



## Laboratory manual for the evaluation of weight kits

Date: 2018-07-20

Version: 1

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## 1. Introduction

### 1.1 Purpose

The purpose of this document is to describe the requirements for weight kits that are calibrated by Measurement Canada's Approval and Calibration Services Laboratory (ACSL).

### 1.2 Scope

This document applies to all weight kits calibrated by the ACSL.

### 1.3 Overview

A weight kit is a collection of weights of a single tolerance class and system of units (metric or Canadian) that is stored in a single purpose-built carrying case. A weight kit may consist of as little as one weight, and no more than 32 individual weights. The weight kit is identified by a unique serial number on the outside of the case. Each weight in the kit is also identified by a unique serial number. The certificate of calibration issued by the ACSL lists these weights and associates their serial number to the serial number of the weight kit.

The ACSL calibrates two types of weight kits:

1. Inspector weight kits (used to inspect Class III, IIIHD, and IIII devices only)
2. Precious metal weight kits (used to inspect Class II devices only)

#### Notes:

1. Measurement Canada's district offices calibrate any other weights that are used as local standards. These weights are typically painted cast iron of a nominal weight of 5 kg (10 lb) and up, and are used to inspect Class III, IIIHD and IIII devices. For more information, [contact your local Measurement Canada office](#). The ACSL calibrates 5 kg stainless steel weights that are part of a weight kit.
2. A weight kit may be either an inspector weight kit or a precious metal weight kit, but not both. Combining weights of the two types into a single weight kit is not permitted. It also is not permitted to use an inspector weight kit to inspect a Class II device nor is it permitted to use a precious metal weight kit to inspect anything other than a Class II device.

More information on the types of weight kits described above is presented in sections 1.5 and 1.6, and the requirements related to them are described in section 1.9 of this manual.

Technical requirements aim to ensure that weights maintain their calibration throughout their one-year calibration cycle. Administrative requirements aim to ensure that all the required information is readily available to ACSL staff. Other requirements exist for practical reasons such as software and process limitations, and health and safety. For further information about requirements [contact the ACSL](#).

The ACSL calibrates authorized service provider (ASP) weight kits without charge up to a maximum number of weight kits. The maximum number of kits for an ASP and the responsibilities of ASPs are set out in Measurement Canada's [bulletin A-2](#).

A completed copy of the ASP calibration checklist is to be provided with each weight kit that is sent for calibration, in addition to the calibration services request (CSR) form.

This manual will be updated as new criteria are identified for the calibration of local standards. It is important to check the most recent posted version of this manual before sending a weight kit for calibration. Any changes will be noted at the end of this document.

## 1.4 List of abbreviations

ACSL	Approvals and Calibrations Services Laboratory
ASD	Alternative service delivery
ASP	Authorized service provider
CSR	Calibration services request
NIST	National Institute of Standards and Technology
OIML	International Organization of Legal Metrology

## 1.5 Inspector weight kits

Inspector weight kits are used to inspect Class III, IIIHD and IIII devices. These weight kits are not to be used to inspect Class II devices. The weights in these kits range from 5 kg to 10 mg in metric units and 10 lb to 0.001 lb or 1/32 oz in Canadian units. An inspector weight kit may contain multiple weights or a single weight. They are sent to Measurement Canada's ACSL in Ottawa for calibration.

**Note:** Single 5 kg hand weights made of cast iron (or sets of such weights) are calibrated at Measurement Canada's district offices, not at the ACSL. Only full weight kits are calibrated at the ACSL. For more information on these kinds of weights, [contact your local Measurement Canada office](#).

The requirements for these weight kits are described in section 1.9. The weights in an inspector weight kit may be in metric or Canadian units as required, but not a combination of both. Any questions about this section should be directed to the ACSL.

Each weight in an inspector weight kit must be within **one half** of the applicable tolerance specified in Part III or IV (metric or Canadian units respectively) of Schedule IV of the [Weights and Measures Regulations](#). The tolerances in the Regulations are roughly equivalent to [OIML \(International Organization of Legal Metrology\) recommendation R111-1 edition 2004](#) class M1 tolerances. Therefore, an OIML class M1 weight must be calibrated to **one half** of the applicable OIML class M1 tolerance in order to be acceptable. Weights of a higher tolerance class (smaller tolerances) are also acceptable. For example, an OIML class F2 weight should meet the one-half requirement without any adjustment.

**Note:** The ACSL issues certificates for mass standards which do not deviate from the nominal value by more than **one half** of the prescribed tolerance. The purpose of this provision is to ensure that, during the certification period, the deviation of mass standards does not exceed the tolerance prescribed in the Regulations.

## 1.6 Precious metal weight kits

Precious metal weight kits are used to inspect Class II devices. They must only be used for the inspection of legal for trade Class II devices; otherwise, the integrity of the weights may be compromised and they may be outside the prescribed tolerance before the end of their calibration cycle. The weights in these kits range from 20 kg to 1 mg. Precious metal weight kits are sent to Measurement Canada's ACSL for calibration.

The requirements for these weight kits are described in section 2. The weights in a precious metal weight kit may only be in metric units. Any questions about this section should be directed to the ACSL.

Each weight in a precious metal weight kit must meet **one half** of the applicable tolerance specified in Part I of Schedule IV of the Regulations. The tolerances in the Regulations are roughly equivalent to [OIML recommendation R111-1 edition 2004](#) class F2 tolerances. Therefore, an OIML class F2 weight must be calibrated to **one half** of the applicable OIML class F2 tolerance in order to be acceptable. Weights of a higher tolerance class (smaller tolerances) are also acceptable. For example, an OIML class F1 weight should meet the one-half requirement without any adjustment.

**Note:** The ACSL issues certificates for mass standards which do not deviate from the nominal value by more than **one half** of the prescribed tolerance. The purpose of this provision is to ensure that, during the certification period, the deviation of mass standards does not exceed the tolerance prescribed in the Regulations.

### 1.7 Weights kits used during the inspection of a volumetric device

Weight kits used during the inspection of a volumetric device, such as a lube oil meter, must meet all the requirements in this manual, with the two following exceptions:

- They may be used for the inspection of devices that are not legal for trade; and
- They are not restricted to a certain class of devices.

If a weight kit is used to inspect a lube oil meter, it must fulfill all the same requirements that apply to inspector weight kits (see section 1.5).

### 1.8 Calibration procedure

The ACSL calibrates inspector weight kits using a direct comparison method and calibrates precious metal weight kits using a series of intercomparisons.

The ACSL does not provide weight cleaning, stamping or adjustment services. It is the responsibility of the ASP to ensure that weights and weight kits meet all the requirements of this document, including the requirement to ensure that the weights are within **one half** of the applicable tolerance prescribed in Schedule IV of the Regulations before they are submitted for certification. If a weight or weight kit does not meet all the requirements of this document, the ACSL will attempt to contact the owner. If the ACSL can't contact the owner and resolve the problem within seven days, the weight kit not satisfying these requirements (including proper adjustment) will be returned, at the owner's expense, without being certified. In some cases (as noted in this document), weight kits will be returned if the problem cannot be fixed. If adjustments are required, Measurement Canada recommends the use of an ISO 17025-certified mass calibration laboratory. Weights should be adjusted as close as possible to the nominal value, and within the applicable tolerance, prior to certification.

The ACSL's [service standards are posted on Measurement Canada's website](#).

### 1.9 Exceptions

Unless an exception applies to a specific numbered requirement, it is the responsibility of kit owners to update and modify their kits as necessary to conform to new requirements. In introducing this new document, efforts have been made to minimize the number of kits that require changes. However, Measurement Canada is aware that there may be some previously certified kits that are no longer acceptable under the new requirements.

## 2. Requirements for weight kits

### 2.1 Administrative requirements

#### 2.1.1 Submission of weights

All the weights in a weight kit must be submitted for calibration at the same time. The ACSL does not certify part of a weight kit; all the weights in the weight kit must be certified at the same time.

**Note:** Any addition, removal or replacement of weights must be indicated on the CSR form or otherwise communicated to the ACSL. Any other change to the weight kit since the last time it was certified must also be indicated on the CSR form. If nothing is indicated on the CSR form, the kit will be certified as it was the last time, but the missing and/or added weights will not be certified.

#### 2.1.2 Calibration services request form

Weight kits must be accompanied by a properly completed (i.e. electronically) and signed CSR form. The **most recent version** of the form must be used and is always available on [Measurement Canada's website](#). The completed form must clearly indicate whether the weight kit is an inspector weight kit or a precious metal weight kit, as appropriate.

#### 2.1.3 Authorized service provider calibration checklist

Weight kits must be accompanied by a completed copy of the ASP calibration checklist. Only the **most recent version** will be accepted.

#### 2.1.4 Acceptance of weight kits

Weight kits must have been accepted for calibration by a regional coordinator, Alternative Service Delivery (ASD) or a regional auditor, ASD prior to being sent to the ACSL.

**Note:** In order for the ACSL to know that a kit has been accepted by a regional coordinator or auditor, the regional coordinator or auditor will have to add it to a list of accepted kits that is posted to an internal Measurement Canada database. The ACSL only accepts lists posted or sent by a regional coordinator or auditor. The ACSL does not, under any circumstance, accept lists sent directly by an ASP.

### 2.2 Weight kit identification

#### 2.2.1 Legibility and permanence of markings

All markings must be legible and sufficiently permanent such that they will withstand normal use of the weight kit.

#### 2.2.2 Owner's name

The case of a weight kit must be clearly labelled with the name of the owner of the kit (company name).

#### 2.2.3 Accuracy class statement

The case of an inspector weight kit must be labelled as such or bear a statement to the effect that the kit is only to be used for the inspection of Class III, IIIHD and IIII devices or that it is not to be used to inspect Class II devices.

#### Examples of statements:

- Inspector weight kit (not for precious metals)
- To be used to inspect Class III, IIIHD and IIII devices only
- Not to be used to inspect Class II devices

The case of a precious metal weight kit must be labelled as such or bear a statement to the effect that the kit is only to be used for the inspection of Class II devices or that it is not to be used to inspect Class III, IIIHD and IIII devices.

**Examples of statements:**

- Precious metal weight kit
- To be used to inspect Class II devices only
- Not to be used to inspect Class III, IIIHD and IIII devices

**Note:** All the weights of a weight kit must belong to the same tolerance class. Mixing weights of different tolerance classes within a single weight kit is not permitted.

2.2.4 Serial number format

The case must clearly be labelled with a serial number that may only contain numbers, letters, spaces and/or a dash (-). No other characters may be used.

2.2.5 Serial number length

Serial numbers must be no longer than 10 characters, including spaces and dashes.

2.2.6 Serial number uniqueness

Serial numbers must be unique. If the serial number of a new weight kit is already in use by another ASP, it will be rejected. Therefore, it is recommended that the serial number of any new weight kit begin with the ASP's registration or accreditation number (e.g. A0000-1234).

**Note:** The ACSL acknowledges that there is no practical means for an ASP to check whether their serial number is unique. If you wish to confirm the uniqueness of your serial numbers or have questions about appropriate serial numbers, [contact the ACSL](#). Should the ACSL receive a weight kit that does not have a unique serial number, it will contact the kit owner so that the serial number can be changed. The weight kit will not need to be returned to the owner for the serial number to be changed.

2.2.7 Serial number of smaller cases within the main case

Any smaller cases within the main case must clearly be labelled with the serial number of the main case.

2.2.8 Serial number identification

The serial number must be prefaced with words or abbreviations identifying it as the serial number (e.g. S/N, serial number, etc.).

2.2.9 Other markings

No other numbers which may be mistaken as the serial number (e.g. model numbers) can be marked on the kit, unless their meaning is clearly indicated.

**Example:** If a kit has a model number marked on it, the number must be prefaced by words such as "model number".

## 2.3 Weight kit construction

### 2.3.1 Single case requirement

All weights must be kept in a single case. Smaller cases within the main case may be used to store weights provided that the cases are appropriately marked with matching serial numbers.

**Exception:** For weight kits including 10 kg and 20 kg weights (which are only permitted in precious metal weight kits), it is acceptable to have two cases to make transportation more practical. In this case, the cases must be marked "1 of 2" and "2 of 2" in addition to the other marking requirements in section 2.2.

### 2.3.2 Case construction

Each weight must have its own appropriately sized compartment in the case that fully supports the weight and prevents the weight from moving during shipping and coming into contact with other weights. Weights must not touch one another, except for the leaf weights (less than 1 g or 0.005 lb) in inspector weight kits, which may be stored in a single compartment.

### 2.3.3 Case interior

The interior of the case must be such that the weights are protected against any wear, abrasion or shock that may be encountered during shipping. Any adhesives or glue used in the construction of the weight kit case must not come into contact with the weights. Weights must not come into contact with any portion of the interior of the case that is not designed to hold and protect the weights.

### 2.3.4 Weights permitted in the case

The case may only contain certified weights belonging to the same weight kit. Any smaller cases within the main case must be part of the same weight kit and marked with the same serial number. No other weights (including uncertified weights) may be stored in the case. Weight kits may not be stored within one another.

### 2.3.5 Tools and items permitted in the case

The only objects that are permitted to be stored in a weight kit case are the most recent certificate, tweezers, clean gloves, hooks and other tools directly related to handling weights. Any such object must be secured so that it does not come into contact with the weights.

#### Notes:

1. Only plastic or plastic tipped tweezers may be stored in precious metal weight kits; metal tipped tweezers are not permitted.
2. Dirty gloves and other tools and objects must not be stored inside weight kit cases. This includes anything not directly related to the weight kit itself.

### 2.3.6 Case cleanliness

Weight kit cases must be **clean** and **dry**. There should be no liquids, crumbs, sawdust, mould, mildew, stickers, tape, glue, dirt, sand, tape, nails, screws, seals, sealing wire, etc., within the case. Weight kits that are damp and mouldy pose a safety hazard to ACSL personnel and will be returned uncalibrated so that they may be repaired prior to calibration. See the Appendix for cleaning information.



### 2.3.7 Case maintenance

Weight kit cases must be in a state of good repair. This includes hinges that function properly, lids that close properly and stay closed, and clasps that fasten properly. No part of the kit should pose a safety hazard to ACSL personnel (e.g. sharp, rusty, or broken clasps or hinges). Kits that pose a safety hazard to ACSL personnel will be returned uncalibrated so that they may be repaired prior to calibration. Kit cases that are damaged in such a way that they will not allow for the safe return of calibrated weights will be returned uncalibrated so that the kit may be repaired prior to calibration.

### 2.3.8 Shipping of cases

Weight kit cases must be sufficiently sturdy and packed well enough to be shipped to and from the ACSL every year.

**Note:** It is strongly recommended that dedicated purpose-built shipping containers be used for fragile cases, such as those commonly supplied with precious metal weight kits.

## 2.4 Weight identification

### 2.4.1 Inspector weight identification

All individual weights must be identified by a unique serial number that consists of numbers, letters and/or a dot (•), a dash (-) and a space. Leaf weights less than 1 g need only to be distinguishable.

“Distinguishable” means that if there is more than one leaf weight of the same nominal value, the duplicate leaf weights must be either:

- identified by a unique serial number that consists of numbers, letters and/or symbols (as defined above); **or**
- marked by, at minimum, a dot (•) or series of dots.

**Examples:** If a weight kit contains one 100 mg leaf weight, no marking is needed.  
If there are two 200 mg leaf weights, at least one must be marked with, at minimum, a dot.

**Note:** Serial numbers must be unique within each ASP. No two weights owned by the same ASP may have the same serial number.

### 2.4.2 Precious metal weight identification

All individual weights must be distinguishable (see 2.4.1). They may alternatively be identified by a unique serial number that consists of numbers, letters and/or symbols. For serial numbers, the acceptable symbols are a dot (•), a dash (-) and a space.

### 2.4.3 Serial number length

Serial numbers must be no longer than 10 characters, including spaces and symbols.

### 2.4.4 Serial number permanence

Serial numbers must be permanent. They must be engraved, stamped or etched into the weights. Ink or stickers cannot be used.

## 2.5 General requirements for weights

### 2.5.1 Weight maintenance

Weights must be clean, dry and free of dust, dirt, corrosion, rust, oils, paints, residues, stickers, ink and any other materials. Any material that adheres to the weights during their normal course of use should be removed prior to sending the weight kit in for calibration. See the Appendix for cleaning information.

## 2.5.2 Weight magnetization

Weights must not be magnetized. Highly magnetized weights cannot be calibrated because they interfere with the mass comparators.

## 2.6 Inspector weights

### 2.6.1 Inspector weight material

All inspector weights with nominal values greater than 100 mg must be constructed from stainless steel. Weights with nominal values from 10 mg to 100 mg may be constructed from stainless steel or aluminum. Further technical requirements can be found in [OIML recommendation R 111-1 edition 2004](#).

### 2.6.2 Inspector weight construction

All inspector weights must be smooth and not have any sharp edges or deep grooves.

**Note:** Weights plated with chrome or any other material will not be accepted if there is any indication of peeling or flaking.

### 2.6.3 Contents of inspector weight kits

Inspector weight kits must be composed of weights no larger than 5 kg (10 lb) and no smaller than 10 mg (0.001 lb). The weights in an inspector weight kit may be in either metric or Canadian units, but mixing the two is not permitted.

An inspector weight kit may include up to 32 weights with any combination of the nominal values listed below, with a total weight of 30 kg (60 lb) or less.

#### Acceptable nominal values for inspector weights

##### Metric units

In kilograms (kg): 5 kg, 3 kg, 2 kg, 1 kg

In grams (g): 500 g, 300 g, 200 g, 100 g, 50 g, 30 g, 20 g, 10 g, 5 g, 3 g, 2 g, 1 g

In milligrams (mg): 500 mg, 300 mg, 200 mg, 100 mg, 50 mg, 30 mg, 20 mg, 10 mg

##### Canadian units

In pounds (lb): 10 lb, 5 lb, 2 lb, 1 lb, 0.5 lb, 0.2 lb, 0.1 lb, 0.05 lb, 0.02 lb, 0.01 lb, 0.005 lb, 0.002 lb, 0.001 lb

In ounces (oz): 8 oz, 4 oz, 2 oz, 1 oz, 1/2 oz, 1/4 oz, 1/8 oz, 1/16 oz, 1/32 oz

**Exception:** Inspector weight kits that contain more than 32 weights or weights of nominal values other than those listed above and that were certified before the original release date of this document can continue to have those weights provided they are calibrated annually. Should one of these weight kits miss its annual calibration, any weights in excess of 32 or weights not listed above will no longer be certified.

## 2.6.4 Inspector weight tolerance

Each weight must be adjusted to within **one half** of the applicable tolerance found in Part III or IV (as applicable) of Schedule IV of the Regulations. The tolerances in the Regulations are roughly equivalent to OIML class M1 tolerances. Note that the ACSL calibrates to **one half** of the prescribed tolerance; therefore, an OIML class M1 weight must be calibrated to **one half** of the applicable OIML class M1 tolerance. Weights of a higher tolerance class (smaller tolerances) are also acceptable. Generally, an OIML class F2 weight meets the one-half tolerance requirement without any additional adjustment.

**Note:** NIST (National Institute of Standards and Technology) class F (the inspector weight class used in the United States) has much larger tolerances than those allowed by Measurement Canada. Weights calibrated to NIST class F tolerances will typically not be acceptable without being adjusted prior to being sent to the ACSL. Any new NIST class F kits that do not meet the prescribed tolerances will be returned to their owner uncertified so that adjustments can be made.

## 2.7 Precious metal weights

### 2.7.1 Precious metal weight material

All precious metal weights with nominal values greater than 5 mg must be constructed from stainless steel. Weights with nominal values from 1 mg to 5 mg may be constructed from stainless steel or aluminum. Further technical requirements can be found in [OIML recommendation R 111-1 edition 2004](#).

### 2.7.2 Precious metal weight construction

Precious metal weights must be sufficiently smooth and free of sharp edges, grooves and other surface features that may accumulate dust, dirt or other material buildups. Surfaces must be smooth, glossy, polished and reflective. Adjustment cavity covers must also be smooth enough to prevent the accumulation of dust, dirt or other material buildups.

**Note:** Weights plated with chrome or any other material will not be accepted if there is any indication of peeling or flaking.

### 2.7.3 Contents of precious metal weight kits

Precious metal weight kits must be composed of weights no larger than 20 kg and no smaller than 1 mg. The weights in a precious metal weight kit may only be in metric units.

Precious metal weight kits must follow a regular 5-2-2-1 series, with no extra weights added. In other words, there is a maximum number of weights of a given nominal value that can be added to a precious metal weight kit, as shown below.

Maximum number of weights in a precious metal weight kit		
---	1 x 20 kg	1 x 10 kg
1 x 5 kg	2 x 2 kg	1 x 1 kg
1 x 500 g	2 x 200 g	1 x 100 g
1 x 50 g	2 x 20 g	1 x 10 g
1 x 5 g	2 x 2 g	1 x 1 g
1 x 500 mg	2 x 200 mg	1 x 100 mg
1 x 50 mg	2 x 20 mg	1 x 10 mg
1 x 5 mg	2 x 2 mg	1 x 1 mg

**Examples:**

1. A precious metal weight kit with the largest weight being 2 kg and the smallest weight being 1 mg will have all of the weights listed above that are between 2 kg and 1 mg. It may have one or two 2 kg weights, and must have only one 1 mg weight.
2. A precious metal weight kit with the largest weight being 5 kg and the smallest weight being 10 mg will have all of the weights listed above that are between 5 kg and 10 mg. It may have only one 5 kg weight and only one 10 mg weight.

**Exception:** Precious metal weight kits that contain weights of nominal values other than those listed above and were first certified before the original release date of this document will be allowed to continue having those weights provided they are calibrated annually. Should one of these weight kits miss its annual calibration, any weights in it that are not listed above will no longer be certified.

**Note:** The ACSL may, at its discretion and with proper justification, accept for calibration a precious metal weight kit that does not satisfy the requirement set out above. If you have a weight kit that does not follow the configuration outlined above and you want to have it calibrated, it is necessary to first [contact the ACSL](#) and justify the need for a different configuration.

2.7.4 Precious metal weight tolerance

Each weight must be adjusted to within **one half** of the applicable tolerance found in Part I of Schedule IV of the Regulations. The tolerances in the Regulations are roughly equivalent to OIML class F2 tolerances. Note that the ACSL calibrates to **one half** of the prescribed tolerance; therefore, an OIML class F2 weight must be calibrated to **one half** of the applicable OIML class F2 tolerance. Weights of a higher tolerance class (smaller tolerances) are also acceptable. Generally, an OIML class F1 weight meets the one-half tolerance requirement without any additional adjustment.

**Note:** NIST class F is unrelated to OIML classes F2 and F1. NIST class F weights are **not** acceptable for use as precious metal weights. They are designed to be used as inspector weights in the United States and therefore have significantly larger tolerances than those allowed by Measurement Canada. A NIST class F kit is also not suitable for use as an inspector weight kit in Canada. Any new NIST class F kits sent for the purpose of being calibrated as a precious metal weight kit will be returned uncalibrated.

## Appendix: Cleaning, care and handling guidelines

When not in use, weights must be covered or stored in their carrying case to protect them from dust and contact. When stored, cases must be kept off the floor to protect them from dampness, which can affect the stability of the weights. Except during transportation, weight kits must always be stored indoors and not left in vehicles or other uncontrolled environments, especially when it is very hot, very cold or very humid.

Precious metal weights must never be touched without protective gloves or special handling tools provided for this purpose. Perspiration, oils and dirt from bare hands affect the weight's mass and contaminate its surface. Small precious metal weights (50 g and less) of a leaf or wire type must be handled with appropriate tweezers that will not scratch or damage the surface finish of the standard. Use plastic tweezers or metal tweezers with plastic tips; tweezers with metal tips must not be used.

**Note:** Because stainless steel can be damaged if it is left in contact with a chamois, Measurement Canada does not recommend their use with weights. A chamois must not be stored in a weight kit. If a new chamois will be used to move weights, it must first be washed with soap and water, and thoroughly rinsed and dried.

Before sending a weight kit in for calibration, the weights and the case must be clean. Weight kit cases must be checked for damage, and any damage must be repaired. The inside of the case must be cleaned. All weights should be removed from the case and the case should be vacuumed, and any debris must be removed.

Weights must be cleaned. Precious metal weights should only be cleaned by lightly dusting them with a lint-free cloth. Precious metal weights must never be cleaned by rubbing, polishing or using compressed air or chemicals. Inspector weights are cleaned by scrubbing off excess rust and other materials stuck to the weights. Rust can be removed using fine steel wool if necessary. Oil and dirt may be removed by using a cloth moistened with denatured alcohol or mineral spirits. The cleaning solution must be allowed to evaporate for a minimum of 24 hours prior to weights being placed back into the case.