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National Instrument Test Procedures for Alcoholic Beverage Measures

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AMENDMENTS

Item no.	Date	Page	Location	Details of change
1	1/2/2014	all	all	Deleted references to certification, updated references to a weighing instrument used in the gravimetric method to control instrument to reflect current terminology, updated information, clarified meaning, adopted a single column format and made minor editorial changes.
2	1/2/2014	2	clause 3.2	Revise the requirements for instrument characteristics and reworded the requirements to a statement (from a question).
3	1/2/2014	2	clause 4	Clarified the circumstances when individual and batch testing (during or after manufacture) occurs.
4	1/2/2014	3 and 4	clauses 4.2 and 4.3.1	Clarified the process where the batch fails testing requirements in the first instance.
5	1/2/2014	5	clause 5	Added clause to give details of requirements for control instruments used for the gravimetric method.
6	1/2/2014	6	clause 6.1	Clarified the volumetric method for testing line measures and brim measures.
7	1/2/2014	9 and 10	test report	Added section to record details of equipment and reference standards.
8	1/2/2014	14	test report	Added a test report to record details of tests conducted on the control instrument.

PREFACE

NMI's Chief Metrologist has determined that NITP 4.3 contains the test procedures for the verification of alcoholic beverage measures.

CONTENTS

EXPLANATION OF TERMS

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

Initial verification

Verification of a new instrument which does not bear a verification mark and has never been verified before.

Verification

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

ABBREVIATIONS

d	scale interval
f_s	a factor that relates the maximum process standard deviation to the difference between the upper and lower specification limits (from AS 2490-1997)
k value	acceptability constant (from AS 2490-1997)
m_1	tare mass of the measure under test
m_2	gross mass of the filled measure (and strike when testing brim measures)
MPD	maximum permissible difference
MPE	maximum permissible error
n	number of measures in the test proportion
s	standard deviation of the test proportion
T_i	lower capacity limit
T_s	upper capacity limit
X	mean capacity of the test proportion
ΣX_i	sum of each of the capacities

1. SCOPE

NITP 4.3 describes the sampling plans and test procedures for the verification of alcoholic beverage measures (hereafter referred to as 'measures') to assess their accuracy and determine their compliance with General Certificate 4/1/0D.

The measures (which are either brim measures or line measures) are used to measure certain alcoholic beverages, in the following categories and capacities:

- liquor (spirit) measures in capacities of 15 mL, 30 mL or 60 mL; or
- drinking measures in capacities from 100 mL to 1 L, e.g. glasses, cups, mugs; or
- portable measures in capacities from 0.5 L to 5 L, e.g. carafes, jugs.

Note: This document does not include within its scope portable containers which are prepacked.

Two test methods are described:

- the *volumetric* method (see clause 6.1); and
- the *gravimetric* method (see clause 6.2).

for use with the appropriate sampling plan (see clause 4) to ensure all measures are calibrated to contain the stipulated volume at a reference temperature of 20 ºC.

All measures used for trade in Australia must be tested in accordance with these test procedures. It is an offence to release measures that have not been tested or have failed these test procedures.

All measures must also comply with the *National Measurement Act 1960* (Cth), the *National Measurement Regulations 1999* (Cth) and the *National Trade Measurement Regulations 2009* (Cth).

When a batch of glass measures is tested, there is a requirement to submit a histogram to the National Measurement Institute (NMI) detailing the result of each test of the batch of glass measures.

2. EQUIPMENT

1. General Certificate 4/1/0D.
2. Appropriate reference standards of measurement:
   (a) for *volumetric* method:
      (i) volume measure (to measure a known volume of water); and
      (ii) burette or pipette (to measure a known volume of water);
   (b) for *gravimetric* method:
      (i) reference weight (to test the control instrument up to 110% of m_2).

   Record details of the reference standards used on Test Report 1.
3. Current Regulation 13 certificates for all reference standards of measurement.

   All 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 no greater than one-third of the applicable MPE of the measures or control instrument being tested.
4. Supply of distilled or potable (town) water.
5. Suitable glass strike (for testing brim measures using the *volumetric* or *gravimetric* methods).
6. Suitable weighing instrument (hereinafter referred to as a control instrument) for determining the mass of a measured volume (for *gravimetric* method). See clause 5.1 for suitability requirements for the control instrument.
7. Test reports (see Appendix A).

3. VISUAL INSPECTION

Visually inspect the measures and determine if:

- all the required data; and
- the applicable characteristics of the instrument are correctly marked.

Where required, record details on the Test Report 1.

3.1 Required Data

1. Test report reference number.
2. Date of test.
3. Type of test: verification or in-service inspection (ensure that the verification mark is in place for in-service inspection or reverification).
4. Verifier's name.
5. Verifier's address.
6. Name of contact person responsible for testing the measures.
7. Address of measure location.
8. Type of measure.
9. Manufacturer's identification.
10. Mould ID (if available).
11. Batch ID (if available).
12. Nominal capacity (mL).
13. Number of measures (batch size).

3.2 Characteristics of the Measures

Where applicable the measures shall comply with the following:

1. Clauses 1.1.1 to 1.1.3 of the General Certificate 4/1/0D.
2. All mandatory descriptive markings (manufacturer's identification, nominal capacity and batch testing mark) shall be clearly and permanently marked or moulded on the measures in the prescribed location.
3. The units, alignment and print height of the capacity marking shall be correct.
4. The measures shall be unbroken, clean and free of defects.

4. SAMPLING PLANS

A batch is defined as a number of measures of common nominal capacity from a single source intended to be identical.

A batch from a continuous production run through one mould in an automatic production process can include stoppages in production as long as the mould has not been replaced, changed, altered or repaired, and the mould continues to produce instruments within tolerance.

Where a machine has a number of cavities within a mould which produce measures of the same capacity, material, shape and style, the measures are considered to be from the same batch. Measures from different moulds are regarded as different batches.

A maximum batch size is considered to be when:

- 1 000 000 measures are produced; or
- the production run is stopped to affect mould repairs or changes.

Measures are tested for accuracy (clause 6.1 and 6.2) and compliance with clause 3.2 using the appropriate sampling plan as follows:

- batch size is 200 or less, *individual testing* of all measures (see clause 4.1); or
- batch size 201 or more, a representative test proportion of measures are selected and tested either:
    - after manufacture (see clause 4.2) when the measures are of common nominal capacity from a single source intended to be identical; or
    - during manufacture (see clause 4.3) when the measures are of a common nominal capacity taken from the production line, intended to be identical and can be shown to be under statistical control).

4.1 Individual Testing

If the total number of measures is 200 or less, test all measures individually for accuracy and compliance with clause 3.2 using either the *volumetric* method (see clause 6.1) or the *gravimetric* method (see clause 6.2).

Record your results on Test Report 1 (A.1). Dispose of any measures that are not within the allowable MPE range (Table 1).

Table 1. Allowable MPEs for measures

Type of measure	Nominal capacity	MPE
Brim measures	15 mL	+1 mL
	30 mL	+2 mL
	60 mL	+3.5 mL
	>60 mL	+6%
Line measures	<200 mL	±5%
	≥200 mL	±(2.5% + 5 mL)

The allowable MPEs for measures manufactured:

- after 1 July 2007 are shown in Table 1 (from General Certificate 4/1/0D);
- before 1 July 2007 are given in Tables 10 and 11 of Schedule 1 of the *National Trade Measurement Regulations 2009* (Cth).

4.2 Sampling Plan after Manufacture

See Appendix B.1 for a worked example.

1. Select a representative test proportion of measures in accordance with Table 2.
2. Determine volume of each measure in the test proportion using either the *volumetric* method (see clause 6.1) or the *gravimetric* method (see clause 6.2). Record results on Test Report 1 (A.2).
3. Calculate and record the allowable number of incorrect measures.
4. Determine if the batch has passed or failed by comparing the number of incorrect measures with the allowable number of incorrect measures specified in Table 2.
5. If the batch fails:
    - reject the batch; or
    - test all remaining measures individually.

    Note: Where measures are tested individually, dispose of any measures that are not within the allowable MPE range (Table 1).

Table 2. Test proportions and allowable incorrect measures for batch testing after manufacture

Batch size	Test proportion	Allowable incorrect measures
201 to 10 000	201	4
10 001 to 35 000	315	6
35 001 to 150 000	501	10
150 001 to 1 000 000	801	16

The above batch and sample sizes are derived from *AS 1199.2-2003: Sampling procedures for inspection by attributes*.

4.3 Sampling Plan during Manufacture

4.3.1 Initial Production Batch

See Appendix B.2 for two worked examples.

Note: Where subsequent production batches are to be tested using attributes (see clause 4.3.2), prior to testing the subsequent batch, attributes of the initial production batch must be recorded to demonstrate traceability.

1. Select a representative test proportion of measures in accordance with Table 3. For moulds with more than one cavity select approximately equal numbers from each cavity.

Table 3. Test proportions, allowable incorrect measures, k values and f_s for batch testing during manufacture

Batch size	Test proportion	Allowable incorrect measures	k value*	f_s*
201 to 1 200	5	0	1.24	0.346
1 201 to 3 200	7	0	1.33	0.318
3 201 to 10 000	10	0	1.41	0.298
10 001 to 35 000	15	0	1.47	0.284
35 001 to 150 000	20	0	1.51	0.277
150 001 to 500 000	25	0	1.53	0.273
500 001 to 1 000 000	35	0	1.57	0.266

* From *AS 2490-1997: Sampling procedures and charts for inspection*

2. Determine the volume of each measure using either the *volumetric* method (see clause 6.1) or the *gravimetric* method (see clause 6.2). Record results on Test Report 1 (A.3).
3. Calculate and record the mean capacity of the test proportion (X) using the formula:

$$X = \frac{X_i}{n}$$

where

X_i is the sum of each of the capacities

n is the number of measures in the test proportion

4. Calculate and record the standard deviation (s) of the test proportion using the formula:

$$s = \sqrt{\frac{1}{n-1} \quad (X_i - X)^2}$$

where

n is the number of measures in the test proportion

X is the mean capacity of the test proportion

X_i is the capacity of each measure in the test proportion

5. Calculate and record the upper capacity limit (T_s) (see Table 1).

$$T_s = nominal\ capacity + allowable\ MPE$$

6. Calculate and record the lower capacity limit (T_i) (see Table 1).

$$T_i = nominal\ capacity - allowable\ MPE$$

7. Determine if the batch has passed or failed. The batch passes if:
   - the volume of each measure in the test proportion is within T_s and T_i;
   - $X \leq T_s - k \times s$;
   - $X \geq T_i + k \times s$; and
   - $s \leq f_s\ T_s - T_i$.
8. If the batch fails:
   - reject the batch; or
   - test all remaining measures individually.

   Note: Where measures are tested individually, dispose of any measures that are not within the allowable MPE range (Table 1).

4.3.2 Subsequent Production Batches

Subsequent batches are tested using the procedure in clause 4.3.1 or by the use of attributes (e.g. height, weight, diameter).

The relationship of the attributes for the test proportion of the initial production batch must be established and maintained prior to testing subsequent production batches using attributes.

Where attributes are used, maintain detailed records to show:

- the relationship of the attribute is traceable to the volume of the measures tested during the initial production batch;
- the standard deviation of the measurement of attributes is equal to or less than the standard deviation of the initial production batch; and
- individual measures with highest and lowest attribute measurements are testing using either the *volumetric* or *gravimetric* method and are found to be within the allowable MPE (Table 1).

5. CONTROL INSTRUMENT

A control instrument is used to determine the mass of measured volume and calculate density of the liquid being dispensed in the *gravimetric* method (see clause 6.2).

5.1 Suitability

The control instrument shall:

- be a non-automatic weighing instrument;
- have a scale interval equal to or better than 0.1 g;
- be capable of having standard weights deposited on the load receptor; and

- have a maximum capacity at least 10% greater than m_2.

5.2 Testing the Control Instrument

1. Place the control instrument in a suitable area with ample background light and at a convenient height.
2. Test the control instrument in accordance with *NITP 6.1 to 6.4 National Instrument Test Procedures for Non-automatic Weighing Instruments* for the following tests:
   (a) repeatability;
   (b) eccentricity; and
   (c) weighing performance.
3. Record results on Test Report 2.
4. The instrument shall not have an error (MPD and MPE) greater than 0.5 e.

   The instrument should be tested immediately before commencing any testing of the measures.

   It is not necessary to test the instrument to its maximum capacity.

5.3 Performance Testing

A weighing performance test is repeated regularly, at least every hour during measurements to ensure the on-going accuracy of the instrument.

The instrument shall not have an error greater than 0.5 e.

If the instrument has a greater error, the instrument shall be calibrated. The measures weighing after the last known correct performance test for the instrument shall be disregarded from the test results and additional measures sourced to re-establish the correct sample size.

Where the accuracy of the control instrument has been observed to deviate, calibration testing shall occur more regularly and if the problem continues, an alternate instrument shall be used.

6. TEST PROCEDURES

Use one of the two methods described below to test the measures for accuracy. Record the measure capacity in 0.5 mL ranges as shown in the worked example (see Appendix B).

Note: For line measures that have more than one capacity line, all capacities must be tested.

Ensure both the volume measure and liquid are between 10 °C and 30 °C when completing the test procedures described in this document.

6.1 Volumetric Method

The method described below is used to test the accuracy of line measures only.

1. Refer to Table 1 and record the allowable MPE range for the measures.
2. Ensure that the rim of the measure under test is clean and smooth.
3. The reference standard volume measure is calibrated ‘to deliver’.
4. Place the measure under test on a stable and level surface with the capacity line at eye level.
5. Deliver a quantity of water from the reference measure, equal to the nominal capacity of the measure, into the measure under test. Allow the reference measure to drain for 30 seconds (or the drain time specified in the Regulation 13 certificate).
6. With the aid of a burette or pipette, determine any variation between the volume of water in the measure and the capacity of the measure.
7. The measurement of capacity is when the bottom of the meniscus coincides with the top of the marked line.

6.2 Gravimetric Method

1. Test the control instrument (see clause 5).
2. Refer to Table 1 and record the allowable MPE range for the measures.
3. Ensure that the rim of the measure under test is clean and smooth.
4. Determine and record the tare mass of the measure under test (m_1) to an accuracy of 0.1 g or better by placing the measure (and the glass strike if testing a brim measure) on the load receptor of the control instrument. Where the control instrument is fitted with a tare device, activate the tare ($m_1 = 0.0\ g$). If the control instrument does not have a tare function, zero the instrument.
5. Remove the measure from the control instrument and place it on a firm horizontal surface at a convenient height.
6. Fill the measure with water, following the procedure for either line measures or brim measures.

   (a) Line Measures

   Fill the measure with water to the capacity under test. Use a pipette to achieve the correct level. The measurement of capacity is when the bottom of the meniscus coincides with the top of the marked line.

   (b) Brim Measures

   Place the glass strike on top of the measure so that it almost covers the top of the measure.

   Pour water into the measure until the measure is full. Remove any air bubble by gently tapping the measure.

   Note: If the bubbles cannot be removed by tapping, remove the glass strike and empty the measure. Clean the inside of the measure and if necessary the strike. Replace the glass strike and repeat the procedure described above.

   Slide the glass strike across the top of the measure and recheck that there are no air bubbles in the measure. If the measure is not full there will be an air bubble under the glass strike. Remove this bubble by introducing water into the measure through the hole in the centre of the glass strike.

   Dry the glass strike and the outside of the measure.
7. Place the filled measure (including the glass strike for brim measures) on the load receptor of the control instrument and record the mass of the filled measure (m_2) to an accuracy of 0.1 g or better.
8. Calculate and record the mass of the water contained in the measure ($m_2 - m_1$).
9. Record the capacity of the measure in millilitres.

   Note: Volume = mass divided by density. The density of town water between 10 °C and 30 °C is taken to be 1 g/mL
10. Remove the measure from the load receptor.

7. SUGGESTED SEQUENCE FOR TESTING

1. Determine the sampling plan, i.e. individual testing, batch testing after manufacture or batch testing during manufacture (see clauses 4.1 to 4.3 respectively).
2. Select the appropriate number of measures to be tested (see clauses 4.1 to 4.3).
3. Visually inspect the measures in the test proportion and make a record of their metrological characteristics (see clause 3.2).
4. Following the sampling plan, test the selected measures using either the *volumetric* method (see clause 6.1) or *gravimetric* method (see clause 6.2).
5. Determine whether the measures have passed or failed.
6. Complete Test Report 1 (and Test Report 2 where required).

APPENDIX A. TEST REPORTS

Appendix A contains test reports on which to record the results.

Although the formats of the test reports may vary according to the individual needs and requirements of trade measurement inspectors and servicing licensees, the following test reports contain the minimum amount of information that must be recorded.

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

Test Report 1 for Alcoholic Beverage Measures

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

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

For in-service inspection or reverification, record the verification mark:.....

Verifier's name .....

Verifier's address .....

Name of contact person responsible for testing the measures.....

Type of measure	Line measure	Liquor measure ☐	Drinking measure ☐	Portable measure ☐
	Brim measure	Liquor measure ☐	Drinking measure ☐	

Manufacturer's/importer's identification	
Mould ID (if available)	
Batch ID (if available)	
Nominal capacity (mL)	
Number of measures (batch size)	

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

Control Instrument	
Make	
Model	
Serial number	
Scale interval (g)	
NMI approval number	
Verification date (if applicable)	
Test Weight	
Weight set serial number	
Regulation 13 certificate number	
Certificate expiry date	
Volume Measure	
Make	
Serial number	
Volume	
Regulation 13 certificate number	
Certificate expiry date	

Test Report 1 for Alcoholic Beverage Measures

Burette or Pipette	
Make	
Serial number	
Volume	
Regulation 13 certificate number	
Certificate expiry date	

General Characteristics (clause 3.2)	Yes, no or N/A
Do the measures comply with clauses 1.1.1 to 1.1.3 of General Certificate 4/1/0D?	
Are all mandatory descriptive markings (manufacturer's identification, nominal capacity and batch testing mark) clearly and permanently marked or moulded on the measures in the prescribed location?	
Are the units, alignment and print height of the capacity markings correct?	
Are the measures unbroken, clean and free of defects?	

Test Report 1 for Alcoholic Beverage Measures

A.1 Test Results for Individual Testing (clause 4.1)

Nominal capacity..... Allowable MPE.....

Allowable MPE range (mL) ..... Batch size .....

Measure capacity range (mL)	Frequency (occurrences)	Number
Total number of measures tested		
Number of incorrect measures		

Comments.....

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

Signature.....

Test Report 1 for Alcoholic Beverage Measures

A.2 Test Results for Sampling Plan after Manufacture (clause 4.2)

Nominal capacity..... Allowable MPE ..... Allowable MPE range (mL) .....

Batch size..... Test proportion ..... Allowable number of incorrect measures..... [1]

Measure capacity range (mL)	Frequency (occurrences)	Number
Total number of measures tested		
Number of incorrect measures		
Allowable number of incorrect measures		
Result		☐ **Pass** ☐ **Fail**

Comments.....

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

Signature.....

[1] Separate page required for allowable number of incorrect measures for each of following:
- first representative test proportion – see Table 2; or
- second representative test proportion – 2% of 2 × test proportion; or
- third representative test proportion – 2% of 3 × test proportion.

Test Report 1 for Alcoholic Beverage Measures

A.3 Test Results for Sampling Plan during Manufacture (clause 4.3)

Nominal capacity..... Allowable MPE. .....

Allowable MPE range (mL) .....

Upper capacity limit (T_s) = nominal capacity + allowable MPE

Lower capacity limit (T_i) = nominal capacity – allowable MPE

Batch size..... Test proportion ..... Allowable number of incorrect measures **0**

Measure capacity range (mL)	Frequency (occurrences)	Number
Total number of measures tested		
Number of incorrect measures		
Allowable number of incorrect measures		**0**
Result		☐ Pass ☐ Fail
Mean capacity of the test proportion $(X) = \quad X \div n$		
Standard deviation $(s) = \quad \frac{1}{n-1} \quad \overline{(X_i - X)^2}$		
Is $X \leq T_s - k \times s$?	..... ≤ ..... – ..... × ..... ☐ yes ☐ no	
Is $X \geq T_i + k \times s$?	..... ≥ ..... – ..... × ..... ☐ yes ☐ no	
Is $s \leq f_s(T_s - T_i)$?	..... ≤ ..... (..... – .....) ☐ yes ☐ no	
Tick Pass if you answer 'yes' to all the questions, otherwise tick Fail		☐ Pass ☐ Fail
Overall result		**☐ Pass ☐ Fail**

Comments.....

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

Signature.....

Test Report 2 for Control Measuring Instrument

Testing the Control Instrument (clause 5.2)

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 5.2.2.1)	Number of supports		
	Load used		
	Position 1		
	Position 2		
	Position 3		
	Position 4		
	☐ Pass ☐ Fail		
Weighing performance — NITP 6.1 to 6.4 (clause 5.4.1)	Loads applied (minimum 5)	Up	Down
Note: When performing a performance test, only weighing performance is required.			
	☐ Pass ☐ Fail		
Overall result	**☐ Pass ☐ Fail**		

APPENDIX B. WORKED EXAMPLES

B.1 Example of Test Results for Sampling Plan after Manufacture

Nominal capacity 150 mL brim measure Allowable MPE 0 to +6%

Allowable MPE range (mL) 150 to 159 mL = 9 mL Batch size 450

Test proportion 201 Allowable number of incorrect measures 4

Measure capacity range (mL)	Frequency (occurrences)	Number
148.0–148.49	1	1
148.5–148.99	—	0
149.0–149.49	—	0
149.5–149.99	—	0
150.0–150.49	1111111	7
150.5–150.99	111111	6
151.0–151.49	111111111	9
151.5–151.99	11111111111	11
152.0–152.49	1111111111	10
152.5–152.99	11111111111111	14
153.0–153.49	1111111111111111	16
153.5–153.99	111111111111111	15
154.0–154.49	111111111111111	15
154.5–154.99	111111111111	12
155.0–155.49	111111111111111	15
155.5–155.99	1111111111111	13
156.0–156.49	111111111	9
156.5–156.99	1111111111	10
157.0–157.49	1111111111111	13
157.5–157.99	111111111	9
158.0–158.49	1111111	7
158.5–158.99	11111111	8
159.0–159.49	1	1
159.5–159.99	1	1
Total number of measures tested		202
Allowable number of incorrect measures		4
Number of incorrect measures		2
Result		**☑ Pass ☐ Fail**

B.2 Examples of Test Results for Sampling Plan during Manufacture

Nominal capacity 285 mL line measure Allowable MPE ±(2.5% + 5 mL)

Allowable MPE range (mL) 272.875 to 297.125 mL = 24.25 mL

Upper capacity limit (T_s) = nominal capacity + MPE T_s = 285 + (285 × 2.5% + 5) = 297.125 mL

Lower capacity limit (T_i) = nominal capacity – MPE T_i = 285 – (285 × 2.5% + 5) = 272.875 mL

Batch size 20 000 Test proportion 15 Allowable number of incorrect measures **0**

Example 1

Measure capacity range (mL)	Frequency (occurrences)	Number
280.00–280.99	1	1
281.00–281.99	11	2
282.00–282.99	1111	4
283.00–283.99	111	3
284.00–284.99	11	2
285.00–285.99	1	1
286.00–286.99	11	2
Total number of measures tested		15
Number of incorrect measures		0
Allowable number of incorrect measures		**0**
Result		☑ Pass ☐ Fail
Mean capacity of the test proportion (X) = $X \div n$		283.3
Standard deviation (s) = $\sqrt{\frac{1}{n-1}\ (X_i - X)^2}$		1.764
Is $X \leq T_s - k \times s$?	283.3 ≤ 297.125 – 1.47 × 1.764 ☑ yes ☐ no	
Is $X \geq T_i + k \times s$?	283.3 ≥ 272.875 + 1.47 × 1.764 ☑ yes ☐ no	
Is $s \leq f_s(T_s - T_i)$?	1.764 ≤ 0.284 (297.125 – 272.875) ☑ yes ☐ no	
Tick Pass if you answer 'yes' to all the questions, otherwise tick Fail		☑ Pass ☐ Fail
Overall result		☑ **Pass** ☐ **Fail**

Example 2

Measure capacity range (mL)	Frequency (occurrences)	Number
273.00–273.99	1	1
274.00–274.99	—	0
275.00–275.99	1	1
276.00–276.99	1	1
277.00–277.99	—	0
278.00–278.99	1	1
279.00–279.99	—	0
280.00–280.99	1	1
281.00–281.99	1	1
282.00–282.99	1	1
283.00–283.99	—	0
284.00–284.99	1	1
285.00–285.99	1	1
286.00–286.99	1	1
287.00–287.99	1	1
288.00–288.99	1	1
289.00–289.99	—	0
290.00–290.99	—	0
291.00–291.99	1	1
292.00–292.99	—	0
293.00–293.99	—	0
294.00–294.99	1	1
295.00–295.99	1	1
Total number of measures tested		15
Number of incorrect measures		0
Allowable number of incorrect measures		**0**
Result		☑ Pass ☐ Fail
Mean capacity of the test proportion $(X) = \quad X \div n$		284.05
Standard deviation $(s) = \quad \frac{1}{n-1} \quad \overline{(X_i - X)^2}$		6.96
Is $X \leq T_s - k \times s$?	284.05 ≤ 297.125 – 1.47 × 6.96 ☑ yes	
Is $X \geq T_i + k \times s$?	284.05 ≥ 272.875 + 1.47 × 6.96 ☑ yes	
Is $s \leq f_s(T_s - T_i)$?	6.96 ≤ 0.284 (297.125 – 272.875) ☐ yes	
Tick Pass if you answer 'yes' to all the questions, otherwise tick Fail		☐ **Pass** ☑ Fail
Overall result		☐ **Pass** ☑ **Fail**