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Procedure Manual for the Pattern Approval of Non-automatic Weighing Instruments

Developed for the Asia–Pacific Legal Metrology Forum

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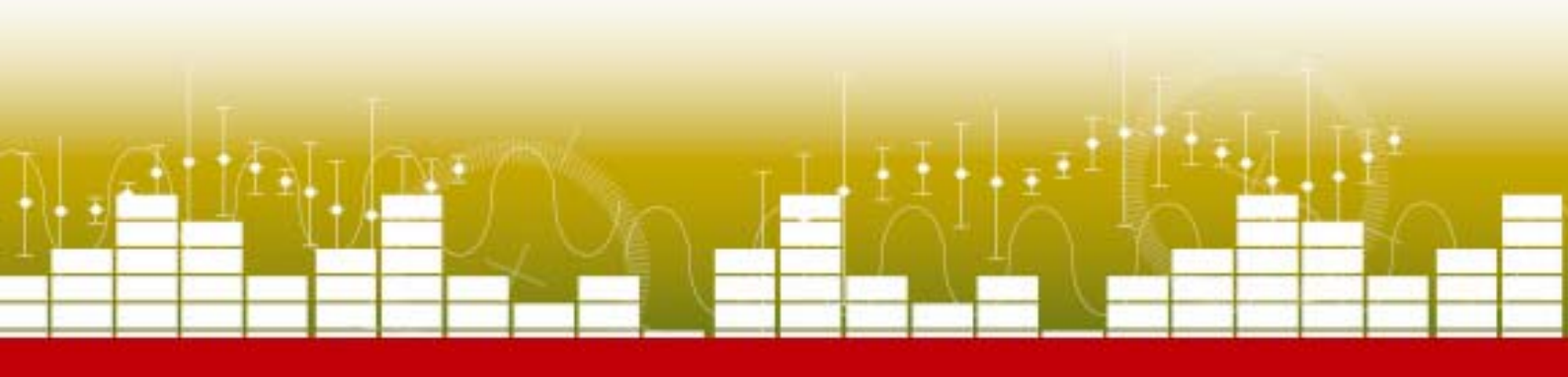


DISCLAIMER

The manual has been designed to be used in conjunction with *OIML R 76-1 Non-automatic Weighing Instruments, Part 1: Metrological and Technical Requirements — Tests*, Edition 1992(E) as amended by Amendment 1 1994(E) published by the International Organisation of Legal Metrology (OIML). The manual makes no claim of authority regarding the procedures used, and hence in any topic or point of dispute OIML R 76 is always correct.

ABBREVIATIONS

#	standard procedure
d	actual scale interval
e	verification scale interval
E	error
E_0	error at zero indication
E_C	corrected error
E_L	error at load indication
ESD	electrostatic discharge
EUT	electronic instrument under test
I	indication
I_0	indication at zero
I_1	indication of first test load
I_2	indication of second test load
I_L	indication of test load
L	load
L_0	load at zero
ΔL	additional load to next changeover point
ΔL_0	additional load to next changeover point at zero
Max	maximum capacity
Min	minimum capacity
mpe	maximum permissible error
OIML	International Organisation of Legal Metrology
P	indication prior to rounding (digital indication)
ΔP	difference between P at the beginning of testing (zero min) and P at a given time
P_{max}	maximum indication prior to rounding (digital indication)
P_{min}	minimum indication prior to rounding (digital indication)
P_V	indication prior to rounding (digital indication) at given tilt where v = 1, 2, 3, 4, 5
P^o_V	indication P_V corrected for the deviation from zero the instrument had prior to loading
ΔTemp	difference in temperature for two consecutive tests at different temperatures
U_n	nominal voltage

CONTENTS

INTRODUCTION

The first meeting of the Asia–Pacific Legal Metrology Forum held in Sydney in 1994 identified training of legal metrology staff as a major concern. Of particular concern was the need to establish regionally consistent training to provide highly competent staff and comparable legal metrology within the region.

As a result a regional training policy and program was established by the Asia–Pacific Legal Metrology Forum. As part of this program the National Standards Commission (now the National Measurement Institute) and the China State Bureau of Technical Supervision, People's Republic of China, have jointly developed a training module for OIML R 76 on non-automatic weighing instruments. The module is designed to assist in the implementation of the international recommendation throughout the APEC region.

This procedure manual has been developed as part of this training module to assist in the development of common laboratory procedures based on OIML R 76. In developing this manual we have drawn upon the expertise of experienced people in both countries. Therefore, the manual provides a practical approach to the assessment procedures for the pattern approval of non-automatic weighing instruments.

The manual has two parts. The first part contains six standard procedures which are used many times throughout the main testing procedures. These standard procedures are not complete in themselves and should be used where appropriate as part of a complete test procedure.

The second part of the manual contains the test procedures required to assess the pattern of a non-automatic weighing instrument. Each test procedure has been numbered so that it is consistent with the same clause in OIML R 76-1 and is presented in an easy to follow format providing:

- references to the appropriate clauses of OIML R 76-1 and OIML R 76-2;
- a list of the equipment and resources required during the test; and
- a step-by-step procedure for the test.

Incorporated throughout the procedures are valuable notes and comments based on experience. If you have some experience to share, comment to make, or question to ask about this manual please let us know.

ACKNOWLEDGMENTS

The Asia–Pacific Legal Metrology Forum would like to acknowledge the hard work of those people from the National Standards Commission (now the National Measurement Institute), particularly Keith Mann and Marian Haire for producing the technical drafts for the procedures. This material was then used by Kerry Marston to write the text of the manual. The optional disk containing the evaluation report sheets were developed and produced by Chris Davies, the manual was edited by Helen Wortham, and Ian Hoerlein and Kimberlee Brown commented and reviewed the draft.

The Asia–Pacific Legal Metrology Forum would also like to acknowledge the support of CSBTS and in particular the work of Professor Shi Changyan, Chief Engineer, National Institute of Metrology; Wang Zhenwen, Senior Engineer, Qingdao Weighing Instrument Testing Centre; Dai Runsheng, Director, Office of OIML Matters; and Han Jianping, Chinese Secretariat for OIML, for their valuable comments on draft materials and their review of the overall manual.

STANDARD PROCEDURES

The following standard procedures are used a number of times throughout the testing that is required for the pattern approval of non-automatic weighing instruments. For convenience and to avoid constant repetition, the standard procedures are outlined in this section. Whenever one of these standard procedures is required to be used during a test procedure, an appropriate reference is made back to this section. For example, whenever it is necessary to evaluate the error using the changeover method then the reference is given as (#1, page 1 of this manual).

#1 Evaluation of Error by the Changeover Method

This procedure enables you to evaluate the error at any test load during any of the testing procedures. It is essential that all users read OIML R 76-1, clauses A.4.4.3 and A.4.1.6 before commencing this procedure.

Equipment required

- OIML R 76-1 and 76-2
- Instrument under test
- Certified weights of 0.1 e to 10 e

Procedure

1. At a certain load, L, observe the indication, I, and record.
2. Apply additional weights of say 0.1 e to the load receptor successively one at a time until the indication has changed unambiguously one scale interval (I + e).
3. Record the additional load as ΔL.
4. Use these values to calculate the error as per OIML R 76-1, clause A.4.4.3 (page 69).

The error value can also be found using the internal test mode if the instrument has been fitted with this device. For the details of how to assess the internal test mode device if it has been fitted refer to the manufacturer's manual or check with the applicant.

However, the following tests **CANNOT** be evaluated in this mode and the error must be determined using the changeover method outlined above:

A.4.2 checking of zero;
A.4.8 discrimination;
B.3.1 short-time power reductions;
B.3.2 electrical bursts;
B.3.3 electrostatic discharge; and
B.3.4 immunity to radiated electromagnetic fields.

#2 Setting to Zero before Loading

Before starting this procedure it is necessary to read OIML R 76-1, clauses A.4.3 and A.4.2.3 and to determine the status of the zero setting on the instrument under test. If the instrument has non-automatic zero setting then follow procedure (a). If the instrument has semi-automatic, automatic zero setting or zero tracking then follow procedure (b).

Equipment required

- OIML R 76-1 and 76-2
- Instrument under test
- Certified weights of 0.1 e to 10 e

(a) Non-automatic zero setting (adjusting the instrument to zero)

This procedure ensures that the instrument is still set to zero, removing any zero error that would add to, or subtract from, any of the errors that are associated with any load applied to the instrument.

Procedure

1. Apply weights equivalent to 0.5 e to the load receptor.
2. With reference to the manufacturer's manual, adjust the instrument to the first change point.
3. Remove the weights.

(b) Semi-automatic, automatic or zero tracking (determination of the zero point)

This procedure enables you to find any zero error that occurs and use this to adjust any calculations to find the true error value for any load applied to the instrument.

Procedure

1. Apply 10 e to the load receptor and note the load at zero, L_0.
2. Note the indication at zero, I_0.
3. Find the changeover point (#1, page 1 of this manual) and note ΔL_0.
4. Calculate the error at zero indication, E_0, where $E_0 = I_0 + 0.5\ e - \Delta L_0 - L_0$.

#3 Pre-load Test

This procedure is designed to exercise the instrument before any testing procedure. It is essential that all users read OIML R 76-1, clause A.4.1.10 before commencing this procedure.

Equipment required

- OIML R 76-1 and 76-2
- Instrument under test
- Certified weights to the maximum load capacity of the instrument

Procedure

1. Apply a load equivalent to maximum capacity, Max, for the instrument in reasonably practical steps depending on the weights available.
2. Remove the weights in a similar manner.
3. Zero the instrument (#2, page 2 of this manual).

#4 Weighing Test

This procedure is used to establish the weighing performance of the instrument at several load points while the instrument is being subjected to various influence factors. It is essential that all users read OIML R 76-1, clause A.4.4.1 before commencing this procedure.

Equipment required

- OIML R 76-1 and 76-2
- Instrument under test
- Certified weights to the maximum load capacity of the instrument

Procedure

1. Determine the range of at least five test loads, L, to be used in this test. The criteria for selecting the test loads are as follows:
   (a) The test loads must span from minimum to maximum capacity for the instrument.
   (b) Include the load at the maximum permissible error (mpe) change points. When selecting the test loads for a multi-interval instrument which has partial weighing ranges include all the mpe change points.
   (c) Do not select the load at the point where the scale interval changes. It is recommended that a load 5 e less than this point be used.
   (d) Do not select maximum capacity if over range blanking occurs at that point. It is recommended that a load 5 e less than maximum be used.
2. Record these test loads in column L of the evaluation sheet and the appropriate mpe in the last column.
3. Find the error at zero or near zero (#2, page 2 of this manual).
4. Apply the test loads, increasing from minimum to maximum.
5. At each test load record the load, L, the indication, I, find the changeover point (#1, page 1 of this manual) and record ΔL.
6. Record the time when the maximum load has been applied.
7. Remove the test loads, decreasing from maximum to zero load.
8. At each test load record the load, L, the indication, I, find the changeover point (#1, page 1 of this manual) and record ΔL.
9. Record the time and ambient temperature.
10. Calculate and record the error E where $E = I + 0.5\ e - \Delta L - L$ and the corrected error E_C where $E_C = E - E_0$.

#5 How to Determine the Status of Automatic Zero Setting and Zero Tracking

This procedure is to ascertain if the instrument has automatic zero setting and zero tracking and whether or not they are in operation. It is essential that all users read OIML R 76-1, clause A.4.1.5 before commencing this procedure.

Equipment required

- OIML R 76-1 and 76-2
- Applicant's documentation
- Instrument under test
- Twenty certified weights of 0.1 d

Definitions

Non-existent	neither automatic zero-setting nor zero-tracking devices are part of the instrument.
Not in operation	neither automatic zero setting nor zero tracking are active in the instrument. For example, it has been disabled.
Out of working range	automatic zero setting and/or zero tracking are in use. If a zero reading is required for the calculations then a load of 10 e is placed on the load receptor to take the instrument out of working range. If this has been necessary the test is then referred to as a near-zero test.
In operation	automatic zero setting and/or zero tracking are in use as the zero reading does not need to be included in the calculations. For example, the repeatability test.

Procedure

1. Stabilise the instrument with the power supply on for at least 30 min.
2. Apply weights of 0.1 d at 2 s intervals and observe the indicated reading:
   (a) If after adding 20 weights of 0.1 d the instrument displays a reading other than zero indication then the device is non-existent or not in operation. Refer to the manufacturer's manual to determine which condition applies.

   OR

   (b) If after adding 20 weights of 0.1 d the instrument still displays zero then the devices are still in operation.

If the automatic zero setting and/or zero-tracking devices are in operation, then for most of the test procedures contained in this manual it will be necessary to select out of working range. To do this apply a 10 e load to the load receptor to stop the instrument correcting to zero which may result in a misreading at zero. In this manual this is referred to as taking a near zero reading.

#6 Supplementary Test

A supplementary test is required for a number of the test procedures if the initial zero-setting range is > 20%. Where required the weighing procedure for a particular test is repeated at the positive limit of the initial zero-setting range as follows. It is essential that all users read OIML R 76-1, clauses 4.5.1 and A.4.4.2 before commencing this procedure.

Equipment required

- As per test in progress
- Additional blank evaluation sheet

Procedure

1. Apply a load equal to the positive limit of the initial zero-setting range.
2. Record this load on a new evaluation report in the remarks column.
3. Switch the power supply to the instrument off and then on.
4. Repeat the appropriate weighing procedure and record the results on the new evaluation report.
5. Determine whether the instrument has passed or failed in accordance with the appropriate requirements as set out in OIML R 76-1.

TESTING REQUIREMENTS

To ensure consistency and traceability in the results achieved during the testing procedures it is essential to regulate the conditions under which the instrument is tested and the accuracy of the equipment used for testing.

The certified weights to be used during the testing procedure must comply with the requirements set out in OIML R 76-1, clause 3.7.1. To meet these OIML requirements it is suggested that the weights used for pattern approval testing of non-automatic weighing instruments should be: F_1 for class 2, F_1 to M_1 for class 3, and F_2 to M_3 for class 4. For class 1 instruments which are very rare, E_1 and E_2 weights are necessary.

It is also essential that all the measuring equipment used to measure and monitor the temperature, humidity and barometric pressure is also calibrated and traceable. A record of the measuring equipment used for every pattern approval procedure is required and should be recorded on OIML R 76-2, page 8 — Information Concerning the Test Equipment Used for Pattern Evaluation.

The general conditions required for testing are set out in OIML R 76-1, clause A.4.1. Although a controlled atmosphere such as air-conditioning is not required as long as the conditions for temperature are met as stated in OMIL R 76-1, clause A.4.1.2, it is highly recommended that no direct sunshine be allowed into the measuring room and in particular not allowed onto the test equipment.

The conditions required in the controlled environmental chambers for the temperature tests (A.5.3) and the damp heat, steady state tests (B.2.2) are set out in the relevant IEC documents as follows:

Temperature tests	IEC 60068-2-1 (1994)
	IEC 60068-2-2 (1974)
	IEC 60068-3-1 (1974)
Damp heat, steady state	IEC 60068-2-3 (1969)
	IEC 60068-3-4 (2001)

For the temperature tests OIML R 76-1, clause A.5.3.1 also states that the absolute humidity should not exceed 20 g/m^3. However, humidity is commonly measured as relative humidity. The following table indicates the maximum allowable relative humidity at various temperatures that will ensure that an absolute humidity of 20 g/m^3 is not exceeded. For example, at 33^{o}C the maximum relative humidity allowed, to ensure that an absolute humidity of 20 g/m^3 is not exceeded, is 57%. This example is shown in the shaded area in the table below.

Temperature verses relative humidity for an absolute humidity of 20 g/m^3

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
20	116	110	103	98	92	87	83	78	74	70
30	66	63	60	57	54	51	48	46	44	42
40	40	38	36	33	33	31	30	28	27	26

PREPARATION OF THE INSTRUMENT FOR TESTING

It is essential that all users read OIML R 76-1, clauses 1, 2, 3.1, 3.2, 3.3, 3.4, 3.5, 7, 8, A.1, A.2 and A.3 before commencing this procedure.

Equipment required

- OIML R 76-1
- OIML R 76-2, pages 6 to 8 — General Information Concerning the Pattern and Test Equipment
- Instrument under test
- Certified weights
- Suitable test table
- Applicant's documentation

Procedure

1. Examine the documentation to familiarise yourself with the instrument.
2. Complete pages 6 to 8 of the evaluation reports. Ensure that the traceability (including serial numbers) of all test measuring equipment to be used during the testing procedures is recorded on OIML R 76-2 (page 8). An example of a completed page 6 of the evaluation report has been included for your information on the next page.
3. Place the instrument on a firm, stable table or test bench.
4. Level the instrument.
5. Switch the power supply on.
6. Allow a least 30 min of warm-up time.
7. Conduct a pre-load test (#3, page 3 of this manual).
8. Check that the instrument is within the mpe as follows:
   (a) apply a load equivalent to Max; and
   (b) calculate the error by the changeover method (#1, page 1 of this manual).
9. Interpret the result as follows:
   (a) If the instrument is within the mpe continue the testing procedure. However, to ensure the instrument has the best chance of passing the wide range of testing procedures it will undergo, the error at this stage should be as close as possible to zero. If this is not the case it would be in the best interest of the applicant to suggest that they might like to recalibrate the instrument.
   (b) If the instrument is not within the mpe make appropriate arrangements for the applicant to recalibrate the instrument.

GENERAL INFORMATION CONCERNING THE PATTERN (example only)

Application N°: R1996/745
Pattern designation: Model RP -15Y
Manufacturer: ACME Scales, Australia
Applicant: High Class Weighing
Instrument category: Price computing weighing instrument < 100 kg

[×] Complete instrument [ ] Module

Accuracy class: [ ] I 1 [ ] II 2 [×] III 3 [ ] IIII 4

[×] Self-indicating [ ] Semi-self-indicating [ ] Non-self-indicating

Min = 0.04 kg

e = Max = d = n =

e_1 =	0.002 kg	Max_1 =	6 kg	d_1 =		n_1 =	3000
e_2 =	0.005 kg	Max_2 =	15 kg	d_2 =		n_2 =	3000
e_3 =		Max_3 =		d_3 =		n_3 =	

T = + T = – 15 kg

U_n = 240 V U_{min} = V U_{max} = V f = 50 Hz Battery, U = V

Zero-setting device:

[ ] Non-automatic
[×] Semi-automatic
[ ] Automatic zero setting
[×] Initial zero setting
[×] Zero tracking

Tare device:

[×] Tare balancing
[ ] Tare weighing
[ ] Preset tare device
[×] Subtractive tare
[ ] Additive tare

[ ] Combined zero/tare device

Initial zero-setting range = 12.5 %

Temperature range: –10 to +40 °C

Printer: [×] Built-in [ ] Connected [ ] Non-present but connectable [ ] No connection

Instrument submitted: RP-15 Y
Identification N°: F9700034
Connected equipment: Nil

Interfaces: Nil
(number, nature)

Load cell:
Manufacturer: .....
Type: .....
Capacity: .....
Number: .....
Classification symbol: .....
Evaluation period: .....

Remarks: see following page
Date of report: 28 September 97
Observer: I. Examiner

CHECKING OF ZERO (A.4.2)

It is essential that all users read OIML R 76-1, clauses 4.5, A.4.2 and A.4.4.2 before commencing this procedure.

A.4.2.1 Range of Zero Setting

The test procedure for finding the range of zero setting is made up of two parts. The first procedure is to find the initial zero-setting range (A.4.2.1.1) and the second is to find the zero-setting range. If the instrument to be tested is non-automatic or semi-automatic then procedure A.4.2.1.2 is used to find the zero-setting range, if the instrument is automatic then procedure A.4.2.1.3 is used.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 17 (page 49)
- Instrument under test
- Certified weights

A.4.2.1.1 Initial Zero-setting Range

Procedure

1. Determine the positive portion of the initial zero-setting range as follows:
   (a) Set the instrument to zero with the load receptor empty.
   (b) Place a load on the load receptor and switch the power supply to the instrument off and then back on.
   (c) Increase the load by a small amount and switch the power supply to the instrument off and then back on again.
   (d) Continue this process increasing the load by a small amount each time until it does not re-zero.
   (e) Reduce the load by very small amounts, switch the instrument off and then on after each load is removed until the instrument resets to zero. Do this to an accuracy of 0.5 e.
   (f) Record the maximum load that can be re-zeroed as the positive portion of the initial zero-setting range on the worksheet.
2. Determine the negative portion of the initial zero-setting range as follows:
   (a) Remove any load from the load receptor and set the instrument to zero by switching the power supply off and then back on.
   (b) Remove the load receptor (platform) from the instrument.
   (c) If, at this point, the instrument can be reset to zero by switching it off and then back on, the weight of the load receptor is used as the negative portion of the initial zero-setting range.

   OR

   If the instrument cannot be reset to zero with the load receptor removed:

(i) add weights to any live part of the instrument (i.e. on the parts where the load receptor rests) until the instrument indicates zero again; the weights should now be equal to the weight of the load receptor;
(ii) remove a load from the receptor in small amounts, switch the power supply to the instrument off and then back on;
(iii) continue this process of removing a load from the receptor in small amounts until the instrument does not re-zero; and
(iv) then add a load to the receptor in very small amounts, switching the power supply to the instrument off and then back on after each addition until it resets to zero; do this to an accuracy of 0.5 e.

(d) Record the maximum load that can be re-zeroed as the negative portion of the initial zero-setting range on the worksheet.

3. Calculate the initial zero-setting range as the sum of the positive and negative portions. Find the initial zero-setting range as a percentage of the maximum load capacity of the instrument. If the load receptor cannot readily be removed only the positive part of the initial zero-setting range need be considered.

4. Determine whether the instrument requires additional testing in accordance with the requirements as set out in OIML R 76-1, clause 4.5.1 (page 36) and clause A.4.4.2 (page 69). That is, any instrument that has an initial zero range >20% will require a supplementary test (#6, page 5 of this manual) using the upper limit of the range as zero point. This wider range is only possible if the instrument also complies with OIML R 76-1, clauses 3.5, 3.6, 3.8 and 3.9 for any load compensated by this device within the specified range.

5. Record results on Evaluation Report No. 17, clause A.4.2.1 (page 49).

A.4.2.1.2 Non-automatic and Semi-automatic Zero-setting Range

Procedure

1. Determine the positive portion of the zero-setting range as follows:
   (a) Set the instrument to zero with the load receptor empty by switching the power supply off and then back on.
   (b) Place a small test load on the load receptor and re-set to zero using the zero-setting device.
   (c) Increase the load by a small amount and again re-set to zero using the zero-setting device.
   (d) Continue this process, increasing the load by a small amount each time until, after placing a load on the load receptor, the instrument cannot be re-zeroed using the zero-setting device; do this to an accuracy of 0.5 e.
   (e) Record this load on the extra report sheet, as the positive load that can be re-zeroed. This is the positive portion of the zero-setting range.

2. Determine the negative portion of the zero-setting range as follows:
   (a) Remove any load from the load receptor and set the instrument to zero.
   (b) Remove the load receptor from the instrument.
   (c) If, at this point, the instrument can be reset to zero using the zero-setting device, the mass of the load receptor is used as the negative portion of the zero-setting range.

OR

If the instrument cannot be reset to zero with the load receptor removed:

(i) add weights to any live part of the instrument (i.e. on the parts where the load receptor rests) until the instrument indicates zero again; the weights should now be equal to the weight of the load receptor;
(ii) remove a load from the receptor in small amounts, reset the instrument to zero using the zero-setting device;
(iii) continue this process of removing a load from the receptor in small amounts until the instrument does not re-zero; and
(iv) then add a load to the receptor in very small amounts, reset the instrument to zero using the zero-setting device until it resets to zero; do this to an accuracy of 0.5 e.

(d) Record this load on the extra report sheet as the negative load that can be re-zeroed. This is the negative portion of the zero-setting range.

3. The zero-setting range is the sum of the positive and negative portions. Calculate and record the zero-setting range as a percentage of the maximum load capacity of the instrument. If the load receptor cannot readily be removed only the positive part of the zero-setting range need be considered.
4. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 4.5.1 (page 36).
5. Record results on Evaluation Report No. 17, clause A.4.2.1 (page 49).

A.4.2.1.3 Automatic Zero-setting Range

There are three possible ways to conduct this test: (a) if the load receptor can be removed; (b) if the load receptor cannot be removed and the instrument is fitted with another zero-setting device; and (c) if the load receptor cannot be removed and no other zero-setting device has been fitted.

(a) Load Receptor CAN be Removed

Procedure

1. Remove the load receptor and substitute with weights until the instrument indicates zero.
2. Remove weights in small amounts and after each weight is removed allow time for the automatic zero-setting device to function, in order to see if the instrument is able to reset to zero automatically. This may take at least 5 s or longer.
3. Repeat this procedure until the instrument will not reset to zero automatically.
4. The maximum load that can be removed so that the instrument will still reset to zero, is the zero-setting range.
5. Find the zero-setting range as a percentage of the maximum capacity of the instrument.
6. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 4.5.1 (page 36).
7. Record results on Evaluation Report No. 17, clause A.4.2.1 (page 49).

(b) Load Receptor CANNOT be Removed and Another Zero-setting Device is Fitted

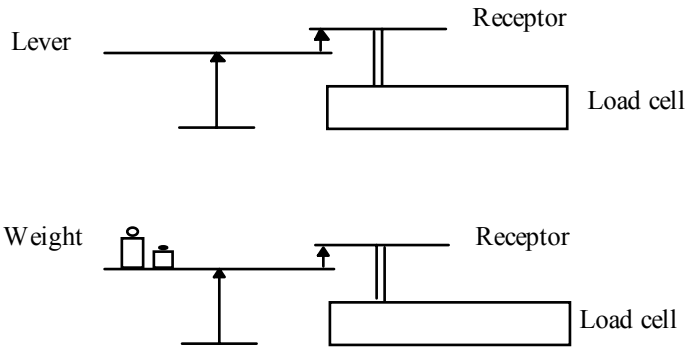
Procedure

1. If the load receptor cannot readily be removed, a practical approach can be to add weights to the instrument and use another zero-setting device (e.g. initial zero setting if provided) to set the instrument to zero.
2. Remove weights in small amounts and after each weight is removed allow time for the automatic zero-setting device to function, in order to see if the instrument is able to reset to zero automatically. This may take at least 5 s or longer.
3. Repeat this procedure until the instrument will not reset to zero automatically.
4. The maximum load that can be removed so that the instrument will still reset to zero, is the zero-setting range.
5. Find the zero-setting range as a percentage of the maximum capacity of the instrument.
6. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 4.5.1 (page 36).
7. Record results on Evaluation Report No. 17, clause A.4.2.1 (page 49).

(c) Load Receptor CANNOT be Removed and No Additional Zero-setting Device is Available

Procedure

1. If the load receptor cannot readily be removed and no additional zero-setting device is available use the first order lever method to reduce the load on the receptor as shown in the diagram below. Note: For safety reasons this approach is only suitable for small instruments .
2. Place one end of the lever underneath the receptor as shown on the diagram. The fulcrum point of the lever needs to be appropriately balanced.
3. Add the weights to the lever as shown and check whether the automatic zero setting still sets the instrument to zero. The maximum load that can be removed from the instrument in this manner, so that it can still be reset to zero, is the zero-setting range.



4. Remove the weights and the display will show the range of automatic zero setting.
5. Find the zero-setting range as a percentage of the maximum capacity of the instrument.
6. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 4.5.1 (page 36).
7. Record results on Evaluation Report No. 17, clause A.4.2.1 (page 49).

4.5.1 and 4.5.7 Zero-tracking Range

In accordance with OIML R 76-1, clauses 4.5.1 and 4.5.7 it is necessary to calculate the range of the zero-tracking device with and without tare being applied. The following procedure is used at the National Measurement Institute to calculate both the positive and negative portions of the zero-tracking range.

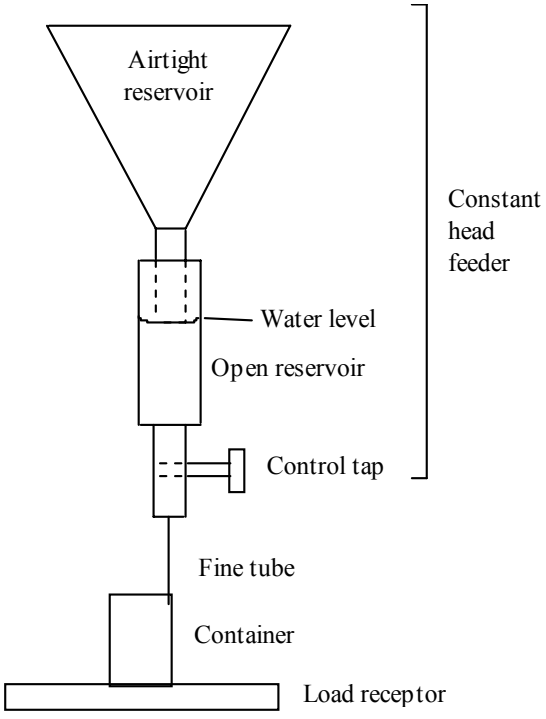
Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 17 (pages 49 to 50)
- Instrument under test
- Certified weights
- Constant head water feeder (a suggestion for this apparatus is shown in the diagram)

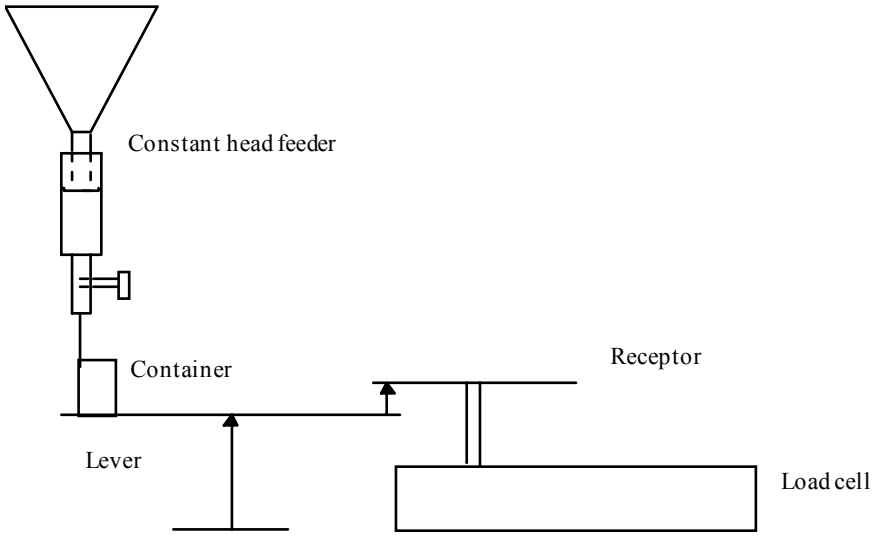
(a) Without Tare

Procedure

1. Determine the positive portion of the zero-tracking range as follows:
   (a) Zero the instrument with an empty load receptor. Weigh the empty water container and note the indication. Remove the container.
   (b) Add small weights of approximately 0.2 d at 2 s intervals until the mass equivalent of the container has been zero tracked.
   (c) Place the container onto the load receptor and remove the weights, allow the zero tracking to correct any small deviation to zero.
   (d) Set up the water system as shown in the diagram. Adjust the water flow so that it runs smoothly down the side of the container (do not allow the water to drip) and ensure that the tube does not touch the side of the container.
   (e) Start the flow of water, ensuring that the zero tracking maintains a zero indication.
   (f) As soon as zero tracking ceases to operate turn off the water and remove the container from the load receptor. In most cases the negative value on the display will indicate the value that has been tracked off.
   (g) Record this value as the positive load that can be zero tracked. This is the positive portion of the zero-tracking range.



2. Determine the negative portion of the zero-tracking range as follows:
   (a) Remove any load from the load receptor and set the instrument to zero.
   (b) Place one end of the lever underneath the receptor as shown in the diagram below. The fulcrum point of the lever needs to be appropriately balanced.



   (c) Place the container on the other end of the lever as shown in the diagram.
   (d) Start the flow of water, ensuring that the zero tracking maintains a zero indication.
   (e) As soon as zero tracking ceases to operate turn off the water and remove the container from the lever. In most cases the positive value on the display will indicate the value that has been tracked off.
   (f) Record this value as the negative load that can be zero tracked. This is the negative portion of the zero-tracking range.
3. The zero-tracking range is the sum of the positive and negative portions. Calculate and record the zero-tracking range as a percentage of the maximum load capacity of the instrument.
4. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 4.5.1 (page 36).
5. Record results on Evaluation Report No. 17, clause A.4.2.1 (page 49).

(b) With Tare Applied

1. Follow the procedure above but apply and activate a tare load prior to carrying out the procedures.
2. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 4.5.7 (page 37).
3. Record results on Evaluation Report No. 17, clause 4.5.7 (page 50).

A.4.2.2 Zero-indicating Device

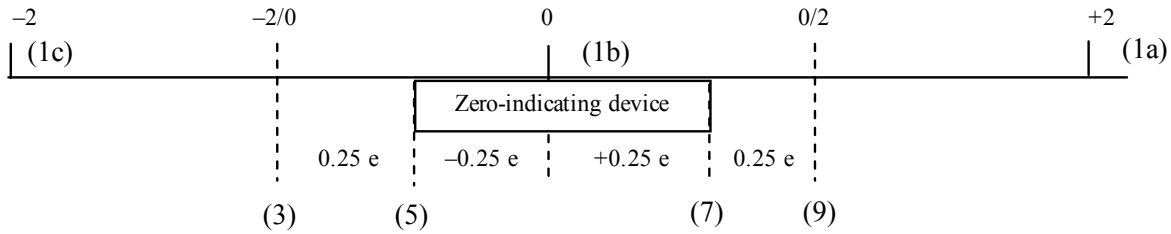
The zero-indicating device may or may not be operating with the zero tracking. If zero tracking is not in operation then follow (a), if zero tracking is in operation follow (b).

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 17 (page 50)
- Instrument under test
- Certified weights

(a) A Digital Indicating Instrument that does not have a Zero-tracking Device

The test procedure is illustrated in the following diagram showing a scale at zero with e = 2. The numbers in brackets, e.g. (1c), refer to the respective step in the procedure.



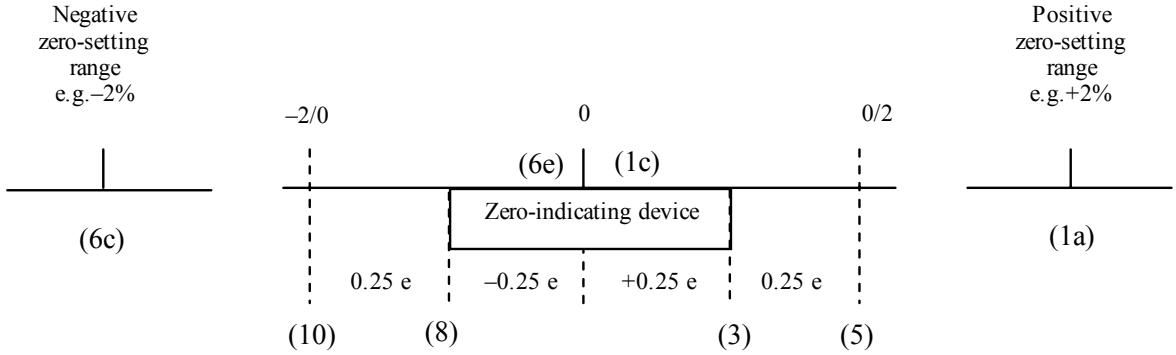
Procedure

1. Adjust the instrument to about one scale interval below zero by:
   (a) placing a load of 1 e on the receptor;
   (b) zeroing the instrument; and
   (c) removing the 1 e load.
2. Apply weights of 0.1 e to the load receptor one at a time until the indication has changed unambiguously. Find this to an accuracy of 0.05 e.
3. Note the value.
4. Continue to add weights of 0.1 e to the load receptor one at a time until the zero-indicating device appears on the display. Find this to an accuracy of 0.05 e.
5. Note the value.
6. Continue to add weights of 0.1 e to the load receptor one at a time until the zero-indicating device disappears from the display. Find this to an accuracy of 0.05 e.
7. Note the value.
8. Continue to apply weights of 0.1 e to the load receptor one at a time until the indication has changed again unambiguously. Find this to an accuracy of 0.05 e.
9. Note the value.

10. Calculate the width of the zero indication as follows:
    (a) the value at point 5 minus the value at point 3 = approximately 0.25 of e;
    (b) the value at point 7 minus the value at point 5 = 0.5 e (±0.25 of e); and
    (c) the value at point 9 minus the value at point 7 = approximately 0.25 of e.
11. Determine if the zero-indicating device is operating within the mpe of ±0.25 e.
12. Record results on Evaluation Report No. 17, clause A.4.2.2 (page 50).

(b) A Digital Indicating Instrument with a Zero-tracking Device in Operation

This procedure is illustrated in the following diagram showing a scale at zero with e = 2. The numbers in brackets, e.g. (1c), refer to the respective step in the procedure.



Procedure

1. Adjust the instrument to the positive limit of the zero-setting range by:
    (a) placing a load on the load receptor which is equivalent to the value found in step 1(e) in Section A.4.2.1.2 of this manual;
    (b) zeroing the instrument; and
    (c) checking that the zero-indicating device is illuminated; if the zero-indicating device is not illuminated remove the load in small portions until it is.
2. Apply weights of 0.1 e to the load receptor one at a time until the zero-indicating device has switched off. Find this to an accuracy of 0.05 e.
3. Note the value.
4. Continue to add weights of 0.1 e to the load receptor one at a time until the display changes unambiguously to 1 e. Find this to an accuracy of 0.05 e.
5. Note the value.
6. Adjust the instrument to the negative limit of the zero-setting range by:
    (a) Removing all the load from the load receptor and pressing zero.
    (b) Removing the load receptor and substituting the load receptor with weights until zero indication is obtained.
    (c) Removing weights from the instrument which are equivalent to the value found in step 2(c) or 2(d) in Section A.4.2.1.2 of this manual.
    (d) Zeroing the instrument.
    (e) Checking that the zero-indicating device is illuminated. If the zero-indicating device is not illuminated add some load in small portions until it is.

7. Remove weights of 0.1 e from the load receptor one at a time until the zero-indicating device disappears from the display. Find this to an accuracy of 0.05 e.
8. Note the value.
9. Continue to remove weights of 0.1 e from the load receptor successively one at a time until the indication has changed again unambiguously to –1 e. Find this to an accuracy of 0.05 e.
10. Note the value.
11. Calculate the width of the zero indication as follows:
    (a) the value at point 5 minus the value at point 3 is approximately 0.25 of e; and
    (b) the value at point 8 minus the value at point 10 is approximately 0.25 of e.
12. Determine if the zero-indicating device is operating within the mpe of ± 0.25 e.
13. Record results on Evaluation Report No. 17, clause A.4.2.2 (page 50).

A.4.2.3 Accuracy of Zero Setting

The procedure used to determine the accuracy of zero setting will depend on the instrument to be tested. If the instrument has non-automatic or semi-automatic zero setting use procedure A.4.2.3.1, if the instrument has automatic zero setting then use procedure A.4.2.3.2.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 17 (page 49)
- Instrument under test
- Certified weights

A.4.2.3.1 Non-automatic and Semi-automatic Zero Setting

Procedure

1. Load the instrument using a weight that is within the zero-setting range and close to a changeover point.
2. Reset to zero using the zero-setting device.
3. Apply 10 e to the load receptor if the instrument has zero tracking and it is in operation.
4. Find the changeover point, ΔL_0 (#1, page 1 of this manual).
5. Calculate the error at zero, E_0, where $E_0 = 0.5\ e - \Delta L_0$ as $I_0 = 0$ and $L_0 = 0$.
6. Determine if the value of E_0 is ≤ 0.25 e which indicates it is within an mpe of ± 0.25 e.
7. Record the results on Evaluation Report No. 17, clause A.4.2.3 (page 49).

A.4.2.3.2 Automatic Zero Setting or Zero Tracking

Procedure

1. Apply a load of approximately 5 e.
2. Zero the instrument and then remove the load.
3. Wait for the automatic zero setting or zero tracking to occur and the indication displays zero, this should take a minimum of 5 s.
4. Quickly apply 10 e to the load receptor.
5. Note this value as L_0 and the indication as I_0.
6. Find the changeover point, ΔL_0 (#1, page 1 of this manual).
7. Calculate the error at zero, E_0, where $E_0 = I_0 + 0.5\ e - \Delta L_0 - L_0$.
8. Determine if the value of E_0 is ≤ 0.25 e which indicates it is within an mpe of ± 0.25 e.
9. Record the results on Evaluation Report No. 17, clause A.4.2.3 (page 49).

4.5.5 and 4.5.7 Speed of Zero Tracking

To decide whether or not a zero-indicating device is mandatory in accordance with the criteria set out in clauses 4.5.5 and 4.5.7 it is necessary to determine the speed of zero tracking. The clauses state that if the rate of zero tracking is <0.25 d/s then a zero-indicating device is mandatory. A speed >0.5 d/s is not allowed, therefore, an instrument without a zero-indicating device must operate between 0.25 d/s and 0.5 d/s. This is equivalent to a 1 d change in 2 to 4 s.

Outlined below are two methods that will enable the calculation of the speed of zero tracking.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 17 (page 50)
- Instrument under test
- Certified weights
- Constant head water feeder (a suggestion for this apparatus is shown in the diagram)

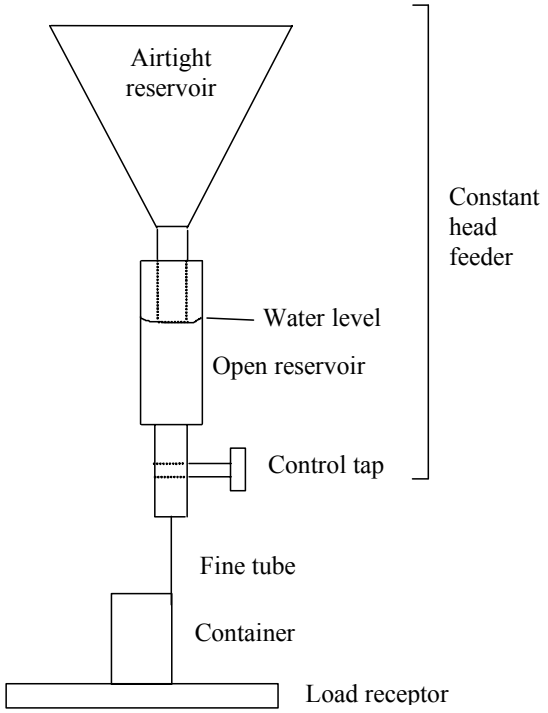
(a) Water Method

Note: For this method to operate correctly, an airtight reservoir of water must be used in conjunction with the drip feeder to maintain a constant head of water. This will ensure a constant flow rate of the water.

Procedure

1. Place the container on the load receptor and set to zero indication.
2. Set up a constant head water feeder as shown in the diagram on the next page. Adjust the water flow so that it runs smoothly down the side of the container (do not allow the water to drip) and ensure that the tube does not touch the side of the container.

3. Start the flow of water, ensuring that the zero tracking maintains a zero indication.
4. Increase the flow rate, ensuring that the zero tracking maintains a zero indication.
5. Continue the process in small steps until the instrument will not maintain a zero indication.
6. At the next change point, start timing the flow of water into the container with a stop watch. Continue to time the flow until the indication has changed at least 5 d. (Hint: The wider this indicated span the more accurate the results will be, e.g. a span of 10 d will give a more accurate result than 5 d.)
7. Stop the timing and the flow of water.
8. Calculate the speed of the flow rate. For example, it takes 50 s for the indication to change 5 d from 5/10 g change point to 30/35 g change point. The flow rate is 5 d/50 s = 0.1 d/s. As the calculated flow rate is < 0.25 d/s a zero-indicating device is required.



9. Repeat the procedure to check that the correct speed of zero tracking has been calculated.
10. Record results on Evaluation Report No. 17, clauses 4.5.5 and 4.5.7 (page 50).

(b) Alternative Method

Procedure

1. Make at least eight loads equivalent to 0.25 d from paper or some other material.
2. Apply the loads at a rate of 1/s and check to see that the indication remains at zero.
3. If the indication does not remain on zero, apply the loads at 2 s intervals and check the result. Repeat the process at 3 s, 4 s, 5 s etc until the indication remains on zero.
4. If the indication remains on zero at point 2, then apply the loads at a faster rate. Repeat the process at a faster rate of application until zero indication can no longer be maintained.
5. Calculate the speed. For example a load of 0.25 d is zero tracked at 2 s but not at 3 s. This is equivalent to 0.125 d/s.
6. Record results on Evaluation Report No. 17, clauses 4.5.5 and 4.5.7 (page 50).

DISCRIMINATION (A.4.8)

It is essential that all users read OIML R 76-1, clauses 3.8 and A.4.8 before commencing this procedure.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 4.1 (pages 14 to 15)
- Instrument under test
- Certified weights
- Time piece
- Temperature probe

Procedure

1. Record the general test details concerning the instrument.
2. Determine whether the instrument is non-self-indicating, analogue indicating or digital indicating.
3. Select the appropriate test/s to conduct as follows:
   (a) if the instrument is non-self-indicating;
   (b) if the instrument is analogue indicating; or
   (c) if the instrument is digital indicating.
4. Conduct the selected test as documented below.

A.4.8.1 Non-self-indication

1. Conduct a pre-load test (#3, page 3 of this manual).
2. Record the time and ambient temperature.
3. Place the minimum load on the load receptor and record as L.
4. Read and record the indication, I.
5. Place an extra load of 0.4 x mpe for the applied load on the load receptor.
6. Measure and record the visible amount of movement of the indicator in millimetres.
7. Remove the load.
8. Repeat steps 3 to 7 using half Max and again for Max.
9. Determine and record whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.8.1 (page 26).

A.4.8.1 Analogue Indication

1. Conduct a pre-load test (#3, page 3 of this manual).
2. Record the time and ambient temperature.
3. Place the minimum load on the load receptor.
4. Record the load, L, and the indication, I_1.
5. Place an extra load equal to the mpe for the applied load on the load receptor.
6. Record the indication, I_2.
7. Calculate and record the change in indication, $I_2 - I_1$.
8. Remove the load.
9. Repeat steps 3 to 8 for half Max and again for Max.
10. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.8.2.1 (page 26).

A.4.8.2 Digital Indication

1. Conduct a pre-load test (#3, page 3 of this manual).
2. Record the time and ambient temperature.
3. Place the minimum load and additional small weights to give 1 d (e.g. 10 additional weights of 0.1 d). If e = d then add additional weights of 0.1 e to give 1 e.
4. Record the load, L, and the indication, I_1.
5. Remove some of the additional weights until you get a negative change in indication of one scale interval (i.e. indication – d).
6. Record the load which has been removed as ΔL.
7. Add a load of 0.1 d to the load receptor.
8. Apply a load of 1.4 d. The indication should increase by 1 d, i.e. I + d.
9. Record the indication as I_2.
10. Calculate and record the change in indication, $I_2 - I_1$.
11. Remove the load.
12. Repeat steps 3 to 11 using half Max and repeat again for Max. Note: Never use the over-range blanking point as a change point for the measurement of ΔL. If over-range blanking occurs at Max then a load of near Max must be used, e.g. Max – 5 e.
13. Determine if the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.8.2.2 (page 27). An example of a completed evaluation report for this test has been included for your information on the next page.
14. If the instrument has an initial zero-setting range > 20% a supplementary test (#6, page 5 of this manual) is required.

4 DISCRIMINATION AND SENSITIVITY (example only)

4.1 Discrimination

4.1.1 Digital indication (A.4.8.2)

Application N°: R1996/745
Pattern designation: Model RP-15Y
Date: 16/12/96
Observer: I. Examiner

	At start	At max	At end	
Temp:	23.1			°C
Rel. h:				%
Time:	9:55			
Bar. pres:				hPa

Load, L	Indication, I_1	Remove load, ΔL	Add 1/10 d	Extra load = 1.4 d	Indication, I_2	$I_2 - I_1$
0.04 kg	0.040 kg	1.0 g	0.2 g	2.8 g	0.042 kg	2
7.50	7.500	2.5	0.5	7.0	7.505	5
15.00	15.000	1.5	0.5	7.0	15.005	5

Check if $I_2 - I_1 = d$

[×] Passed [ ] Failed

Remarks:

SENSITIVITY (A.4.9)

It is essential that all users read OIML R 76-1, clauses 6.1 and A.4.9 before commencing this procedure.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 4.2 (page 15)
- Instrument under test (non-self-indicating)
- Certified weights
- Time piece
- Temperature probe

Procedure

1. Record the general test details concerning the instrument.
2. Conduct a pre-load test (#3, page 3 of this manual).
3. Record the time and ambient temperature.
4. Allow the instrument to oscillate normally.
5. Record the minimum applied load, L, e.g. zero.
6. Apply an extra load equal to the value of the mpe for the minimum applied load on the instrument while the load receptor is still oscillating. For damped instruments the extra load shall be applied with a slight impact.
7. Record the extra load.
8. Measure and record the linear distance between the middle points of this reading and the reading without the extra load as the permanent displacement of the indication.
9. Apply another test load, e.g. maximum load, and record L.
10. Repeat steps 6 to 8.
11. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 6.1 (page 51).

ECCENTRICITY (A.4.7)

It is essential that all users read OIML R 76-1, clauses 3.6.2 and A.4.7 before commencing this procedure.

It is suggested that large weights be used in preference to several small weights. Smaller weights shall be placed on top of larger weights, but unnecessary stacking should be avoided within the segment to be tested. Apply the load centrally in the segment if a single weight is used, and uniformly over the segment if several small weights are used.

Equipment

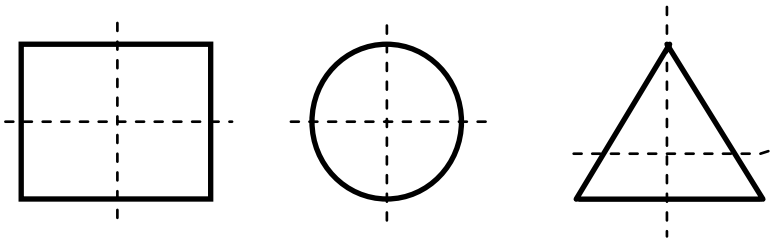
- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 3 (pages 12 to 13)
- Instrument under test
- Certified weights
- Time piece
- Temperature probe
- Barometer if instrument is class Ⓘ

Procedure

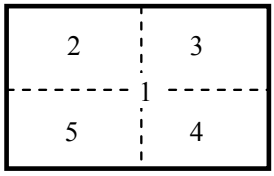
1. Record the general test details concerning the instrument.
2. Determine the state of the automatic zero-setting device and zero-tracking device (#5, page 4 of this manual). Record by marking the appropriate box with an ×.
3. Determine if the instrument has a load receptor having not more than four points of support, a load receptor having more than four points of support, special load receptors such as a tank or hopper, or is used for rolling loads.
4. Select the appropriate tests as follows:
   - A.4.7.1 if the instrument has a load receptor having not more than four points of support;
   - A.4.7.2 if the instrument has a load receptor having more than four points of support;
   - A.4.7.3 if the instrument has special load receptors such as a tank or hopper; or
   - A.4.7.4 if the instrument is used for rolling loads.
5. Conduct the selected test as documented on the following page.

A.4.7.1 Instrument with a Load Receptor Having not More than Four Points of Support

1. Divide the surface of the load receptor into four roughly equal quarter segments as outlined in diagrams below and in OIML R 76-1, Figure 8 (page 71).



2. Draw a sketch of the load receptor on the report showing the four roughly equal segments and the numbered locations of the test load positions which will be used in the results table as indicated in the following diagram.



3. Indicate on the sketch you have drawn, the location of the display or other perceptible part of the instrument.
4. Do a pre-load test (#3, page 3 of this manual) at location 1 as per your sketch.
5. Record the time and ambient temperature for all classes and the barometric pressure for class Ⓘ only.
6. Take a zero reading at either zero or 10 e at location 1 if out of working range (#2, page 2 of this manual).
7. Apply one-third Max plus maximum additive tare (if applicable) at the same location, with 10 e still on the load receptor if used.
8. Remove the 10 e if you are using it.
9. Record the indication, I.
10. Find the changeover point (#1, page 1 of this manual) and record ΔL.
11. Remove the load.
12. Repeat steps 6 to 11 at the four other locations in turn as indicated on your sketch.
13. Calculate the error, E, where $E = I + 0.5\ e - \Delta L - L$ and record.
14. Calculate E_C where $E_C = E - E_0$.
15. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.6.2.1 (page 25). An example of a completed evaluation report for this test has been included for your information at the end of this procedure on page 29.
16. If the instrument has an initial zero-setting range > 20% a supplementary test (#6, page 5 of this manual) is required.

A.4.7.2 Instrument with a Load Receptor Having More than Four Points of Support

1. Determine the number of support points.
2. Roughly divide the surface of the load receptor into (n) equal segments, where (n) is the number of points of support.

3. Draw a sketch of the load receptor on the report to show the number of segments and the numbered locations of the test load positions so that the same test load will be applied to each point of support. Note: Where two points of support are too close together for the test load to be distributed as indicated above, double the test load and distribute over twice the area on both sides of the axis connecting the two points of support. Indicate on your sketch any segments that span two points of support.
4. Indicate on the sketch the location of the display or other perceptible part of the instrument.
5. Do a pre-load test (#3, page 3 of this manual) at location 1 as per the diagram.
6. Record the time and ambient temperature for all classes and the barometric pressure for class Ⓘ only.
7. Take a zero reading at either zero or 10 e at location 1 if out of working range (#2, page 2 of this manual).
8. Apply 1/(n–1) Max plus maximum additive tare (if applicable) at the same location, with 10 e still on the load receptor if used.
9. Remove the 10 e if you are using it.
10. Record the load, L, and the indication, I.
11. Find the changeover point (#1, page 1 of this manual) and record ΔL.
12. Remove the load.
13. Repeat steps 7 to 12 at all the different numbered locations in turn as indicated on your sketch.
14. Calculate the error, E, where $E = I + 0.5\ e - \Delta L - L$ and record.
15. Calculate E_C where $E_C = E - E_0$.
16. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.6.2.2 (page 25).
17. If the instrument has an initial zero-setting range > 20% a supplementary test (#6, page 5 of this manual) is required.

A.4.7.3 Instrument with Special Load Receptors (Tank, Hopper, etc.)

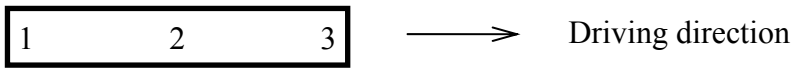
1. Determine the number of support points.
2. Draw a sketch of the load receptor on the report to show the number of segments and the numbered locations where the test load will be applied.
3. Indicate on the sketch the location of the display or other perceptible part of the instrument.
4. Do a pre-load test (#3, page 3 of this manual) at location 1 as per the diagram.
5. Record the time and ambient temperature for all classes and the barometric pressure for class Ⓘ only.
6. Take a zero reading at either zero or 10 e at location 1 if out of working range (#2, page 2 of this manual).

7. Apply one-tenth Max plus maximum additive tare (if applicable) at the same location, with 10 e still on the load receptor if used.
8. Remove the 10 e if you are using it.
9. Record the load, L, and the indication, I.
10. Find the changeover point (#1, page 1 of this manual) and record ΔL.
11. Remove the load.
12. Repeat steps 6 to 11 at all the different numbered locations in turn as indicated on your sketch.
13. Calculate the error, E, where $E = I + 0.5\ e - \Delta L - L$ and record.
14. Calculate E_C where $E_C = E - E_0$.
15. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.6.2.3 (page 25).
16. If the instrument has an initial zero-setting range > 20% a supplementary test (#6, page 5 of this manual) is required.

A.4.7.4 Instrument Used for Weighing Rolling Loads

For the following procedure it is recommended that rolling loads be used. However if these are not available then it is appropriate to use the equivalent static test load.

1. Determine the positions 1, 2 and 3 at the beginning, middle and end of the load receptor respectively in the normal driving direction.
2. Draw a sketch (as shown below) of the load receptor on the Evaluation Report No. 3 (page 13), marking in the test load positions.



3. Indicate on the sketch the location of the display or other perceptible part of the instrument.
4. Do a pre-load test (#3, page 3 of this manual) at location 2 as per the diagram.
5. Record the time and ambient temperature for all classes and the barometric pressure for class Ⓘ only.
6. Take a zero reading at either zero or 10 e at location 2 if out of working range (#2, page 2 of this manual).
7. Apply a rolling load no greater than 0.8 Max plus maximum additive tare (if applicable) at location 1, with 10 e still on the load receptor if used. Note: The load selected should be representative of the way the instrument is normally used. We recommend that the load is no smaller than 0.5 Max and no greater than 0.8 Max.
8. Remove the 10 e if you are using it.
9. Record the load, L, and the indication, I.
10. Find the changeover point (#1, page 1 of this manual) and record ΔL.
11. Remove the load.

12. Repeat steps 6 to 11 at positions 2 and 3 and then in the reverse direction 3, 2 and 1 in turn as indicated on the report.
13. Calculate the error, E, where $E = I + 0.5\ e - \Delta L - L$ and record.
14. Calculate E_C where $E_C = E - E_0$.
15. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.6.2.4 (page 25).
16. If the instrument has an initial zero-setting range > 20% a supplementary test (#6, page 5 of this manual) is required.

3 ECCENTRICITY (A.4.7) (example only)

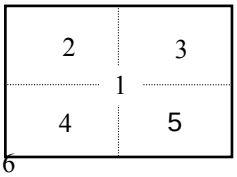
3.1 Eccentricity using weights (A.4.7.1, 2 and 3)

Application N°:	R1996/745
Pattern designation:	Model RP-15Y
Date:	16/12/96
Observer:	I. Examiner
Verification scale interval e:	2/5 g
Resolution during test(smaller than e):	.....

	At start	At max	At end	
Temp:	23.2			°C
Rel. h:				%
Time:	14:35			
Bar. pres:				hPa

(only class (I) 5)

Location of test loads: mark on a sketch (see an example below) the successive locations of test loads, using numbers which shall be repeated in the table below.



Also indicate in the sketch the location of the display or of another perceptible part of the instrument.

Automatic zero-setting and zero-tracking device is:

☐ Non-existent ☐ Not in operation ☒ Out of working range

$E = I + 1/2\ e - \Delta L - L$

$E_c = E - E_0$ with E_0 = error calculated at or near zero(*)

Load, L	Location	Indication, I	Add. load, ΔL	Error, E	Corrected error, E_c	mpe
(*) 0.02 kg	1	0.020 kg	1.0 g	(*) 0.0 g	0.0 g	1 g
5.00	1	5.000	0.8	0.2	0.2	3
(*) 0.02	2	0.020	1.0	(*) 0.0	0.0	1
5.00	2	5.000	0.4	0.6	0.6	3
(*) 0.02	3	0.020	1.0	(*) 0.0	0.0	1
5.00	3	5.000	0.2	0.8	0.8	3
(*) 0.02	4	0.020	0.8	(*) 0.2	0.0	1
5.00	4	5.000	1.0	0.0	–0.2	3
(*) 0.02	5	0.020	1.0	(*) 0.0	0.0	1
5.00	5	5.000	1.0	0.0	0.0	3

☒ Passed ☐ Failed

Remarks:

DETERMINATION OF INITIAL INTRINSIC ERROR (A.4.4 AND A.4.5)

It is essential that all users read OIML R 76-1, clauses 3.5, 3.6.3, 3.7.3, A.4.4 and A.4.5 before commencing this procedure.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 1 (page 10)
- Instrument under test
- Certified weights
- Temperature probe
- Humidity probe
- Time piece
- Barometer if instrument is class Ⓘ

Procedure

1. Record the general test details concerning the instrument.
2. Determine the state of the automatic zero-setting device and zero-tracking device (#5, page 4 of this manual). Record by marking the appropriate box with an ×.
3. Indicate the range of initial zero setting by marking an × across the yes or no box on Evaluation Report No. 1 as follows: mark the yes box if > 20% and mark the no box if ≤ 20%.
4. Determine the range of at least ten test loads, L, to be used in this test. The criteria for selecting the test loads is as follows:
   (a) The test loads must span from minimum to maximum capacity for the instrument.
   (b) Include the load at the mpe change points. When selecting the test loads for a multi-interval instrument which has partial weighing ranges include all the mpe change points.
   (c) Do not select the load at the point where the scale interval changes. It is recommended that a load 5 e less than this point be used.
   (d) Do not select maximum capacity if over-range blanking occurs at that point. It is recommended that a load 5 e less than maximum be used.
5. Do a pre-load test (#3, page 3 of this manual).
6. Record the time, ambient temperature and humidity for all classes, and the pressure if the instrument is class Ⓘ.
7. Find the error at zero or near zero (#2, page 2 of this manual).
8. Apply the test loads, increasing from minimum to the maximum load. At each test load:
   (a) record the load, L;
   (b) record the indication, I; and
   (c) find the changeover point (#1, page 1 of this manual) and record ΔL.
9. Record the time when the maximum load was applied.

10. Remove the test loads, decreasing from maximum to zero. At each test load:
    (a) record the load, L;
    (b) record the indication, I; and
    (c) find the changeover point (#1, page 1 of this manual) and record ΔL.
11. Record the time and ambient temperature.
12. Calculate the error, E, where $E = I + 0.5\ e - \Delta L - L$ and record.
13. Calculate E_C where $E_C = E - E_0$.
14. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.5.1 (page 23). An example of a completed evaluation report for this test has been included for your information on the next page.
15. If the instrument has an initial zero-setting range > 20% a supplementary test (#6, page 5 of this manual) is required.

A span stability test must be conducted at regular intervals throughout the testing of the instrument. It is recommended that a span stability test be conducted after this test, see next page of this manual. Do the first span stability test at this point providing the instrument has been switched on for a minimum of 5 h.

1a WEIGHING PERFORMANCE (A.4.4) (A.5.3.1) (example only)

(Calculation of the error)

Application N°:	R1996/745
Pattern designation:	Model RP-15Y
Date:	13/12/96
Observer:	I. Examiner
Verification scale interval e:	2/5 g
Resolution during test(smaller than e):	.....

	At start	At max	At end	
Temp:	20.8		20.7	°C
Rel. h:	41.9			%
Time:	14:25	14:29	14:32	
Bar. pres:				hPa

(only class I)

Automatic zero-setting and zero-tracking device is:

☐ Non-existent ☐ Not in operation ☒ Out of working range ☐ In operation

Initial zero-setting > 20% of Max: ☐ ☒ No (see OIML R 76-1, A.4.4.2)

$E = I + 1/2\ e - \Delta L - L$

$E_c = E - E_0$ with E_0 = error calculated at or near zero(*)

Load, L	Indication, I		Add. load, ΔL		Error, E		Corrected error, E_c		mpe
	↑	↓	↑	↓	↑	↓	↑	↓	
(*) 0.02 kg	0.020 kg	0.020 kg	1.0 g	1.2 g	(*) 0.0 g	–0.2 g	0.0 g	–0.2 g	1 g
0.04	0.040	0.040	1.2	1.2	–0.2	–0.2	–0.2	–0.2	1
0.50	0.500	0.500	1.2	1.2	–0.2	–0.2	–0.2	–0.2	1
1.00	1.000	1.000	1.0	1.2	0.0	–0.2	0.0	–0.2	1
2.00	2.000	2.000	1.0	1.2	0.0	–0.2	0.0	–0.2	1
3.00	3.000	3.000	1.2	1.2	–0.2	–0.2	–0.2	–0.2	2
4.00	4.000	4.000	1.0	1.2	0.0	–0.2	0.0	–0.2	2
5.00	5.000	5.000	1.2	1.4	–0.2	–0.4	–0.2	–0.4	3
5.99	5.990	5.990	1.0	1.4	0.0	–0.4	0.0	–0.4	3
8.00	8.000	8.000	2.5	3.0	0.0	–0.5	0.0	–0.5	5
10.00	10.000	10.000	3.0	3.0	–0.5	–0.5	–0.5	–0.5	5
12.50	12.500	12.500	3.0	3.0	–0.5	–0.5	–0.5	–0.5	7.5
15.00	15.000		3.5		–1.0		–1.0		7.5

☒ Passed ☐ Failed

Remarks: Initial test.

SPAN STABILITY TEST (B.4)

It is essential that all users read OIML R 76-1, clause B.4 before commencing this procedure.

The test for span stability is a set of a minimum of eight measurements for electronic instruments which are conducted at regular intervals before, during and after the instrument has been subjected to all other performance tests except the endurance test. It is essential that a suitable plan be established for the entire testing program so that the span stability tests occur at the appropriate intervals and fulfil the requirements set out in OIML R 76. The following table sets out a suggested sequence for five of the eight tests. The three remaining tests can be slotted into the test cycle at any time as long as they fulfil the standard OIML R 76-1 requirements. Note that one of these three remaining tests requires the power supply is off/on.

Span stability test to be conducted after	Criteria for the span stability test that applies at this time
Initial weighing performance test	As for initial weighing performance test
Warm-up test	Power supply OFF for a minimum of 8 h Power supply ON for a minimum of 5 h
Static temperature and temperature effects on no-load indication tests	Conduct the test a minimum of 16 h after the completion of the temperature tests
Damp heat, steady state test	Conduct the test a minimum of 16 h after the completion of damp heat, steady state test
Short-time power reductions, electrical bursts and electrostatic discharge tests	Any time after these tests are completed

The procedure is the same for each measurement and is set out below. The result of each measurement is recorded in a separate table. The average error calculation for each measurement is plotted on a summary graph as the final result.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 14 (pages 36 to 41)
- Instrument under test
- Certified weights
- Temperature probe
- Humidity probe
- Time piece
- Barometer

Procedure

1. Record the general test details concerning the instrument.
2. Determine the state of the automatic zero-setting device and zero-tracking device (#5, page 4 of this manual). Record by marking the appropriate box with an ×.

3. Record the test load, L, which should be Max or near Max. It is important to note that exactly the same traceable test load should be used for each of the eight span stability tests.

For each measurement

1. Record the number of the measurement and, for all measurements except the first, record the 'conditions of measurement' if the measurement has been performed:
   (a) after the temperature test, the instrument having been stabilised for a least 16 h;
   (b) after the humidity test, the instrument having been stabilised for at least 16 h;
   (c) after the instrument has been disconnected from the mains for a least 8 h and then stabilised for at least 5 h;
   (d) after any change of location; or
   (e) under any other specific condition.
2. Conduct a pre-load test (#3, page 3 of this manual).
3. Record the time, ambient temperature, humidity and pressure.
4. Take the zero reading at either zero or 10 e if out of working range (#2, page 2 of this manual).
5. Apply the test load.
6. Remove the 10 e if you are using it.
7. Record the test load indication, I_L.
8. Find the change point value, ΔL, and record.
9. Calculate E_L using $E_L = I_L + 0.5\ e - \Delta L - L$ and record.
10. Calculate $E_L - E_0$ and record.
11. For the first measurement repeat steps 4 to 10 four more times (five times in all).
12. For the first measurement calculate and record:
    (a) average error = average $(E_L - E_0)$;
    (b) $(E_L - E_0)_{Max} - (E_L - E_0)_{Min}$; and
    (c) 0.1e.
13. If $(E_L - E_0)_{Max} - (E_L - E_0)_{Min} \leq 0.1e$ for the first measurement then one test load and its reading will be sufficient for all subsequent measurements of span stability. If not, then five test loads shall be performed, readings taken and recorded, and the average error calculated as above for all subsequent measurements. The same weights used for the first measurement must be used in all subsequent measurements.
14. At the completion of each measurement, plot the average error on the graph provided as OIML R 76-2 (page 41). An example of a completed graph has been included for your information on page 36.
15. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause B.4 (page 82). An example of part of a completed evaluation report for this test has been included for your information on the next page.

14 SPAN STABILITY (cont.) (example only)

Subsequent measurements

For each of the subsequent measurements (at least 7), indicate on the line 'conditions of the measurement', as appropriate, if the measurement has been performed:

- after the temperature test, the EUT having been stabilised for at least 16 h;
- after the humidity test, the EUT having been stabilised for at least 16 h;
- after the EUT has been disconnected from the mains for at least 8 h and then stabilised for at least 5 h;
- after any change in the test location;
- under any other specific condition.

Measurement N° 2:

Date:	16/12/96
Observer:	I. Examiner
Location:	Laboratory

	At start	At max	At end	
Temp:	24.5			°C
Rel. h:	39.7			%
Time:	16:07			
Bar. pres:	1003.6			hPa

Conditions of the measurement: Power off 16 h and then on 6.5 h

$E_0 = I_0 + 1/2\ e - \Delta L_0 - L_0 \quad E_L = I_L + 1/2\ e - \Delta L - L$

	Indication of zero, I_0	Add. load, ΔL_0	E_0	Indication of load, I_L	Add. load, ΔL	E_L	$E_L - E_0$	Corrected value (*)
1	(*) 0.020 kg	1.0 g	0.0 g	15.000 kg	3.5 g	–1.0 g	–1.0 g	
2	0.020	1.0	0.0	15.000	3.0	–0.5	–0.5	
3	0.020	1.0	0.0	15.000	3.0	–0.5	–0.5	
4	0.020	1.0	0.0	15.000	3.5	–1.0	–1.0	
5	0.020	1.0	0.0	15.000	3.5	–1.0	–1.0	

(*) When applicable, necessary corrections resulting from variations of temperature, pressure, etc. See remarks.

If five loadings and readings have been performed:

Average error = average $(E_L - E_0)$ = **–0.8 g**

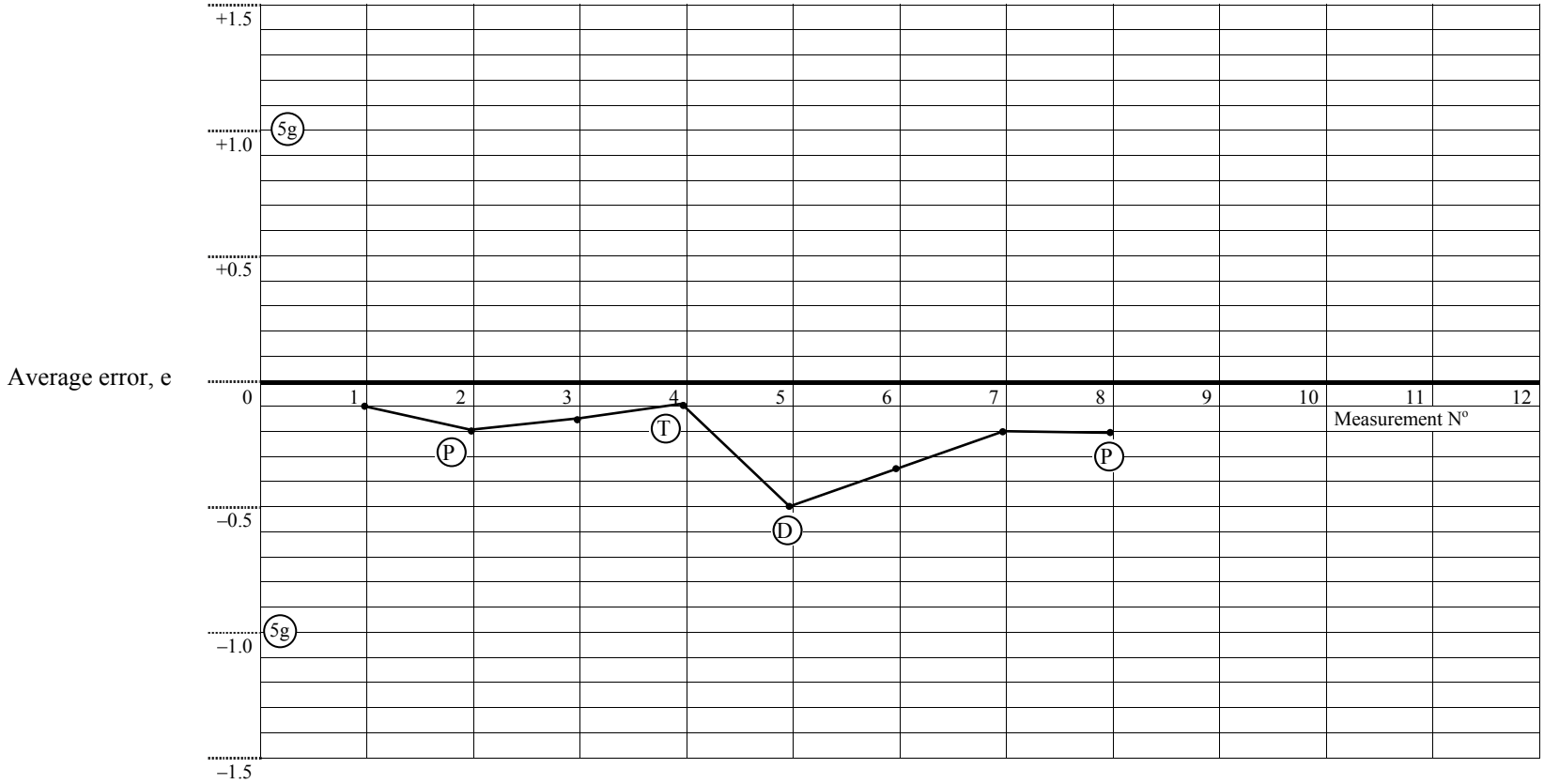
Remarks:

14 SPAN STABILITY (B.4) (example only)

Application N°: R1996.475

Pattern designiation: Model RP-15Y

Plot on the diagram the indication of temperature test Ⓣ, damp heat test Ⓓ and disconnections from the mains power supply Ⓟ



Maximum allowable variation: 3.75 g

[×] Passed [ ] Failed

VARIATION OF INDICATION WITH TIME (A.4.11)

It is essential that all users read OIML R 76-1, clauses 3.9.4 and A.4.11 before commencing this procedure.

To assess the variation of indication with time, two test sequences are conducted. These are A.4.11.1 — Creep Test and A.4.11.2 — Zero Return Test. For the first half hour of testing these tests are carried out together.

Note: It is recommended that these tests not be conducted after the repeatability test, as the instrument has just been exercised in the same direction. If this is not possible ensure that the instrument has been allowed sufficient time to recover.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 6.1 (page 17) — Zero Return Test
- OIML R 76-2 Evaluation Report No. 6.2 (page 18) — Creep Test
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Barometer if instrument is class Ⓘ

Procedure

1. Record the general test details concerning the instrument.
2. Determine the state of the automatic zero-setting device and zero-tracking device (#5, page 4 of this manual). Record by marking the appropriate box with an ×.
3. Record the ambient temperature for all classes, and the pressure if the instrument is class Ⓘ.
4. Conduct a pre-load test (#3, page 3 of this manual).
5. Record the time.
6. Take the zero reading at either zero or 10 e if out of working range (#2, page 2 of this manual).
7. Calculate P using $P = I + 0.5\ e - \Delta L$ and record on Evaluation Report No. 6.1.
8. Apply a test load of Max or near Max. Record the load, L, and the indication, I, on Evaluation Report No. 6.2.
9. Find the changeover point (#1, page 1 of this manual) and record ΔL on Evaluation Report No. 6.2.
10. Calculate P as above and record on Evaluation Report No. 6.2.
11. Wait 5 min.
12. Record the time and the indication, I, on Evaluation Report No. 6.2.
13. Find the changeover point (#1, page 1 of this manual) and record ΔL on Evaluation Report No. 6.2.
14. Calculate P as above and record on Evaluation Report No. 6.2.

15. Wait another 10 min and repeat steps 12 to 14.
16. Wait a further 15 min and again repeat steps 12 to 14.
17. Calculate ΔP, the difference between P at the start (0 min) and P at a given time.
18. Determine using the criteria set out on Evaluation Report No. 6.2 as to whether the creep test needs to be continued for 4 h.
19. If the test is to continue, repeat steps 12 to 14 at 1, 2, 3 and 4 h.
20. Calculate ΔP, the difference between P at the start (0 min) and P at a given time.
21. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.9.4.1 (page 28).
22. If the creep test is terminated after 30 min:
    (a) remove the weights leaving the 10 e if it has been used;
    (b) repeat the zero return test as shown in steps 5 to 7; and
    (c) calculate and record ΔP on Evaluation Report No. 6.1.

    If the instrument is multiple range then:
    (d) ensure the instrument is switched to the lowest range;
    (e) take a zero or near zero reading, e.g. 10 e;
    (f) watch the display over 5 min, then;
    (g) take a zero or near zero reading again; and
    (h) calculate and record ΔP on Evaluation Report No. 6.1.
23. If the creep test has continued to 4 h:
    (a) remove the weights and destroy the Evaluation Report No. 6.1 that you have been using;
    (b) allow the instrument to recover for at least 1 h;
    (c) using a new copy of Evaluation Report No. 6.1, repeat the zero return test as shown in steps 1 to 8;
    (d) apply a test load of Max or near Max;
    (e) wait 30 min, remove the test load leaving the 10 e if it has been used and repeat steps 5 to 7; and
    (f) calculate and record ΔP on Evaluation Report No. 6.1.

    If the instrument is multiple range then:
    (g) ensure the instrument is switched to the lowest range;
    (h) take a zero or near zero reading, e.g. 10 e;
    (i) watch the display over 5 min, then;
    (j) take a zero or near zero reading again; and
    (k) calculate and record ΔP on Evaluation Report No. 6.1.
24. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.9.4.2 (page 29). An example of the completed evaluation reports for these tests have been included for your information on the next two pages.
25. If the instrument has an initial zero-setting range > 20% a supplementary test (#6, page 5 of this manual) is required.

6 TIME-DEPENDENCE (example only)

6.1 Zero return (A.4.11.2)

Application N°:	R1996/745
Pattern designation:	Model RP-15Y
Date:	13/12/96
Observer:	I. Examiner
Verification scale interval e:	2/5 g
Resolution during test(smaller than e):	.....

	At start	At max	At end	
Temp:	23.1		23.4	°C
Rel. h:				%
Time:				
Bar. pres:				hPa

(only class ①)

Automatic zero-setting and zero-tracking device is:

☐ Non-existent ☐ Not in operation ☒ Out of working range

$P = I + 1/2e - \Delta L$

Time of reading	Load, L_0	Indication of zero, I_0	Add. load, ΔL	P
15:57	0.02 kg	0.02 kg	0.8 g	0.0202 kg
After loading for 0.5 h		Load =15 kg		
16:28	0.02 kg	0.02 kg	1.6 g	0.0194 kg

Change of zero indication $|\Delta P|$ = 0.8 g

Check if $|\Delta P| \leq 0.5$ e

☒ Passed ☐ Failed

Remarks:

6. TIME DEPENDENCE (example only)

6.2 Creep (A.4.11.1)

Application N°:	R1996/745
Pattern designation:	Model RP-15Y
Date:	13/12/96
Observer:	I. Examiner
Verification scale interval e:	2/5 g
Resolution during test(smaller than e):	.....

	At start	At max	At end	
Temp:	23.1		23.4	°C
Rel. h:				%
Time:				
Bar. pres:				hPa

(only class Ⓘ)

$P = I + 1/2\ e - \Delta L$

Time of reading		Load, L	Indication, I	Add. load, ΔL	P	ΔP
15:58	0 min	15 kg	15.000 kg	3.5 g	14.999 kg	
16:03	5 min		15.000	3.0	14.9995	0.5
16:13	15 min		15.000	2.5	15.0000	1.0
16:28	30 min		15.000	2.5	15.0000	1.0
(*)			Terminated			
	1 h					
	2 h					
	3 h					
	4 h					

ΔP = difference between P at the start (0 min) and P at a given time.

(*) If $|\Delta P| \leq 0.5$ e during the first 30 min and if the variation of $|\Delta P|$ between 15 min and 30 min ≤ 0.2 e, then the test is terminated. If not, the test shall continue for the next 3.5 h. Check that during the total 4 h: $|\Delta P| \leq$ mpe.

[x] Passed [ ] Failed

Remarks:

TARE (A.4.6)

It is essential that all users read OIML R 76-1, clauses 3.5.3.3, 3.5.3.4, 3.6.3, 4.6 and A.4.6 before commencing this procedure.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 9 (pages 21 to 22)
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Barometer if instrument is class Ⓘ

A.4.6.1 Tare Weighing Test

Procedure

1. Record the general test details concerning the instrument.
2. Determine the state of the automatic zero-setting device and zero-tracking device (#5, page 4 of this manual). Record by marking the appropriate box with an ×.
3. Determine at least five test loads, which will include load values close to the minimum capacity, the maximum possible net load and the mpe change points.
4. Conduct a pre-load test (#3, page 3 of this manual).
5. Record the time and ambient temperature for all classes, and the pressure if the instrument is class Ⓘ.
6. Determine the first tare value. This value should be not less than the minimum for the instrument and an additional small weight to take it near the changeover point.
7. Record the total amount which has been applied to the load receptor as the tare value.
8. Press tare.
9. Conduct a weighing test (#4, page 3 of this manual) using the test loads determined in point 4.
10. Record the time and ambient temperature for all classes, and the pressure if the instrument is class Ⓘ.
11. Calculate E using $E = I + 0.5\ e - \Delta L - L$ and E_C using $E_C = E - E_0$.
12. Determine a second tare value and repeat steps 5 to 12.
13. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.5.3.3 (page 23). An example of a completed evaluation report for this test has been included for your information on page 44.
14. If the instrument has an initial zero-setting range > 20% a supplementary test (#6, page 5 of this manual) is required.

A.4.6.2 Accuracy of Tare Setting

The procedure used to determine the accuracy of tare setting will depend on the instrument to be tested. If the instrument has non-automatic or semi-automatic tare setting use procedure A.4.6.2.1, if the instrument has automatic tare setting then use procedure A.4.6.2.2, if the instrument has pre-set tare then use procedure A.4.6.2.3.

A.4.6.2.1 Non-automatic and Semi-automatic Tare Setting

Procedure

1. Load the instrument using a weight that is near the minimum tare-setting range and close to a changeover point.
2. Re-set to zero using the tare-setting device.
3. Apply 10 e to the load receptor if the instrument has zero tracking and it is in operation.
4. Find the changeover point, ΔL_0 (#1, page 1 of this manual).
5. Calculate the error at zero, E_0, where $E_0 = 0.5\ e - \Delta L_0$ as $I_0 = 0$ and $L_0 = 0$.
6. Determine if the value of E_0 is ≤ 0.25 e which indicates it is within an mpe of ± 0.25 e.
7. Record results on Evaluation Report No. 17, clause A.4.6.2 (page 50).

A.4.6.2.2 Automatic Tare Setting

Procedure

1. Apply a suitable load to the load receptor that will activate the automatic tare setting.
2. Wait for automatic tare setting to occur and the indication displays zero, this should take a minimum of 5 s.
3. Quickly apply 10 e to the load receptor.
4. Note this value as L_0 and the indication as I_0.
5. Find the changeover point, ΔL_0 (#1, page 1 of this manual).
6. Calculate the error at zero, E_0, where $E_0 = I_0 + 0.5\ e - \Delta L_0 - L_0$.
7. Determine if the value of E_0 is ≤ 0.25 e which indicates it is within an mpe of ± 0.25 e.
8. Record results on Evaluation Report No. 17, clause A.4.6.2 (page 50).

A.4.6.2.3 Pre-set Tare Setting

The following test is performed by the National Measurement Institute to check the accuracy of both (a) displayed and (b) internal rounding of the entered tare value. In the examples below we use an instrument with e = 5 g.

Procedure

(a) Display Rounding

1. Key in a tare value which has a resolution higher than the value of e. For example, key in say 402 g.
2. Activate the pre-set tare. In the example, if the display rounds to 400 g or rejects the entry then it is a pass. If it accepts and displays the entry then it is a fail.
3. Check again using another value. For example key in say 403 g. If the display rounds to 405 g or rejects the entry then it is a pass. If it accepts and displays the entry then it is a fail.

(b) Internal Rounding

1. Place a load on the receptor.
2. Key in the displayed value and activate the pre-set tare.
3. Measure any error at or near zero by the changeover method. For example, if say 400 g is applied to the load receptor, key in 400 g and activate the pre-set tare. Find the error, which in this example is equal to +0.5 g.
4. Repeat the procedure with the same load on the receptor, key in a value which has a higher resolution then e. To continue with the above example, key in say 402 g and find the error. If the error has changed by 2 g to –1.5 g then the internal value has not been rounded but is operating to the entered value. This is a fail.
5. Record results on Evaluation Report No. 17, clause 4.7.1 (page 51).

9 TARE (WEIGHING TEST) (A.4.6.1) (example only)

Application N°: R1996/745
Pattern designation: Model RP-15Y
Date: 17/12/96
Observer: I. Examiner
Verification scale interval e: 2/5 g
Resolution during test(smaller than e): .....

Automatic zero-setting and zero-tracking device is:

☐ Non-existent ☒ Not in operation ☐ Out of working range ☐ In operation

First tare value
Tare: 1 kg

Tare indication: 0

	At start	At max	At end	
Temp:	23.7		23.4	°C
Rel. h:				%
Time:	13:35		13:55	
Bar. pres:				hPa

(only class Ⓘ)

$E = I + 1/2\ e - \Delta L - L$
$E_c = E - E_0$ with E_0 = error calculated at or near zero(*)

Load, L	Indication, I ↓	Indication, I ↑	Add. load, ΔL ↓	Add. load, ΔL ↑	Error, E ↓	Error, E ↑	Corrected error, E_c ↓	Corrected error, E_c ↑	mpe
(*) 0.00 kg	0 000 kg	0.000 kg	0.8 g	1.0 g	(*) 0.2 g	0.0 g	0.0 g	–0.2 g	1 g
0.04	0.040	0.040	0.8	1.0	0.2	0.0	0.0	–0.2	1
0.50	0.500	0.500	0.8	1.0	0.2	0.0	0.0	–0.2	1
1.00	1.000	1.000	0.8	1.0	0.2	0.0	0.0	–0.2	1
2.00	2.000	2.000	0.8	1.0	0.2	0.0	0.0	–0.2	2
4.00	4.000	4.000	0.8	1.0	0.2	0.0	0.0	–0.2	2
5.99	5.990	5.990	0.8	1.2	0.2	–0.2	0.0	–0.4	3
8.00	8.000	8.000	2.5	3.0	0.0	–0.5	–0.2	–0.7	5
10.00	10.000	10.000	3.0	3.0	–0.5	–0.5	–0.7	–0.7	5
12.50	12.500	12.500	3.0	3.5	–0.5	–1.0	–0.7	–1.2	7.5
14.00	14.000		3.5		–1.0		–1.2		7.5

☒ Passed ☐ Failed

Remarks:

STABILITY OF EQUILIBRIUM (A.4.12)

This series of tests has been designed to check that a semi-automatic or automatic weighing instrument does not perform any function such as printing out readings, storing any data, zero setting, or tare balancing until is has reached equilibrium or the reading has stabilised. Each procedure to test each of these functions has been documented below as a separate test.

It is essential that all users read OIML R 76-1, clauses 4.4.2, 4.4.5, 4.4.6 and A.4.12 before commencing this procedure.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 7 (page 19)
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Barometer if instrument is class Ⓘ

(a) Printing

Procedure

1. Record the general test details concerning the instrument.
2. Determine the test load which should be up to 50% of Max of the instrument**.**
3. Conduct a pre-load test (#3, page 3 of this manual).
4. Record the time and ambient temperature for all classes and the barometric pressure for class Ⓘ only.
5. Apply the test load.
6. Manually disturb the load receptor and then immediately press the print command. Note: If printing is automatic, it is not necessary to manually disturb the load receptor.
7. After the ticket is issued watch the display for 5 s.
8. Record both the maximum and the minimum displayed indication that occurs during this 5 s period.
9. Record the printed indication.
10. Remove the test load.
11. Repeat steps 4 to 9 four more times (five times in all).
12. Compare the printed indications with the displayed indications.
13. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 4.4.5 (page 35). An example of a completed evaluation report for this test has been included for your information at the end of this procedure.

(b) Storage of Data

Procedure

1. Record the general test details concerning the instrument.
2. Determine the test load which should be up to 50% of Max of the instrument**.**
3. Conduct a pre-load test (#3, page 3 of this manual).
4. Record the time and ambient temperature for all classes and the barometric pressure for class Ⓘ only.
5. Apply the test load.
6. Manually disturb the load receptor and then immediately press the data storage command.
7. After the data has been stored watch the display for 5 s.
8. Record both the maximum and the minimum displayed indication that occurs during this 5 s period.
9. Re-display the stored data and record.
10. Remove the test load.
11. Repeat steps 4 to 9 four more times (five times in all).
12. Compare the stored data indications with the displayed indications.
13. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 4.4.5 (page 35). An example of a completed evaluation report for this test has been included for your information at the end of this procedure.

(c) Zero Setting

Procedure

1. Record the general test details concerning the instrument.
2. Determine the test load. This must be within the range of zero.
3. Do a pre-load test (#3, page 3 of this manual).
4. Record the time and ambient temperature for all classes and the barometric pressure for class Ⓘ only.
5. Apply the test load. Add small masses and set as close as possible to a changeover point.
6. Manually disturb the load receptor and press the zero key.
7. As soon as the zero has been captured, take the zero reading at either zero or 10 e if out of working range (#2, page 2 of this manual). Record the results.
8. Remove the test load and reset to zero.
9. Repeat steps 4 to 7 four more times (five times in all).
10. Check the accuracy of the zero setting as per Evaluation Report 17, clause A.4.2.3 (page 49).
11. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clauses 4.5.2 and 4.5.4 (page 36) and clauses 4.5.6 and 4.5.7 (page 37).

(d) Tare Balancing

Procedure

1. Record the general test details concerning the instrument.
2. Determine the test load, which should be approximately 50% of the maximum tare value.
3. Do a pre-load test (#3, page 3 of this manual).
4. Record the time and ambient temperature for all classes and the barometric pressure for class Ⓘ only.
5. Apply the test load. Add small masses and set as close as possible to a changeover point.
6. Manually disturb the load receptor while pressing the tare key.
7. As soon as the tare zero has been captured, take the zero reading at either zero or 10 e if out of working range (#2, page 2 of this manual). Record the results.
8. Remove the test load and clear the tare.
9. Repeat steps 4 to 7 four more times (five times in all).
10. Check the accuracy of the zero setting as per Evaluation Report 17, clause A.4.6.2 (page 50).
11. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 4.6.3 (page 37) and clause 4.6.8 (page 38). An example of a completed evaluation report for this test has been included for your information on the next page.

7 STABILITY OF EQUILIBRIUM (A.4.12) (Example only)

Application N°: R1996/745
Pattern designation: RP-15Y
Date: 17/12/96
Observer: I. Examiner

	At start	At max	At end	
Temp:	22.2			°C
Rel. h:				%
Time:	15:25			
Bar. pres:				hPa

Load = 7.5 kg

N°	First printed value after disturbance and command	Reading after print out during 5 s	
		Minimum	Maximum
1	7.500 kg	7.500 kg	7.500 kg
2	7.500	7.500	7.500
3	7.500	7.500	7.505
4	7.500	7.500	7.500
5	7.500	7.500	7.500

Check if only two adjacent figures appear, one being the printed value

[×] Passed [ ] Failed

Remarks:

In the case of zero seting or tare balancing
$E_0 = I_0 + 1/2e - \Delta - L_0$ $L_0 = 0$ or near zero

N°	Load, L_0	Indication, I_0	Add. load, ΔL	Error, E_0
Zero setting 0.101 kg				
1	0.020 kg	0.020 kg	1.0 g	0.0 g
2	0.020	0.020	1.2	–0.2
3	0.020	0.020	1.0	0.0
4	0.020	0.020	0.8	0.2
5	0.020	0.020	1.0	0.0
Tare balancing 2.001 kg				
6	0.000 kg	0.000 kg	0.2 g	0.8
7	0.000	0.000	0.2	0.8
8	0.000	0.000	0.2	0.8
9	0.000	0.002	2.0	1.0
10	0.000	0.000	0.2	0.8

Check the accuracy to 4.5.2 for zero setting and to 4.6.3 for tare balancing

[ ] Passed [×] Failed

Remarks:

Passed zero setting
Failed tare balancing

REPEATABILITY (A.4.10)

It is essential that all users read OIML R 76-1, clauses 3.6.1 and A.4.10 before commencing this procedure. This test procedure has been designed to check if the instrument will give a consistent result for the same weight when it is applied to the load receptor a number of times. Two series of weighings are performed, the first using approximately 50% of Max and the second using Max or near Max. Note: Never use the over-range blanking point as a change point for the measurement of ΔL. If over-range blanking occurs at Max then a load of near Max must be used, e.g. Max–5 e.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 5 (page 16)
- Instrument under test
- Certified weights
- Temperature probe
- Time piece

Procedure

1. Record the general test details concerning the instrument.
2. Determine the state of the automatic zero-setting device and zero-tracking device (#5, page 4 of this manual). Record by marking the appropriate box with an ×.
3. Determine the test load for the first set of weighings. This should be approximately 50% of Max. It is recommended that for a multi-interval instrument this test load should be near Max in the lowest partial range.
4. Record the time and ambient temperature.
5. Conduct a pre-load test (#3, page 3 of this manual).
6. Apply the test load and record the indication, I.
7. Find the changeover point (#1, page 1 of this manual) and record ΔL.
8. Calculate P using $P = I + 0.5\ e - \Delta L$ and record.
9. Remove the test load. If the indication does not return to zero, make a note under remarks.
10. Reset instrument to zero if the indication is not showing zero.
11. Repeat steps 6 to 10 nine more times (ten times in all). If Max > 1000 kg repeat two more times (three times in all).
12. Calculate $P_{max} - P_{min}$ and record the result and the mpe for the test load.
13. Determine the test load for the second set of weighings. This should be at Max or near Max depending on the position of the blanking point.
14. Repeat steps 6 to 12.
15. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.6.1 (page 25). An example of a completed evaluation report for this test (page 21) has been included for your information on the next page.
16. If the instrument has an initial zero-setting range which is > 20% a supplementary test (#6, page 5 of this manual) is required.

5 REPEATABILITY (A.4.10) (example only)

Application N°:	R1996/745
Pattern designation:	Model RP-15Y
Date:	13/12/96
Observer:	I. Examiner
Verification scale interval e:	2/5 g
Resolution during test(smaller than e):	.....

	At start	At max	At end	
Temp:	23.2			°C
Rel. h:				%
Time:	15:18			
Bar. pres:				hPa

(only class ①)

Automatic zero-setting and zero-tracking device is:

☐ Non-existent ☒ In operation

Load (weighing 1–10) 7.5 kg

Load (weighing 11– 15 kg

$P = I + 1/2e - \Delta L$

	Indication of load, I	Add. load, ΔL	P
1	7.500 kg	2.5 g	7.5000 kg
2	7.500	2.5	7.5000
3	7.500	2.5	7.5000
4	7.500	3.0	7.4995
5	7.500	2.5	7.5000
6	7.500	2.5	7.5000
7	7.500	2.5	7.5000
8	7.500	3.0	7.4995
9	7.500	2.5	7.5000
10	7.500	2.5	7.5000

	Indication of load, I	Add. Load, ΔL	P
11	15.000 kg	3.0 g	14.9995 kg
12	15.000	3.0	14.9995
13	15.000	3.0	14.9995
14	15.000	3.0	14.9995
15	15.000	3.0	14.9995
16	15.000	3.5	14.9990
17	15.000	3.0	14.9995
18	15.000	3.0	14.9995
19	15.000	3.5	14.9990
20	15.000	3.0	14.9995

$P_{max} - P_{min}$ (weighing 1–10) 0.5 g

mpe 5 g

$P_{max} - P_{min}$ (weighing 11–20) 0.5 g

mpe 7.5 g

☒ Passed ☐ Failed

Remarks:

TILTING (A.5.1)

It is essential that all users read OIML R 76-1, clauses 3.9.1 and A.5.1 before commencing this procedure.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 8 (page 20)
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Barometer if instrument is class Ⓘ

Procedure

1. Record the general test details concerning the instrument.
2. Determine the tilt that is to be used for the instrument for the testing procedure as follows:
   (a) If no levelling indicator is present use a 1/20 (5%) tilt and mark the fourth box on the report.
   (b) If the instrument is class Ⓘ, Ⓘ, or Ⓘ and a levelling indicator is present place the instrument on a level surface and tilt longitudinally until a 2/1000 (0.2%) is reached then:
      (i) If the limiting value of the levelling indicator has been reached use this tilt for the testing procedure and mark the first box on the report. Note: The limiting value is a 2 mm movement of the level bubble from its centre position, irrespective of the diameter of the ring.
      (ii) If the limiting value of the levelling indicator has not been reached continue to tilt the instrument until the limiting value is reached. Measure this tilt and record in the remarks at the end of the report. This will be the tilt used for the testing procedure and mark the second box on the report.
   (c) If the instrument is class Ⓘ, place the instrument on a level surface and tilt longitudinally until the limiting factor for the levelling indicator is reached. Measure the tilt and:
      (i) If the tilt is not greater than 2/1000 (0.2%) do not proceed with the test and mark the third box on the report.
      (ii) If the tilt is greater than 2/1000 (0.2%), record the tilt in the remarks at the end of the report. This will be the tilt used for the testing procedure and mark the second box on the report.
3. Determine the state of the automatic zero-setting device and zero-tracking device. Record by marking the appropriate box with an ×.
4. Determine L for the unloaded test. This must be as close to zero as possible, if the automatic zero-setting and zero-tracking devices are in operation add a load of 10 e for these to be out of working range.

5. Determine the two test loads to be used. One of the loads must be the lowest load where the mpe changes, this is for class Ⓘ = 50 000 e, class Ⓘ = 5000 e, class Ⓘ = 500 e, and class Ⓘ = 50 e. The other test load must be at Max or near Max. Note: Never use the over-range blanking point as a change point for the measurement of ΔL. If over-range blanking occurs at Max then a load of near Max must be used, e.g. Max – 5 e.
6. Record the test loads as L.
7. Record the time and ambient temperature for all classes, and the pressure if the instrument is class Ⓘ.
8. Level the instrument.
9. Carry out a pre-load test (#3, page 3 of this manual).
10. Record the I_1 for the unloaded position at or near zero.
11. Find the changeover point (#1, page 1 of this manual) and record ΔL_1.
12. Apply the first test load, and immediately remove the 10 e if it has been used (do not allow the instrument to return to zero).
13. Record the indication, I_1.
14. Find the changeover point (#1, page 1 of this manual) and record ΔL_1.
15. Apply the second test load (do not allow the instrument to return to zero).
16. Record the indication, I_1.
17. Find the changeover point (#1, page 1 of this manual) and record ΔL_1.
18. Replace 10 e if used and remove the load.
19. Calculate and record P_V, where $P_V = I_V + 0.5\ e - \Delta L_V$ (v = 1, 2, 3, 4, 5 where v is the tilt position).
20. Calculate and record P^o_V, which is the indication P_V corrected for the deviation from the zero reading the instrument had prior to loading.
21. With the instrument facing you, adjust the tilt of the instrument so that the bubble in the levelling indicator is as shown in column $I_2 / \Delta I_2$, column $I_3 / \Delta I_3$, column $I_4 / \Delta L_4$, column $I_5 / \Delta I_5$.
22. At each adjustment, repeat steps 10 to 20 four times (five times altogether).
23. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.9.1 (page 27). An example of a completed evaluation report for this test has been included for your information on the next page.
24. If the instrument has an initial zero-setting range > 20% a supplementary test (#6, page 5 of this manual) is required.

8 TILTING (A.5.1, 2 and 3) (example only)

			At start	At max	At end	
Application N°:	R1996/745					
Pattern designation:	Model RP-15Y					
Date:	17/12/96	Temp:	23.5		23.1	°C
Observer:	I. Examiner	Rel. h:				%
Verification scale interval e:	2/5 g	Time:	16:18			
Resolution during test(smaller than e):	.....	Bar. pres:				hPa
		(only class I)				

[ ] Tilting 0.2% (class II, III or IIII)

[×] Tilting to the limiting value of level indicator (class I, II, III or IIII if the tilting at this limiting value is greater than 0.2%)

[ ] Tilting to the limiting value of level indicator (class I only) if the tilting is not greater than 0.2 %, in which case the test shall not be performed

[ ] Tilting 5% if no level indicator on instrument liable to be tilted

Give (if appropriate on a separate sheet a sketch of the load receptor showing the location of the level indicator, if provided

Automatic zero-setting and zero-tracking device is:

[ ] Non-existent [ ] Not in operation [×] Out of working range

$P_v = I_v + 1/2\ e - \Delta L_v$ (v = 1, 2, 3, 4, 5)
P_v^o is the indication P_v corrected for the deviation from zero the instrument had prior to loading

Load, L	I_1	ΔL_1	I_2	ΔL_2	I_3	ΔL_3	I_4	ΔL_4	I_5	ΔL_5	$\lvert P_1 - P_v \rvert_{max}$ or $\lvert P_1^o - P_v^o \rvert_{max}$
Unloaded (*)											
(*)0.02 kg	0.02 kg	1.2 g	0.02 kg	1.2 g	0.02 kg	1.2 g	0.02 kg	1.2 g	0.02 kg	1.0 g	(≤ 2e)
$P_v \rightarrow$	0.0198 kg		0.0198 kg		0.0198 kg		0.0198 kg		0.0200 kg		0.2 g
Loaded										2e =	4 g
1	1.000	1.2	1.000	1.0	1.000	1.0	1.000	1.0	1.000	1.0	(≤ mpe = 2 g)
$P_v \rightarrow$	0.9998		1.000		1.000		1.000		1.000		
$P_v^o \rightarrow$	1.0000		1.0002		1.0002		1.0002		1.0000		0.2 g
15	15.000	3.5	15.000	3.5	15.000	4.0	15.000	3.0	15.000	4.5	(≤ mpe)
$P_v \rightarrow$	14.999		14.999		14.9985		14.9995		14.998		
$P_v^o \rightarrow$	14.9992		14.9992		14.9987		14.9997		14.9980		1.2 g
											mpe = 7.5 g

(*) No tilting test at no-load for instruments in class I and in class II not for direct sales to the public.

[×] Passed [ ] Failed

Remarks: 2 mm movement of the level indicator is equal to 1 in 230.

WARM-UP TIME (A.5.2)

It is essential that all users read OIML R 76-1, clauses 5.3.5 and A.5.2 before commencing this procedure.

This test has been designed to check if the instrument will weigh accurately while it is going from ambient temperature to its operating temperature after it has been turned off for a period of time. It is therefore essential to ensure that the instrument has been switched off and disconnected from its power supply for a minimum of 8 h prior to the test. It is also important to conduct this test during the first half-hour after the indicator has stabilised as this is the period during which the internal temperature is changing most rapidly. Note that a pre-load test is not conducted prior to testing.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 10 (page 23)
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Barometer if instrument is class Ⓘ

Procedure

1. Record the general test details concerning the instrument.
2. Determine the state of the automatic zero-setting device and zero-tracking device (#5, page 4 of this manual). Record by marking the appropriate box with an ×.
3. Record the time and ambient temperature for all classes, and the pressure if the instrument is class Ⓘ.
4. Record the period of time that the instrument has been disconnected from the power supply.
5. Reconnect the instrument to its power supply and switch on.
6. As soon as the indication has stabilised set to zero.
7. Take the zero reading at either zero or 10 e if out of working range (#2, page 2 of this manual).
8. Apply the test load of Max or near Max if over-range blanking occurs
9. Remove the 10 e if you are using it.
10. Record the indication, I_l.
11. Find the changeover point (#1, page 1 of this manual) and record ΔL_l.
12. Calculate E_l using $E_l = I_l + 0.5\ e - \Delta L_l - L_l$.
13. Replace the 10 e if used and remove the Max load.
14. Calculate $E_l - E_0$.
15. Repeat steps 7 to 14 after 5 min, 15 min and 30 min.

16. Record the ambient temperature for all classes, and the pressure if the instrument is class Ⓓ.
17. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 5.3.5 (page 27). An example of a completed evaluation report for this test has been included for your information on the next page.

It is recommended that a span stability test be conducted after this test, see page 25 of this manual. To do this wait a minimum of 5 h with the power supply connected and switched on before commencing the span stability test.

10 WARM-UP TIME (A.5.2) (Example only)

			At start	At max	At end	
Application N°:	R1996/745					
Pattern designation:	Model RP -15Y					
Date:	16/12/96	Temp:	23		23.1	°C
Observer:	I. Examiner	Rel. h:				%
Verification scale interval e:	2/5 g	Time:	9:10			
Resolution during test(smaller than e):	.....	Bar. pres:				hPa
Duration of disconnection before test:	40 h	(only class I)				

Automatic zero-setting and zero-tracking device is:

☐ Non-existent ☐ Not in operation ☒ Out of working range ☐ In operation

$E = I + 1/2\ e - \Delta L - L$
E_0 = error calculated at zero or near zero (unloaded)
E_I = error calculated at load (loaded)

	Time (*)	Load, L	Indication, I	Add. load, ΔL	Error, E	$E_I - E_o$	mpe = 7.5 g
Unloaded	0 min	0.02 kg	0.020 kg	0.2 g	0.8 g		
Loaded		15.00	15.000	3.5	–1.0	–1.8 g	
Unloaded	5 min	0.02	0.020	0.4	0.0		
Loaded		15.00	15.000	3.0	–0.5	–1.1	
Unloaded	15 min	0.02	0.020	0.6	0.4		
Loaded		15.00	15.000	3.0	–0.5	–0.9	
Unloaded	30 min	0.02	0.020	0.6	0.4		
Loaded		15.00	15.000	3.0	–0.5	–0.9	

(*) Counted from the moment an indication has first appeared. Check that $|E_1 - E_o| \leq$ mpe

☒ Passed ☐ Failed

Remarks:

TEMPERATURE TESTS (A.5.3)

It is essential that all users read OIML R 76-1, clauses 3.9.2, A.5.3 and B.2.1 before commencing this procedure. The following procedure combines the two performance tests A.5.3.1 — Static Temperature and A.5.3.2 — Temperature Effects on the No-load Indication. A proposed test sequence for test A.5.3.1 combined with A.5.3.2 (temperature test where the temperature limits are –10°C to +40°C) is given in the diagram on the next page (OIML R 76-1, Figure 10, page 77). The procedure below follows this proposed test sequence, the stages for which are noted to the left of the corresponding steps in the procedure.

Equipment required

- OIML R 76-1
- Five copies of OIML R 76-2 Evaluation Report No. 1 (page 10) for A.5.3.1
- One copy of OIML R 76-2 Evaluation Report No. 2 (page 11) for A.5.3.2
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Humidity probe
- Temperature chamber to meet OIML criteria
- Barometer if instrument if class Ⓘ

Procedure

1. Record the general test details concerning the instrument on the five copies of Evaluation Report No. 1 and the one copy of Evaluation Report No. 2.
2. Determine the state of the automatic zero-setting device and zero-tracking device (#5, page 4 of this manual). Record by marking the appropriate box with an × on the five copies of Evaluation Report No. 1 and the copy of Evaluation Report No. 2.
3. Place the instrument in the temperature test chamber set at the reference temperature of

S | 20°C.

4. Ensure the instrument has been connected to a suitable power supply for a minimum of 5 h and has been stabilised at the reference temperature.

Wt | 5. Wait for 2 h. Record the time, reference temperature for all classes, and the pressure if the instrument is class Ⓘ on the first copy of Evaluation Report No. 1.

6. Conduct a pre-load test (#3, page 3 of this manual).

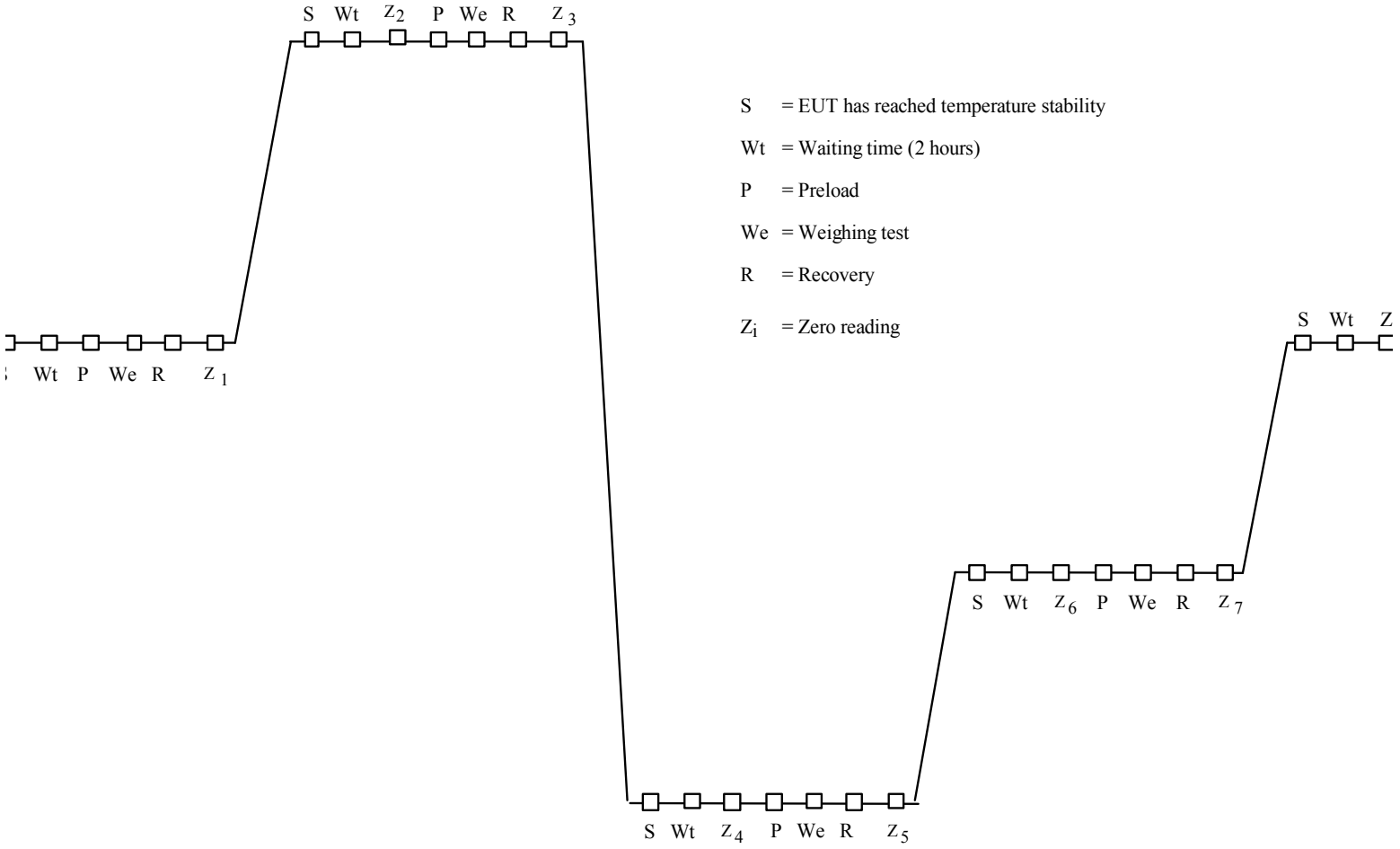
We | 7. Conduct a weighing test (#4, page 3 of this manual).

8. Determine whether the instrument has passed or failed at this temperature in accordance with the requirements as set out in OIML R 76-1, clause 3.5.1 and Table 6 (page 23).

R | 9. Allow the instrument to recover for approximately 1 h.

10. Record the date, time and reference temperature on Evaluation Report No. 2.

Figure 10. Proposed test sequence for test A.5.3.1 combined with A.5.3.2
(temperature test where the temperature limits are –10°C / +40°C)



Z_1

11. Record the indication, I, at zero or near zero using 20 e.
12. Find the changeover point (#1, page 1 of this manual) and record ΔL.
13. Calculate P where P = I + 0.5 e – ΔL.
14. Do not remove the 20 e from the load receptor.
15. Change the temperature setting to the higher temperature of 40°C unless otherwise specified. The time to reach this temperature will vary depending on the performance of the test chamber.

S

16. Determine if the instrument has reached temperature stability by:
    (a) ensuring that the ambient temperature inside the test chamber has been stable for at least 30 min; and
    (b) monitoring the zero reading of the instrument at 20 e until a constant reading is achieved.

Wt

17. Wait 2 h.
18. Record the date, time and temperature on Evaluation Report No. 2.
19. Record the indication, I, at zero or near zero using 20 e.
20. Find the changeover point (#1, page 1 of this manual) and record ΔL.
21. Replace the 20 e if it has been used with 10 e.
22. Calculate P where P = I + 0.5 e – ΔL.
23. Record the time, specified higher temperature for all classes, and the pressure if the instrument is class Ⓘ on the second copy of Evaluation Report No. 1.

P

24. Conduct a pre-load test (#3, page 3 of this manual).

We

25. Conduct a weighing test (#4, page 3 of this manual). Replace the 10 e with 20 e, do not allow the instrument to return to zero.
26. Record the results on the second copy of Report No. 1.
27. Determine whether the instrument has passed or failed at this temperature in accordance with the requirements as set out in OIML R 76-1, clause 3.5.1 and Table 6 (page 23).

R

28. Wait 1 h.
29. Record the date, time and temperature on Evaluation Report No. 2.

Z_3

30. Record the indication, I, at zero or near zero using 20 e.
31. Find the changeover point (#1, page 1 of this manual) and record ΔL.
32. Calculate P, where P = I + 0.5 e – ΔL.
33. Do not remove the 20 e from the load receptor if it has been used.
34. Change the temperature setting to the lower temperature of –10°C unless otherwise specified.
35. Repeat steps 16 to 33 using the third copy of Evaluation Report No. 1. You are now at Z_5 on Figure 10.
36. Change the temperature setting to 5°C.

37. Repeat steps 16 to 33 using the fourth copy of Evaluation Report No. 1. You are now at Z_7 on Figure 10.
38. Change the setting back to the reference temperature of 20°C.
39. Repeat steps 16 to 28, using the fifth and final copy of Evaluation Report No. 1. Note: This step is completed when the instrument has recovered for 1 h.
40. Complete Report No. 2 by calculating and recording ΔP, ΔTemp and the zero change per 5°C. Record on this Evaluation Report, the number of the relevant weighing test that occurred with each temperature effect on no-load indication test.
41. Determine whether the instrument has passed or failed the temperature effect on no-load indication test in accordance with the requirements as set out in OIML R 76 -1, clause 3.9.2.3 (page 28). Examples of both the evaluation reports for these tests has been included for your information on the next two pages.
42. If the instrument has an initial zero-setting range > 20% a supplementary test (#6, page 5 of this manual) is required.

It is recommended that a span stability test be conducted after this test, see page 25 of this manual. To do this wait a minimum of 16 h with the power supply connected and switched on before commencing the span stability test.

1c WEIGHING PERFORMANCE (A.4.4)(A.5.3.1) (example only)

(Calculation of the error)

Application N°:	R1996/745
Pattern designation:	Model RP-15Y
Date:	31/12/96
Observer:	I. Examiner
Verification scale interval e:	2/5 g
Resolution during test(smaller than e):	.....

	At start	At max	At end	
Temp:	40.3		40.1	°C
Rel. h:	39.4			%
Time:	9:50	9:53	9:56	
Bar. pres:				hPa

(only class ①)

Automatic zero-setting and zero-tracking device is:

☐ Non-existent ☐ Not in operation ☒ Out of working range ☐ In operation

Initial zero-setting > 20% of Max: ☐ ☐ No (see OIML R 76-1, A.4.4.2)

$E = I + 1/2\ e - \Delta L - L$

$E_c = E - E_0$ with E_0 = error calculated at or near zero(*)

Load, L	Indication, I		Add. load, ΔL		Error, E		Corrected error, E_c		mpe
	↓	↑	↓	↑	↓	↑	↓	↑	
(*) 0.02 kg	(*)0.022 kg	0.022 kg	0.8 g	1.0 g	(*) 2.2 g	2.2 g	0.0 g	0.0 g	1 g
0.04	0.042	0.042	1.0	1.0	2.0	2.0	–0.2	–0.2	1
1.00	1.002	1.002	0.4	0.8	2.6	2.2	0.4	0.0	1
2.00	2.004	2.002	2.2	0.8	2.8	2.2	0.6	0.0	2
4.00	4.004	4.004	1.8	2.0	3.2	3.0	1.0	0.8	2
5.99	5.994	5.994	1.0	1.6	4.0	3.4	1.8	1.2	3
8.00	8.005	8.005	4.0	4.0	3.5	3.5	1.3	1.3	5
10.00	10.005	10.005	3.5	4.0	4.0	3.5	1.8	1.3	5
12.50	12.505	12.505	3.0	3.0	4.5	4.5	2.3	2.3	7.5
15.00	15.005		3.0		4.5		2.3		7.5

☒ Passed ☐ Failed

Remarks:

2 TEMPERATURE EFFECT ON NO-LOAD INDICATION (A.5.3.2) (example only)

Application N°: R1996/745
Pattern designation: Model RP-15Y
Observer: I. Examiner
Verification scale interval e: 2/5 g
Resolution during test (smaller than e): .....

Automatic zero-setting and zero-tracking device is:

☐ Non-existent ☐ Not in operation ☒ Out of working range

$P = I + 1/2e - \Delta L$

Report page(*)	Date 96/97	Time	Temp (°C)	Zero indication, I	Add. load, ΔL	P	ΔP	ΔTemp	Zero-change per .... °C
	30.12	13:55	20.1	0.020 kg	1.0 g	0.0200 kg			
	31.12	9:40	40.3	0.022	0.4	0.0226	2.6 g	20.2	0.6436 g
	31.12	10:45	40.3	0.022	0.4	0.0226			
	02.01	10:48	–10.2	0.016	1.8	0.0152	7.4	50.5	0.1188
	02.01	11:50	Ð10.1	0.016	1.6	0.0154			
	03.01	9:00	5.1	0.018	1.4	0.0172	1.8	15.2	0.5921
	03.01	10:04	5.2	0.018	1.4	0.0172			
	06.01	8:57	20.2	0.020	1.6	0.0194	2.2	20.0	0.5500

ΔP = difference of P for two consecutive tests at different temperatures
ΔTemp = difference of temperature for two consecutive tests at different temperatures
Check if the zero-change per 5°C is smaller than e (class Ⓘ, Ⓘ or Ⓘ)
Check if the zero-change per 1°C is smaller than e (class Ⓘ)

☒ Passed ☐ Failed

Remarks:

(*) Give the report page of the relevant weighing test where weighing tests and temperture effect on no-load indication test are conducted together (see OIML R 76-1, Figure 10)

VOLTAGE VARIATIONS (A.5.4)

It is essential that all users read OIML R 76-1, clauses 3.9.3 and A.5.4 before commencing this procedure.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 11 (page 24)
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Humidity probe
- Voltage regulator

Procedure

1. Record the general test details concerning the instrument.
2. Determine the state of the automatic zero-setting device and zero-tracking device (#5, page 4 of this manual). Record by marking the appropriate box with an ×.
3. Record nominal voltage or voltage range.
4. Turn off the mains power supply to the instrument.
5. Attach a voltage regulator to the instrument and set to reference voltage.
6. Turn on the mains power supply to instrument.
7. Determine the test loads to be used, these should be 10 e and a load between half Max and Max.
8. Record time and ambient temperature.
9. Conduct a pre-load test (#3, page 3 of this manual).
10. Apply 10 e to the load receptor.
11. Record the load, L_0, and indication, I_0.
12. Find the changeover point (#1, page 1 of this manual) and record ΔL.
13. Calculate the error, E_0, where $E_0 = I + 0.5\ e - \Delta L_0 - L_0$ and record.
14. Apply the test load to the load receptor.
15. Remove the 10 e.
16. Record the load, L, and the indication, I.
17. Find the changeover point (#1, page 1 of this manual) and record ΔL.
18. Calculate the error, E, where $E = I + 0.5\ e - \Delta L - L$ and record.
19. Calculate E_C where $E_C = E - E_0$.

20. Replace the 10 e on the load receptor and remove the test load to ensure the instrument does not return to zero.
21. Adjust the mains power supply voltage to the reference voltage –15%.
22. Wait 5 min.
23. Repeat steps 11 to 20.
24. Adjust the mains power supply voltage to the reference voltage +10%.
25. Wait 5 min.
26. Repeat steps 11 to 20.
27. Adjust the mains power supply voltage to the reference voltage.
28. Wait 5 min.
29. Repeat steps 11 to 20.
30. Determine whether the instrument has passed or failed the voltage variations test in accordance with the requirements as set out in OIML R 76-1, clause 3.9.3 (page 28). An example of a completed evaluation report for this test has been included for your information on the next page.
31. If the instrument has an initial zero-setting range > 20% a supplementary test (#6, page 5 of this manual) is required.

11a VARIATIONS OF VOLTAGE (A.5.4) (example only)

			At start	At max	At end	
Application N°:	R1996/745					
Pattern designation:	Model RP-15Y					
Date:	16/12/96	Temp:	23.3			°C
Observer:	I. Examiner	Rel. h:				%
Verification scale interval e:	2/5g	Time:	12:15			
Resolution during test(smaller than e):	.....	Bar. pres:				hPa
		(only class ①)				

Automatic zero-setting and zero-tracking device is:

☐ Non-existent ☐ Not in operation ☒ Out of working range ☐ In operation

Marked nominal voltage or voltage range: 240 AC V

$E = I + 1/2\ e - \Delta L - L$
$E_C = E - E_0$ with E_0 = error at zero or near zero(*)

Voltage	U (V)	Load, L	Indication, I	Add. load, ΔL	Error, E	Corrected error, E_c	mpe
Reference value(**)		10 e = 0.02 kg	0.020 kg	1.2 g	(*) –0.2 g	0.0 g	1 g
	240	10.0	10.000	2.5	0.0	0.2	5
Reference value –15 %(**)		10 e = 0.02	0.020	1.0	0.0	0.0	1
	204	10.0	10.000	2.5	0.0	0.0	5
Reference value +10 %(**)		10 e = 0.02	0.020	1.2	–0.2	0.0	1
	264	10.0	10.000	3.0	–0.5	–0.3	5
Reference value(**)		10 e = 0.02	0.020	1.2	–0.2	0.0	1
	240	10.0	10.000	3.0	–0.5	–0.3	5

☒ Passed ☐ Failed

Remarks:

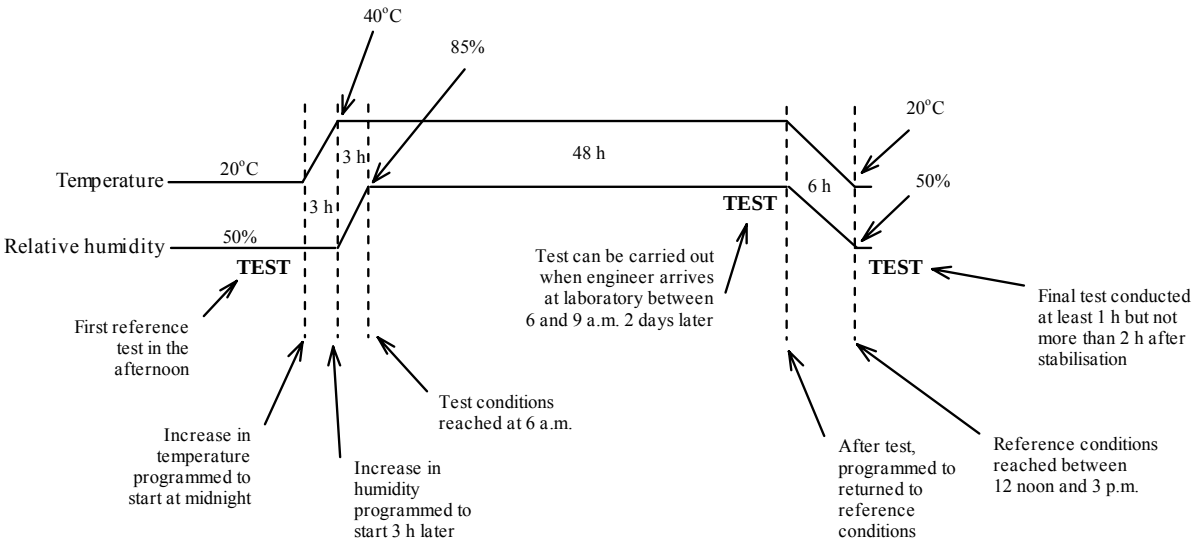
(**) In case a voltage-range is marked, use the average value as reference value and calculate upper and lower values of applied voltages according to A.5.4.

DAMP HEAT, STEADY STATE (B.2.2)

It is essential that all users read OIML R 76-1, clause B.2.2 and IEC 60068-3-4 (2001) before commencing this procedure.

It is very important that the test facilities are such that during the testing cycle no water is allowed to condense on the instrument. To do this the temperature should increase first to 40°C before the relative humidity is increased as shown in the diagram below.

A relatively long waiting period is required after conditions are changed to allow the instrument to stabilise completely before testing. For efficient work practice it is essential that the testing period is organised in such away as to allow the testing period to occur during the normal laboratory working hours. The following diagram illustrates a suggested schedule that fits into normal working days starting at approximately 7:30.



Equipment required

- OIML R 76-1
- IEC 60068-3-4 (2001)
- OIML R 76-2 Evaluation Report No. 13 (page 33 to 35)
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Humidity probe
- Humidity chamber to meet OIML criteria
- Barometer if instrument is class Ⓘ

Procedure

1. Record the general test details concerning the instrument.
2. Determine the state of the automatic zero-setting device and zero-tracking device (#5, page 4 of this manual). Record by marking the appropriate box with an ×.
3. Place the instrument in the humidity test chamber set at a reference temperature of 20°C and 50% humidity and apply 20 e to the load receptor. The time to reach this reference temperature and humidity will vary depending on the performance of the test chamber.
4. Determine if the instrument has reached temperature and humidity stability by:
   (a) ensuring that the ambient temperature and relative humidity inside the test chamber has been stable for at least 30 min; and
   (b) monitoring the zero reading on the instrument at 20 e until a constant reading is achieved.
5. Replace the 20 e, if it has been used, with 10 e.
6. Conduct a pre-load test (#3, page 3 of this manual).
7. Record the time, temperature and relative humidity for all classes and the barometric pressure for class Ⓘ on Evaluation Report No. 13 (page 33).
8. Conduct a weighing test (#4, page 3 of this manual). Replace the 10 e with 20 e, do not allow the instrument to return to zero.
9. Record the results on the Evaluation Report No. 13 (page 33).
10. Record the time, reference temperature and relative humidity for all classes and the barometric pressure for class Ⓘ on Evaluation Report No. 13 (page 33).
11. Determine whether the instrument has passed or failed the damp heat, steady state test in accordance with the requirements as set out in OIML R 76-1, clause B.2.2 (page 78).
12. Adjust the temperature setting in the test chamber to test conditions of 40°C or the upper temperature limit set by the manufacturer. The test chamber should take 3 h to reach the test conditions.
13. After the temperature has reached its upper limit adjust the relative humidity setting in the test chamber to reach the test conditions of 85% over 3 h. Note: The temperature is adjusted first over a 3 h period followed by the humidity over a 3 h period to prevent any moisture from condensing on the instrument.
14. After the test chamber has reached its test conditions wait 48 h.
15. Repeat steps 5 to 11 recording the results on Evaluation Report No. 13 (page 34).
16. Adjust the test chamber to return back to the reference conditions of 20°C and 50% relative humidity over a 6 h period.
17. Repeat steps 5 to 11, between 1 and 2 h after the reference conditions have been reached within the chamber. Record the results on Evaluation Report No. 13 (page 35). An example of a completed evaluation report for this test has been included for your information on the next page.

It is recommended that a span stability test be conducted after this test, see page 25 of this manual. To do this wait a minimum of 16 h with the power supply connected and switched on before commencing the span stability test.

13 DAMP HEAT, STEADY STATE (B.2.2) (Example only)

(a) Initial test (at reference temperature)

			At start	At max	At end	
Application N°:	R1996/745					
Pattern designation:	Model RP-15Y					
Date:	10/1/97	Temp:	20.1		20.3	°C
Observer:	I. Examiner	Rel. h:	49.9		50.4	%
Verification scale interval e:	2/5 g	Time:	14:15	14:19	14:23	
Resolution during test(smaller than e):	.....	Bar. pres:				hPa
		(only class ①)				

Automatic zero-setting and zero-tracking device is:

☐ Non-existent ☐ Not in operation ☒ Out of working range ☐ In operation

$E = I + 1/2\ e - \Delta L - L$
$E_c = E - E_0$ with E_0 = error calculated at or near zero(*)

Load, L	Indication, I		Add. load, ΔL		Error, E		Corrected error, E_c		mpe
	↓	↑	↓	↑	↓	↑	↓	↑	
(*) 0.02 kg	0.020 kg	0.020 kg	1.0 g	1.8 g	(*) 0.0 g	–0.8 g	0.0 g	–0.8 g	1 g
0.04	0.040	0.040	1.0	1.6	0.0	–0.6	0.0	–0.6	1
1.00	1.000	1.000	1.0	1.6	0.0	–0.6	0.0	–0.6	1
2.00	2.000	2.000	1.0	1.6	0.0	–0.6	0.0	–0.6	2
4.00	4.000	4.000	1.0	1.6	0.0	–0.6	0.0	–0.6	2
5.99	5.990	5.990	1.2	1.8	–0.2	–0.8	–0.2	–0.8	3
8.00	8.000	8.000	3.5	3.5	–1.0	–1.0	–1.0	–1.0	5
10.00	10.000	10.000	3.5	4.0	–1.0	–1.5	–1.0	–1.5	5
12.50	12.500	12.500	4.0	4.0	–1.5	–1.5	–1.5	–1.5	7.5
15.00	15.000		4.5		–2.0		–2.0		7.5

☒ Passed ☐ Failed

Remarks:

SHORT-TIME POWER REDUCTIONS (B.3.1)

It is essential that all users read OIML R 76-1, clauses 5.4.3 and B.3.1 before commencing this procedure.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 12.1 (page 25)
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Test generator for main power reductions to meet OIML criteria

Procedure

1. Record the general test details concerning the instrument.
2. Determine the nominal voltage, U_n, to be used from the information supplied by the manufacturer either in the manual or on the instrument and record.
3. Connect the instrument to the test generator.
4. Conduct a pre-load test (#3, page 3 of this manual).
5. Record the time and ambient temperature.
6. Apply a load of 20% Max on the load receptor.
7. Record the load.
8. Set the displayed reading to the centre of e by the changeover method. To do this:
   (a) apply an additional 0.5 e weight to the load already on the receptor;
   (b) apply any additional weights of 0.1 e until the changeover point is reached (#1, page 1 of this manual); and
   (c) remove the 0.5 e weight, leaving the additional weights.
9. Record the indication, I, for no disturbance.
10. Start the disturbances and allow this to reduce the voltage ten times at 10 s intervals and at 0% amplitude.
11. Record the indication, I, and note any variation when you compare it with the indication for no disturbances.
12. Switch off the disturbances.
13. Record whether or not the instrument has a significant fault and any appropriate remarks.
14. Check that the indication is still set at centre, e, as per step 8 above, if not make the appropriate adjustments.

15. Start the disturbances and allow this to reduce the voltage ten times at 10 s intervals and at 50% amplitude.
16. Record the indication, I, and note any variation when you compare it with the indication for no disturbances.
17. Switch off the disturbances.
18. Record whether or not the instrument has a significant fault and any appropriate remarks.
19. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause B.3.1 (page 79).

Always record a remark. For example:

(a) no visible effect;
(b) display increased by 1 e and returned to normal after the disturbance stopped;
(c) display fluctuates up and down but cannot be read or printed;
(d) display decreased by 4 e and can be mistaken for a reading.

ELECTRICAL BURSTS (B.3.2)

It is essential that all users read OIML R 76-1, clauses 5.4.3 and B.3.2, and IEC 61000-4-4 (1995).

This test has been designed to determine the effect of electrical bursts on the accuracy and operation of the instrument. It tests separately for electrical bursts along the (a) power supply lines, and/or (b) I/O circuits and communication lines if they are present on the instrument. These tests must be carried out under the following conditions:

- ambient temperature 15°C to 35°C;
- relative humidity 25% to 75%; and
- pressure 86 kPa to 106 kPa (class Ⓘ instrument only).

The procedure that you follow for (a) power supply lines, and/or (b) I/O circuits and communication lines if the instrument has any, will depend on the design of test equipment that you use. It may be more suitable with your equipment to conduct all the positive polarity testing at one time before conducting the negative polarity or vice versa. Alternatively it may be more suitable to conduct a positive polarity test followed by a negative polarity test. The procedure below has been designed to conduct a positive polarity test followed by a negative polarity test.

(a) Power Supply Lines

Equipment required

- OIML R 76-1
- IEC 61000-4-4
- OIML R 76-2 Evaluation Report No. 12.2 (page 26)
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Barometer if instrument is class Ⓘ
- Electrical generator for electrical bursts to meet OIML criteria

Procedure

1. Record the general test details concerning the instrument.
2. Connect the instrument to the test generator.
3. Record the time, relative humidity and ambient temperature for all classes, and the pressure if the instrument is class Ⓘ.
4. Conduct a pre-load test (#3, page 3 of this manual).
5. Apply one small test load on the load receptor (e.g. 10% to 20% Max, making sure the test load is above Min).
6. Record the load.

7. Set the displayed reading to the centre of e by the changeover method. To do this:
   (a) apply an additional 0.5 e weight to the load already on the receptor;
   (b) apply any additional weights of 0.1 e until the changeover point is reached (#1, page 1 of this manual); and
   (c) remove the 0.5 e weight, leaving the additional weights.
8. Record the indication, I, for no disturbance.
9. Adjust the test equipment for a 1 kV test voltage with a positive polarity.
10. Apply the disturbance for at least 1 min to the L phase line (active).
11. Record the indication, I, and note any variation when you compare it with the indication for the no disturbance test.
12. Switch off the disturbance.
13. Record whether or not the instrument has a significant fault and any appropriate remarks.
14. Adjust the test equipment for a 1 kV test voltage with a negative polarity.
15. Apply the disturbance for at least 1 min to the L phase line (active).
16. Record the indication, I, and note any variation when you compare it with the indication for the no disturbance test.
17. Switch off the disturbance.
18. Record whether or not the instrument has a significant fault and any appropriate remarks.
19. Check that the indication is still set at centre, e, as per step 7 above.
20. Repeat steps 8 to 19 for the N line (neutral) and again for the PE line (protective earth).
21. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause B.3.2 (page 79). An example of a completed evaluation report for this test has been included for your information on page 74.

(b) I/O Circuits and Communication Lines (if Present)

Equipment required

- OIML R 76-1
- IEC 61000-4-4 (1995)
- OIML R 76-2 Evaluation Report No. 12.3 (page 27)
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Barometer if instrument is class Ⓘ
- Electrical generator for electrical bursts to meet OIML criteria

Procedure

1. Record the general test details concerning the instrument.
2. Set up the cable line to be tested in the capacitive coupling (CC) clamp and using the procedures in IEC 61000-4-4, clause 7.2.2.
3. Record the type of cable line that is to be tested and explain or make a sketch on the report to indicate where the CC clamp has been located.
4. Conduct a pre-load test (#3, page 3 of this manual).
5. Record the time, relative humidity and ambient temperature for all classes, and the pressure if the instrument is class Ⓘ.
6. Apply one small test load on the load receptor (e.g. 10% to 20% Max, making sure the test load is above Min).
7. Record the load.
8. Set the displayed reading to the centre of e by the changeover method. To do this:
   (a) apply an additional 0.5 e weight to the load already on the receptor;
   (b) apply any additional weights of 0.1 e until the changeover point is reached (#1, page 1 of this manual); and
   (c) remove the 0.5 e weight, leaving the additional weights.
9. Record the indication, I, for no disturbance.
10. Adjust the test equipment for a 0.5 kV test voltage with a positive polarity.
11. Apply the disturbance for at least 1 min.
12. Record the indication, I, and note any variation when you compare it with the indication for no disturbances.
13. Switch off the disturbance.
14. Record whether or not the instrument has a significant fault and any appropriate remarks.
15. Adjust the test equipment for a 0.5 kV test voltage with a negative polarity.
16. Apply the disturbance for at least 1 min.
17. Record the indication, I, and note any variation when you compare it with the indication for no disturbances.
18. Switch off the disturbance.
19. Record whether or not the instrument has a significant fault and any appropriate remarks.
20. Repeat steps 8 to 19 for all I/O cable lines and communication lines connected to the instrument.
21. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause B.3.2 (page 79).

12.2 Electrical bursts (B.3.2) (Example only)

(a) Power supply lines

			At start	At max	At end	
Application N°:	R1996/475					
Pattern designation:	Model RP-15Y					
Date:	14/1/97	Temp:	22.8			°C
Observer:	I. Examiner	Rel. h:	51.6			%
Verification scale interval e:	2/5 g	Time:	11:15			
	.	Bar. pres:				hPa

(only class Ⓘ)

Power supply lines: test voltage 1 kV, duration of the test 1 min at each polarity

Load	Disturbance			Polarity	Result		
	L ↓ ground	N ↓ ground	PE ↓ ground		Indication, I	Significant fault (> e)	
						No	Yes (remarks)
3.0 kg	Without disturbance				3.002 kg		
	×			pos	3.008		× see □
				neg	3.002	×	see □
	Without disturbance				3.002		
		×		pos	3.004	×	see □
				neg	3.002	×	see □
	Without disturbance				3.002		
			×	pos	3.002	×	see □
				neg	3.002	×	see □

L = phase, N = neutral, PE = protective earth

☐ Passed ☒ Failed

Remarks:
- □ Indication increased by 3 e and was displayed for 5 s.
- □ No visible effect
- □ Indication jumped by 1 e intermittently
- □ Indication was flicking by perhaps 3 e but could not be read or printed

ELECTROSTATIC DISCHARGE (B.3.3)

There are two applications of electrostatic discharge: (a) direct discharge and (b) indirect discharge. Direct discharge is tested by actual contact with the instrument and by air discharge onto the instrument. Indirect discharge is tested on the coupling planes, not the instrument, and simulates the effect of electrostatic discharge between the instrument and a nearby piece of equipment.

It is essential that all users read OIML R 76-1, clauses 5.4.3 and B.3.3, and IEC 61000-4-2 (1995) before commencing this procedure. It is essential to ensure that the laboratory has been set up in accordance with IEC 61000-4-2, clause 7 for these tests.

These procedures must also be carried out under the following conditions:

- ambient temperature 15°C to 35°C;
- relative humidity 25% to 75%; and
- pressure 86 kPa to 106 kPa (class Ⓘ instrument only).

(a) Direct Discharge

Equipment required

- OIML R 76-1
- IEC 61000-4-2
- OIML R 76-2 Evaluation Report No. 12.3 (pages 28 to 30)
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Humidity probe
- Barometer if instrument is class Ⓘ
- Electrostatic discharge (ESD) generator gun to meet OIML criteria

Procedure

1. Record the general test details concerning the instrument.
2. Determine the direct discharge applications as either contact discharge or paint penetration and mark the appropriate box with an ×.
3. Mark the air discharge box with an ×.
4. Set up the instrument according to IEC 61000-4-2, clauses 7.1.1 and 7.1.2.
5. Set the ESD generator gun to continuous discharge and apply the discharge all over the instrument to determine the most sensitive polarity for the instrument. Mark the appropriate box with an ×. We recommend using 8 kV air discharges.
6. Attach the contact discharge adaptor to the ESD generator gun.
7. Conduct a pre-load test (#3, page 3 of this manual).
8. Record the time, ambient temperature and relative humidity for all classes, and the barometric pressure for class Ⓘ only.
9. Ensure that the test range conditions are met.

10. Apply one small test load on the load receptor (e.g. 10% to 20% Max, making sure the test load is above Min).
11. Record the load.
12. Set the displayed reading to the centre of e by the changeover method. To do this:
    (a) apply an additional 0.5 e weight to the load already on the receptor;
    (b) apply any additional weights of 0.1 e until the changeover point is reached (#1, page 1 of this manual); and
    (c) remove the 0.5 e weight, leaving the additional weights**.**
13. Record the indication, I, for no disturbance.
14. Adjust the ESD generator gun to apply a 2kV contact discharge.
15. Apply the discharge by first touching the contact to any part of the instrument then operating the discharge switch to activate the discharge.
16. After applying the discharge remove the ESD generator gun.
17. Wait at least 10 s, and repeat steps 14 to 15. Do this a minimum of nine times (ten times in all) to various points on the instrument.
18. Record the number of discharges and the time between each interval (repetition interval).
19. Record the indication, I, and note any variation when you compare it with the indication for no disturbances.
20. Record whether or not the instrument has a significant fault and any appropriate remarks.
21. Adjust the ESD generator gun to apply a 4 kV contact discharge.
22. Repeat steps 14 to 19.
23. Adjust the ESD generator gun to apply a 6 kV contact discharge.
24. Repeat steps 14 to 19.
25. Remove the contact discharge adapter from the ESD generator gun and adjust to 8 kV.
26. Apply 8 kV air discharge to the instrument by continuously holding down the switch of the ESD generator gun while approaching the instrument until the ESD generator gun discharges to it (this can be as close as 1 mm).
27. Repeat steps 14 to 19.
28. Determine whether the instrument has passed or failed in accordance with the criteria set out in OIML R 76-1, clause B.3.3 (page 80).
29. If the instrument has failed, record on Evaluation Report No. 12.3 (page 30) the specific test point at which this failure occurred by using either a sketch or photograph of the instrument. An example of a completed evaluation report for this test has been included for your information on page 79.

(b) Indirect Discharge (Contact Discharges Only)

Equipment required

- OIML R 76-1
- IEC 61000-4-2
- OIML R 76-2 Evaluation Report No. 12.3 (pages 29 to 30)
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Humidity probe
- Barometer if instrument is class Ⓘ
- Electrostatic discharge (ESD) generator gun to meet OIML criteria

Procedure

1. Record the general test details concerning the instrument.
2. Set up the instrument according to IEC 61000-4-2, clause 8.3.2.
3. Set the ESD generator gun to continuous discharge and apply the discharge all over the coupling plane to determine the most sensitive polarity for the instrument. Mark the appropriate box with an ×. We recommend using 8 kV air discharges.

   Note: Experience has shown that 99% of instruments are not affected by the indirect ESD. The failed instruments were also affected by the same polarity of discharge as the direct. The same polarity as the direct can be assumed to be used.
4. Attach the contact discharge adaptor to the ESD generator gun.
5. Conduct a pre-load test (#3, page 3 of this manual).
6. Record the time, ambient temperature and relative humidity for all classes, and the barometric pressure for class Ⓘ only.
7. Ensure the test range conditions are met.
8. Apply one small test load on the load receptor (e.g. 10% to 20% Max, making sure the test load is above Min).
9. Record the load.
10. Set the displayed reading to the centre of e by the changeover method. To do this:
    (a) apply an additional 0.5 e weight to the load already on the receptor;
    (b) apply any additional weights of 0.1 e until the changeover point is reached (#1, page 1 of this manual); and
    (c) remove the 0.5 e weight, leave the additional weights.
11. Record the indication, I, for no disturbance.
12. Adjust the ESD generator gun to apply a 2 kV contact discharge.

13. Apply the discharge by first touching the contact to any part of the horizontal coupling plane then operating the discharge switch to activate the discharge. Remove the ESD generator gun.
14. Wait at least 10 s and repeat steps 12 to 13. Do this a minimum of nine times (a minimum of ten times in all).
15. Record the number of discharges and the time between each interval (repetition interval).
16. Record the indication, I, and note any variation when you compare it with the indication for no disturbances.
17. Record whether or not the instrument has a significant fault and any appropriate remarks.
18. Adjust the ESD generator gun to apply a 4 kV contact discharge.
19. Repeat steps 12 to 16.
20. Adjust the ESD generator gun to apply a 6 kV contact discharge.
21. Repeat steps 12 to 16.
22. Repeat steps 9 to 20 applying the discharge to the vertical coupling plane.
23. Determine whether the instrument has passed or failed in accordance with the criteria set out in OIML R 76-1, clause B.3.3 (page 80).
24. If the instrument has failed, record on Evaluation Report No. 12.3 (page 30) the specific test point at which this failure occurred by using either a sketch or photograph of the instrument.

12.3 Electrostatic discharges (B.3.3) (example only)

(a) Direct application

Application N°:	R1996/475
Pattern designation:	Model RP-15Y
Date:	14/1/98
Observer:	I. Examiner
Verification scale interval e:	2/5 g

	At start	At max	At end	
Temp:	23.1			°C
Rel. h:	51.4			%
Time:	11:40			
Bar. pres:				hPa

(only class Ⓘ)

[×] Contact discharges [ ] Paint penetration

[×] Air discharges Polarity(*) : [ ] pos [×] neg

Load	Discharges			Result		
	Test voltage (kV)	Number of discharges ≥ 10	Repetition interval(s)	Indication, I	Significant fault (> e) No	Yes (remarks, test points)
3 kg	Without disturbance					
	2	10	10 s	3.000 kg	×	see □
	4	10	10	3.000	×	see □
	6	10	10	3.000	×	see □
	8 (air discharges)	10	10	3.000	×	see □

	Without disturbance					
	2					
	4					
	6					
	8 (air discharges)					

[×] Passed [ ] Failed

Remarks:

□ No visible effect
□ On two occasions the EUT did a power up routine

Note: If the EUT fails, the test point at which this occurs shall be recorded

(*) IEC 61000-4-2 specifies that the test shall be conducted with the most sensitive polarity

IMMUNITY TO RADIATED ELECTROMAGNETIC FIELDS (B.3.4)

It is essential that all users read OIML R 76-1, clauses 5.4.3 and B.3.4 before commencing this procedure.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 12.4 (pages 31 to 32)
- IEC 61000-4-3
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Humidity probe
- Barometer if instrument is class Ⓘ
- Radiated electromagnetic susceptibility test chamber and test equipment to meet OIML criteria

Procedure

1. Record the general test details concerning the instrument.
2. Ensure the 'uniform area' of the chamber has been calibrated in accordance with IEC-61000-4-3, clause 6.2.
3. Determine the rate of sweep in accordance with IEC 61000-4-3, clause 8 and record.
4. Record the type/s of the antenna used (refer to IEC 61000-4-3 Annex B if necessary). To get the full range of frequencies required (26 to 1000 MHz) you may have to use more than one antenna.
5. Record the test frequency range.
6. Place the instrument on the test platform and set it up with the front facing the antenna in accordance with IEC 61000-4-3, clause 7.
7. Record the setup by taking a close-up photograph of the instrument and of the cable connections.
8. Check that the antenna is at the same height and distance from the instrument as when the 'uniform area' was calibrated.
9. Spot check a number of calibration grid points in the 'uniform area' for both the horizontal and vertical polarities.
10. Do a pre-load test (#3, page 3 of this manual).
11. Record the time, ambient temperature and relative humidity for all classes and the barometric pressure for class Ⓘ only.
12. Apply one small test load on the load receptor (e.g. 10% to 20% Max, making sure the test load is above Min).

13. Record the load.
14. Record the type of material used to make the load, e.g. wood, plastic etc.
15. Set the displayed reading to the centre of e by the changeover method. To do this:
    (a) apply an additional 0.5 e weight to the load already on the receptor;
    (b) apply any additional pieces of wood or plastic etc. until the changeover point is reached (#1, page 1 of this manual); and
    (c) remove the 0.5 e weight leaving the additional pieces of wood or plastic etc.
16. Record the indication, I, for no disturbance.
17. With the antenna in a vertical polarisation, sweep through the full range of frequencies stepping up in accordance with IEC 61000-4-3, clause 8. We recommend a minimum dwell time of 3 s at each frequency.
18. Check and note any changes in the indication during the application of the disturbance.
19. Record the greatest change in the indication when compared with the indication for no disturbances.
20. Record whether or not the instrument has a significant fault and any appropriate remarks.
21. Repeat steps 14, then steps 16 to 19 in sequence with the rear, left and right sides of the instrument facing the antenna.
22. With the antenna in a horizontal polarisation repeat steps 14, then 16 to 20.
23. If necessary change the antenna in order to cover the complete range of frequencies required and repeat steps 14, then 16 to 21.
24. Determine whether the instrument has passed or failed in the accordance with the criteria set out in OIML R 76-1, clause B.3.4 (page 80).
25. Attach the photographs of the instrument to the report.

It is recommended that a span stability test be conducted after this test, see page 25 of this manual. You must ensure the power has been on for a minimum of 5 h.

12.4 Immunity to Radiated Electromagnetic Fields (B.3.4) (example only)

Application N°: R1996/475
Pattern designation: Model RP-15Y
Date: 14/1/98
Observer: I. Examiner

	At start	At max	At end	
Temp:	22.6			°C
Rel. h:	56.9			%
Time:	13:15			
Bar. pres:				hPa

(only class ①)

Rate of sweep: 1.5 m Decade/s

Material load: wood and plastic

Load: 3.0 kg

Disturbance				Result		
Antenna	Frequency range (MHz)	Polarization	Facing EUT	Indication, I	Significant fault (> e)	
					No	Yes (remarks)
without disturbance				3.000 kg		
Biconi-log	26–80	Vertical	Front	3.000	×	
			Right	3.000	×	
			Left	3.000	×	
			Rear	3.000	×	
		Horizontal	Front	3.000	×	
			Right	3.000	×	
			Left	3.000	×	
			Rear	3.000	×	
Biconi-log	80–1000	Vertical	Front	3.004		× 389.21397 MHz
			Right	3.002	×	
			Left	3.002	×	
			Rear	3.002	×	
		Horizontal	Front	3.002	×	
			Right	3.010		× 294.57098 MHz
			Left	3.008		× 294.57098 MHz
			Rear	3.004		× 812.77452 MHz

Frequency range: 26–1000 MHz
Field strength: 3 V/m
Modulation: 80% AM, 1 kHz sine wave

☐ Passed ☒ Failed

Remarks:
Where the EUT failed only the maximum displayed error is recorded above. Refer to the test log report for the points of failure.

Note: If EUT fails, the frequency at which this occurs shall be recorded.

ENDURANCE TEST (A.6)

It is essential that all users read OIML R 76-1, clauses 3.9.4.3 and A.6 before commencing this procedure. This test is required for all instruments with a maximum capacity up to 100 kg.

Equipment required

- OIML R 76-1
- OIML R 76-2 Evaluation Report No. 15 (pages 42 to 43)
- Instrument under test
- Certified weights
- Temperature probe
- Time piece
- Humidity probe
- Barometer if instrument is class Ⓘ

Procedure

1. Record the general test details concerning the instrument.
2. Determine the state of the automatic zero-setting device and zero-tracking device (#5, page 4 of this manual). Record by marking the appropriate box with an ×.
3. Conduct a pre-load test (#3, page 3 of this manual).
4. Record the time, ambient temperature and relative humidity for all classes, and the pressure if the instrument is class Ⓘ.
5. Conduct a weighing test (#4, page 3 of this manual).
6. Record the results on Evaluation Report No. 15 (pages 42).
7. Calculate E using $E = I + 0.5\ e - \Delta L - L$.
8. Calculate E_C using $E_C = E - E_0$.
9. Apply a load of approximately 10 e to the load receptor and leave it on for the duration of the 100 000 applications, any zero shift will then be seen.
10. Apply a test load of about 50% of the Max by repetitive loading and unloading to a total of 100 000 applications. The frequency and speed of the application shall be such that the instrument attains an equilibrium when loaded and unloaded. The force of the load applied shall not exceed the force attained in a normal loading condition.
11. Record the number of loadings on Evaluation Report No. 15 (pages 43).
12. Record the time, ambient temperature and relative humidity for all classes, and the pressure if the instrument is class Ⓘ.
13. Conduct a weighing test (#4, page 3 of this manual). Note: If this test is not conducted immediately after the repetitive loading, a pre-load test (#3, page 3 of this manual) will be necessary.
14. Record the results on the second page of the Evaluation Report No. 15 (page 43).

15. Calculate E using $E = I + 0.5\ e - \Delta L - L$.
16. Calculate E_C using $E_C = E - E_0$.
17. Calculate and record the durability error due to wear and tear.
18. Determine whether the instrument has passed or failed in accordance with the requirements as set out in OIML R 76-1, clause 3.9.4.3 (page 29). An example of the last page of an evaluation report for this test has been included for your information on the next page.
19. If the instrument has an initial zero-setting range > 20% a supplementary test (#6, page 5 of this manual) is required.

IMPORTANT REMINDER

To finalise the assessment of the instrument for the awarding of OIML R 76 certification it is necessary for the assessor to complete Evaluation Report No. 17 — Checklist, pages 46 to 56.

15 ENDURANCE TEST (A.6) (cont.) (Example only)

(b) Performance of the test

Number of loadings: 100 021 Load applied: 7.89 kg

(c) Final test

Date: 16/1/98
Observer: I. Examiner

	At start	At max	At end	
Temp:	20.9		20.8	°C
Rel. h:	52.6			%
Time:	15:35	15:39	15:42	
Bar. pres:				hPa

(only class ①)

$E = I + 1/2\ e - \Delta L - L$
$E_c = E - E_0$ with E_0 = error calculated at or near zero(*)

Durability error due to wear and tear = $|E_{c\ initial} - E_{c\ final}|$(**)

Load, L	Indication, I ↓	Indication, I ↑	Add. load, ΔL ↓	Add. load, ΔL ↑	Error, E ↓	Error, E ↑	Corrected error, E_c ↓	Corrected error, E_c ↑	mpe	(**)Durability error due to wear and tear
(*) 0.02 kg	0.02.0 kg	0.020 kg	1.0 g	1.8 g	(*)0.0 g	–0.8 g	0.0 g	–0.8 g	1 g	0.0 g
0.04	0.040	0.040	1.0	1.6	0.0	–0.6	0.0	–0.6	1	0.0
1.00	1.000	1.000	1.0	1.6	0.0	–0.6	0.0	–0.6	1	0.2
2.00	2.000	2.000	1.0	1.6	0.0	–0.6	0.0	–0.6	2	0.2
4.00	4.000	4.000	1.0	1.6	0.0	–0.6	0.0	–0.6	2	0.2
5.99	5.990	5.990	1.2	1.8	–0.2	–0.8	–0.2	–0.8	3	0.4
8.00	8.000	8.000	3.5	3.5	–1.0	–1.0	–1.0	–1.0	5	0.5
10.00	10.000	10.000	3.5	4.0	–1.0	–1.5	–1.0	–1.5	5	0.0
12.50	12.500	12.500	4.0	4.0	–1.5	–1.5	–1.5	–1.5	7.5	0.5
15.00	15. 000		4.5		–2.0		–2.0		7.5	0.0

[×] Passed [ ] Failed

Remarks: