(s) of approval.

## 5. SUGGESTED SEQUENCE FOR TESTING PROCEDURES

1. Check the certificate of approval for any additional tests required. Make provision for including these tests in the testing sequence.
2. Visually inspect the area measuring instrument and make note of its metrological characteristics.
3. Determine the reference points for the tests.
4. Conduct the accuracy tests to determine the **single measurement error**.
5. Conduct the accuracy tests to determine the **mean error**.
6. Conduct any additional tests that are required to complete the testing, including if necessary, any additional testing required by the certificate of approval.
7. Complete the test report.
8. Determine whether the instrument has passed or failed.
9. Carry out anything else needed to complete the procedure. See [General Information for Test Procedures](#) for more details. This may include:
  - obliterating the verification mark from the instrument;
  - applying a verification mark; and
  - applying a seal.

## APPENDIX A. TEST REPORT

The following test report 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 report in the style shown at the top of each of the following pages.

## Test Report for Area Measuring Instruments

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

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

For in-service inspection, record the verification mark .....

Name of owner/user .....

Address of owner/user .....

Name of contact on premises .....

Address where the instrument is located .....

Description of instrument .....

Manufacturer ..... Model .....

Serial number ..... Certificate(s) of approval number .....

Max ..... Min ..... Verification scale interval .....

### Details of the Equipment and Reference Standards of Measurement (clause 2)

Make				
Serial number				
Nominal value of template (dm <sup>2</sup> )				
Regulation 13 certificate number				
Certificate expiry date				

### Characteristics of the Instrument (clause 3.2)

	yes, no or N/A
Does the instrument comply with its certificate(s) of approval?	
Is the instrument being used in an appropriate manner?	
Are all mandatory markings clearly and permanently fixed on the instrument in the prescribed location?	
Is the data plate fixed on the instrument?	
Is the instrument complete, clean and in an operational condition?	
Are there any apparent obstructions to the operation of the instrument?	
Is the instrument securely mounted on a firm and level base?	
Does the operator (and where applicable the customer) have a clear and unobstructed view of the indicating device and the complete measuring process?	
Is the instrument adequately protected against abnormal dust, air movement, vibrations, atmospheric conditions and any other influence likely to affect its performance?	

**Mean Measurement Error (clause 4.3)**

dm <sup>2</sup>	First reference point	Error	Second reference point	Error	Third reference point	Error
Actual						
Run # 1						
Run # 2						
Run # 3						
Run # 4						
Run # 5						
Run # 6						
Run # 7						
Run # 8						
Run # 9						
Run # 10						
Run # 11						
Run # 12						
Run # 13						
Run # 14						
Run # 15						
Run # 16						
Run # 17						
Run # 18						
Run # 19						
Run # 20						
Mean error						
Overall result			First reference point		<input type="checkbox"/> Pass	<input type="checkbox"/> Fail
			Second reference point		<input type="checkbox"/> Pass	<input type="checkbox"/> Fail
			Third reference point		<input type="checkbox"/> Pass	<input type="checkbox"/> Fail

**Single Measurement Error (clause 4.2)**

Measurement sensors test (clause 4.2.2)	(1) First reference point (dm <sup>2</sup> )		Error	
	Left reading			
	Middle reading			
	Right reading			
	Reference point tests (clause 4.2.3)	(2) Second reference point (dm <sup>2</sup> )		
		Reading		
		(3) Third reference point (dm <sup>2</sup> )		
		Reading		
		(4) Fourth reference point (dm <sup>2</sup> )		
	Reading			
(5) Fifth reference point (dm <sup>2</sup> )				
Reading				
Overall result — measurement sensors test	(1) First reference point			
	Left reading	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	
	Middle reading	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	
	Right reading	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	
Overall result — reference point tests	(2) Second reference point	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	
	(3) Third reference point	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	
	(4) Fourth reference point	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	
	(5) Fifth reference point	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	

**Additional Tests (clause 4.4)**

Second measurement head	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
Auxiliary indicating device(s)	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
Totaliser	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
Printer	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
Stamper	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A

Verifier's name ..... Identification number .....

Signature .....

Comments .....

.....

.....

.....

.....

.....