Consumer and Corporate Affairs Canada
Consommation et Corporations Canada

WEIGHTS AND MEASURES

CALIBRATION AND CERTIFICATION PROCEDURES FOR VOLUMETRIC STANDARDS

Canada

CALIBRATION AND CERTIFICATION

OF

VOLUMETRIC STANDARDS

LEGAL METROLOGY BRANCH

1990.11

TABLE OF CONTENTS

DEFINITIONS

The following terms are defined for the specific needs of this manual.

Measure or test measure — Narrow neck standard which is filled and emptied by the top and the capacity of which does not normally exceed 50 litres. They are generally used to test dispensers or high speed dispensers.

Prover or open prover — Narrow neck standard with a capacity exceeding 50 litres, which is equipped with drain piping and a valve. They are generally used to test meters with a capacity exceeding 115 litres per minute.

Master standard — Standard, owned by the Department of Consumer and Corporate Affairs, designed and used to calibrate measures and provers. Master standards belong to a class of local standards of a higher precision than measures and provers.

Local standard — Standard, owned by the Department of Consumer and Corporate Affairs, designated under section 13 of the Weights and Measures Act and certified in relation to a reference standard as being accurate within prescribed tolerances.

Industrial standard — Standard, other than those owned by the Department of Consumer and Corporate Affairs, certified in relation to a reference standard as being accurate within the same tolerances applicable to local standards.

Measurement uncertainty — An estimate characterizing the range of values within which the true value of a measument result is expected to lie with stated probability.

Traceability — The property of a result of a measurement whereby it can be related to reference standards, through an unbroken chain of comparisons. (*ref. International vocabulary of basic and general terms in metrology*)

Reference standard — Reference standard means a standard that: (a) represents or registers a unit of measurement referred to in Schedule I or II or that represents or registers a multiple or fraction of such a unit of measurement; (b) has been calibrated and certified by the National Research Council of Canada, and (c) is or is to be used as a standard for the purpose of determining the accuracy of a local standard. (*ref. Weights and Measures Act*)

CALIBRATION AND CERTIFICATION OF VOLUMETRIC STANDARDS

INTRODUCTION

1. SCOPE

This manual contains the criteria for acceptance and methods and procedures for the calibration and certification of volumetric standards used by Weights and Measures inspectors for the inspection of measuring devices used in trade.

Existing volumetric standards which do not comply with the acceptance criteria contained in this manual may continue to be used, recalibrated and certified as long as they do not contain any defects which could affect their accuracy.

2. AUTHORITY

The power and duties conferred upon the Minister by the Weights and Measures Act to designate and certify local standards have been delegated to persons occupying specific positions in the Department of Consumer and Corporate Affairs. The delegation of authority document can be found in Appendix I.

Calibration certificates for industrial standards should be signed by the same persons who have been delegated the authority to certify local standards.

3. ADMINISTRATIVE CONSIDERATIONS

The calibration and certification of industrial volumetric standards is the responsibility of the regions. The calibration and certification of volumetric local standards is, for metrological control reasons, the responsibility of the Legal Metrology Branch.

However, in the case of doubt, regions may test volumetric local standards to ensure their accuracy. If the doubt is confirmed, the region will notify the Legal Metrology Branch which will take the necessary measures to recalibrate and recertify the standard.

4. NOTWITHSTANDING CLAUSE

Acceptance criteria and the methods and procedures contained in this manual have been developed from practices and knowledge acquired to date. They are not restrictive. Manufacturers of standards may from time to time propose alternate methods for the calibration of volumetric standards. In such cases, the alternative must be evaluated by the regional Specialist or the Engineering Section of the Legal Metrology Branch before a standard is certified.

5. CALIBRATION AND CERTIFICATION SCHEDULE

Industrial standards used or intended to be used by Weights and Measures inspectors shall be calibrated and certified in the same manner, and in accordance with the same requirements, as local standards.

The following table is extracted from section 56 of the Weights and Measures Regulations and specifies the minimum frequency of calibration of volumetric standards.

Provers (Equipped with valves)	4 years
Measures (Narrow neck standards)	1 year
Master meter	2 years
Pipe provers	4 years
Glass graduate	10 years

6. TRACEABILITY AND UNCERTAINTY

In order to certify a volumetric standard, its accuracy must be determined in relation to a reference standard. Standards used by Weights and Measures inspectors to certify trade devices are not normally calibrated by direct comparison to a reference standard, but by means of a master standard, the metrological quality of which lies between that of the reference standard and that of the standard under calibration. It is important to ensure that the master standard selected has been calibrated in relation to a reference standard so that the result of measurement can be related to it through an uninterrupted chain of comparisons.

It is impossible to determine and certify the exact value of a standard. Any calibration result is accompanied by a certain degree of uncertainty.

Uncertainties originate from many sources that can be classified in two main classes:

- Random errors which are differences between consecutive measurements that vary in an unpredictable way such as the amount of clingage in a standard or small variations in reading a thermometer or a meniscus.

- Systematic errors are differences between consecutive measurement results which remain constant or vary in a predictable way such as residual errors of a thermometer or the calibration error of a master standard itself.

Measurement uncertainties in calibrations must be reduced to the practical minimum. Here are some precautions that must be taken:

- Calibrations must be performed in an environment which is convenient for a task that requires attention, minuteness and temperature stability.

- Readings must be precisely taken

- A master standard that has superior metrological qualities and has been provided specifically for the calibration of working standards must be used. Avoid using a standard that is of the same or lower accuracy than the standard being calibrated.

7. PREPARATION OF STANDARDS

Before being calibrated, standards must have been cleaned and, if necessary repaired. Walls must be free of greasy or oily residue, dirt or rust. The coating on the inside surface must be in good condition, with no obvious peeling. The standard must be free of flammable or noxious vapours.

PART I

ACCEPTANCE CRITERIA, CALIBRATION AND CERTIFICATION

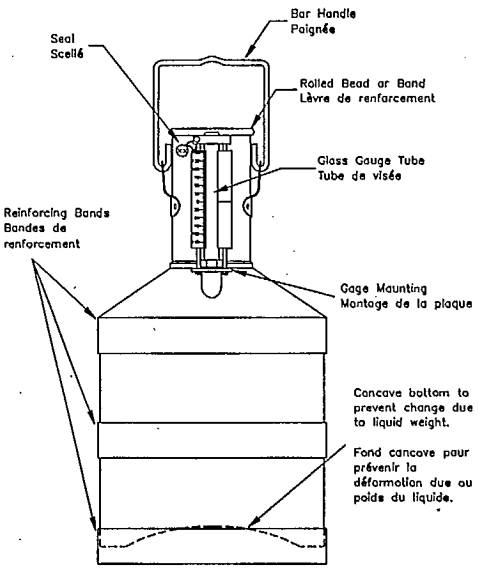
CHAPTER I

TEST MEASURES
(NARROW NECK STANDARDS)
5 LITRE, 20 LITRE AND 50 LITRE

1.1 DESIGN AND CONSTRUCTION

Material, shape and rigidity

Figure 1: 20 litre measure



1.1.1 A test measure may be made of mild steel, stainless steel or any other material resistant to the liquids to which it will be exposed. The material selected shall have a thermal expansion coefficient not to exceed twice that of stainless steel calculated at any temperature between -40°C and +40°C. The material of a measure which will be used with products likely to produce flammable vapours shall be a good conductor of electricity in order to permit the dissipation of static charges.

1.1.2 The shape of the measure shall be such that any section perpendicular to the vertical axis will be circular. The shape of the measure shall permit complete filling and discharge.

1.1.3 The measure shall be sufficiently rigid that it is not distorted during filling or emptying. Reinforcing strips may be used to support the structure of the standard.

1.1.4 The bottom of the measure shall be concave to prevent any distortion during filling due to the weight of the liquid.

1.1.5 A reinforcing strip shall be installed on the base of the measure to protect the bottom and to permit levelling. When the measure is set on a flat, level surface, the vertical axis of the measure shall be perpendicular to this surface.

1.1.6 The upper edge of the neck shall be turned to form a lip or reinforced with a strip to prevent distortion.

1.1.7 The minimum angle of the top cone shall be 35 degrees taken from the horizontal plane in the case of measures having a capacity up to 20 litres and 20 degrees for larger measures.

1.1.8 The measure shall have a handle by which it can be carried in one hand without danger of spilling the liquid contained therein.

Inside finishing

1.1.9 The interior surface shall be resistant to rust or corrosion by the liquid to be measured. The interior surface shall be smooth to facilitate the drainage. A protection coating shall be used if necessary; this coating shall be resistant to the product to be measured. The coating of a measure used with liquids likely to produce flammable vapours shall be a good conductor of electricity to permit the dissipation of any static charges which may be produced.

The neck of the measure

1.1.10 The inside diameter of the neck shall not be larger than 10 cm (4 inches).

1.1.11 The part of the neck where the sight window is located shall be uniform in shape so that the graduations are linear.

Sight window and graduated plate

1.1.12 The measure shall have a sight window or a tube and a graduated plate which complies with the requirements of Chapter III.

Marking

1.1.13 The measure shall be equipped with a descriptive plate made of a durable rust or corrosion resistant material. The markings shall be indelible. The following information shall appear on the plate:

- manufacturer's name
- serial number
- nominal capacity
- name of the material of which the measure is made
- cubical coefficient of thermal expansion of the material used

1.2 CALIBRATION

Material required

- one master standard with slicker plate (master standard)
- one thermometer graduated to 0.1°C
- sufficient water supply at room temperature
- graduated measures (10 ml, 50 ml and 100 ml)
- one spirit level
- one local standard of length
- paper towels
- inclinometer to determine the slope of the cones
- pipette

Visual examination and preparation

1.2.1 Examine the measure to ensure that its design and construction are consistent with the requirements described in 1.1.

1.2.2 Examine the measure to ensure:

- that the seals are intact
- that there is no apparent damage, such as dents, cracks in the sight glass or tube or welds, or other damages
- that the coating is not peeling, that there are no traces of rust or signs of deterioration
- that the interior of the standard is clean
- that the graduated plate is in good condition and properly installed

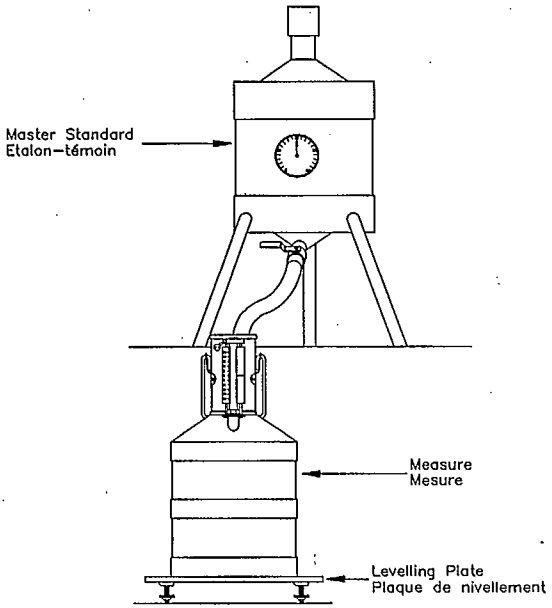
1.2.3 The measure, the master standard and the water to be used for calibration shall be at room temperature in order to limit errors due to temperature variations during calibration.

1.2.4 Examine the master standard and the slicker plate itself to ensure that they are not damaged. Examine the upper edge of the master standard to ensure that there is no mark or indentation, and that it is uniformly flat.

Arrangement of the equipment (see figure 2)

1.2.5 Place the master standard on a flat, stable, level table. The table shall have sufficient strength and stability to support the master standard without sagging. The rear bracket of the master standard shall be fastened to the table to prevent accidents or spillage. The measure shall be placed on a low table, counter or any other stable, level, flat surface. The neck of the measure shall be positioned just below the discharge pipe from the master standard. Check that the two pieces of equipment are level. Install a short hose through which the contents of the master standard may be discharged into the measure.

Figure 2: Master standard



Slicker Plate Measure
Arrangement of Equipment

Cuve d'essai avec disque
Disposition de l'équipment

Wetting and watertight check

1.2.6 Fill the master standard with water to the brim in order to wet it and test it for watertightness. Check the joints and the discharge valve for leakage.

1.2.7 Empty the contents of the master standard into the measure. Be careful not to allow any liquid to overflow. Allow the master standard to drain for the period of time indicated on its certificate. Close the valve slowly.

1.2.8 Check the joints, the gauge glass and the bottom of the measure for watertightness. Ensure that the level of the liquid is at the centre of the gauge glass.

1.2.9 Empty the measure and allow it to drain for the period of time indicated in Part II, Chapter II, Section 2.14. Reposition the measure for calibration.

Calibration (volumetric method)

1.2.10 Fill the master standard to the brim. Let it stand for a moment to allow any air bubbles to rise to the surface. Check and record the water temperature. Remove any surplus water by means of the slicker plate (see instructions in Part II, Chapter I, Section 1.2).

1.2.11 Empty the contents of the master standard into the measure being careful not to spill any of the liquid. Allow it to stand long enough for any air bubbles to rise to the surface.

1.2.12 Record the indicated volume. Record the temperature of water. Ensure that the volume previously indicated has not changed because some water could have been drawn off by the thermometer. Correct if needed.

1.2.13 On the basis of the two temperature readings, calculate the amount of water to be removed or added to the measure in order to compensate for the difference in temperature between the measure and the master standard and as well for the difference between the test temperature and 15°C (see explanations and the example in Part II, Chapter 2, Section 2.4).

1.2.14 Add or remove the quantity calculated, using the appropriate graduated measures and the pipette.

1.2.15 Adjust the graduated plate as precisely as possible, using the bottom of the meniscus of the water as the reference point. (See Part II, Chapter I, Section 1.1) Record the magnitude and direction of the adjustment performed for file purposes.

1.2.16 Repeat the test to confirm the results.

Verification of the graduated plate

1.2.17 Verify the accuracy of the markings on the graduate plate, using the appropriate graduated measures. The main graduations should be volumetrically verified; the others may be verified by linear measuring. (See detailed procedure in Part I, Chapter III.)

Sealing, Stamping and Certification

1.2.18 Ensure that the serial number marked on the name plate is the same as the one that is marked on the graduated plate. Seal the gauge plate and stamp the date of calibration on the name plate (flag and date).

1.2.19 Complete the certificate. A sample certificate is shown in Appendix 2.

CHAPTER II

PROVERS

2.1 DESIGN AND CONSTRUCTION

Material, shape and rigidity

2.1.1 A narrow neck open prover shall be constructed of low carbon mild steel, stainless steel or some other material provided that such material is compatible with the liquids to which it will be exposed. The material used shall have a coefficient of thermal expansion not to exceed twice that of stainless steel when its temperature is within the range of -40°C to +40°C.

2.1.2 The thickness of the material selected and the prover configuration shall be such to ensure sufficient structural rigidity to prevent any deformation or distortion due to filling, emptying or transportation.

2.1.3 The prover shape shall be such to ensure complete filling and emptying when properly levelled. Any horizontal cross section perpendicular to the vertical axis shall be circular except for an eccentric cone (see figure 5).

2.1.4 The bottom of the prover shall be conically shaped and sloped with a pitch of at least 10 degrees downward to the drain for proper drainage. The top of the prover shall be conically shaped to slope upwards to the narrow neck, for adequate release of air bubbles. The pitch should be at least 20 degrees for a prover having a capacity of 100 litres or less, and at least 15 degrees for provers having a capacity that exceeds 100 litres. Greater slopes should be considered for viscous liquids.

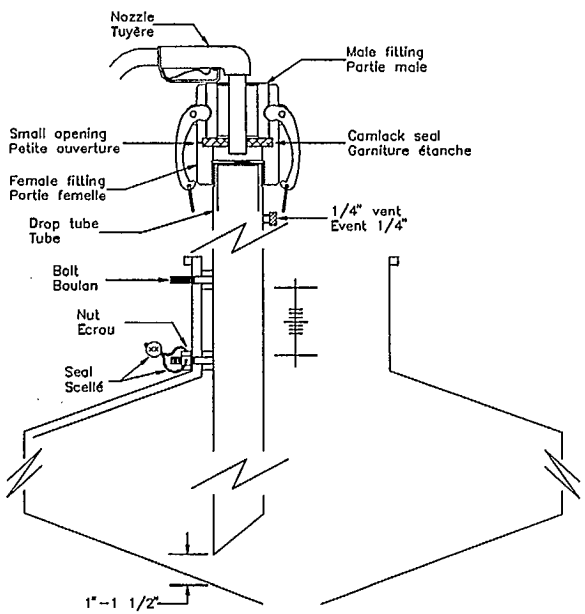
2.1.5 A prover may incorporate an adjustable displacer tube which can displace no more than 2% of the nominal capacity of the prover. The displacer shall be sealable and have automatic means to readily detect leakage.

2.1.6 Provers must be equipped with a permanently affixed drop tube that extends to the bottom cone. A drop tube is not required for provers used exclusively where the loading spout of meters, such as loading rack meters, normally reach the bottom cone or for provers used exclusively for bottom loading. (See figure 3 for an example of a drop tube.)

Figure 3: Example of a drop tube

EXAMPLE OF A DROP TUBE MOUNTING FOR A 500 LITRES PROVER USED TO VERIFY TRUCK MOUNTED METERS.

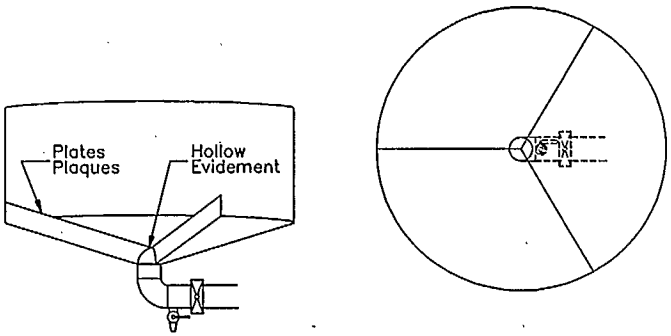
EXEMPLE DU MONTAGE D'UN TUBE POUR CUVE DE 500 LITRES UTILISÉ POUR VÉRIFIER LES COMPTEURS MONTÉS SUR CAMION.



2.1.7 Baffles shall be installed securely to the bottom cone to prevent swirling which would slow down drainage. They must be cut away over the outlet to permit free drainage.

Figure 4: Antiswirl Plates

ANTISWIRL PLATES
PLAQUES ANTIREMOUS

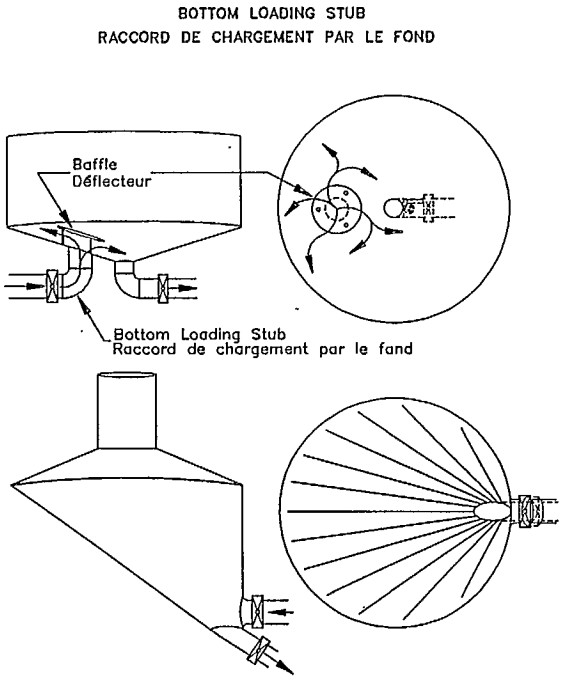


Minimum 3 blades 3" to 4" high
Minimum 3 plaques 3" à 4" de haut

Piping

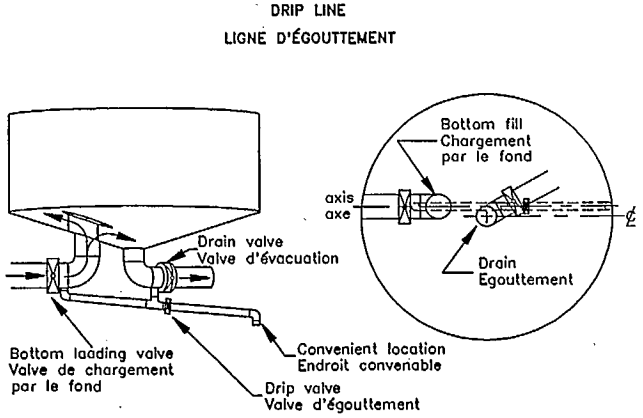
2.1.8 A bottom loading stub may be installed in the bottom cone as close as practicable to the main drain. Above the bottom loading stub, there shall be a deflector to direct the flow away from the top opening and from the displacer (see figure 5).

Figure 5: Bottom loading stub



2.1.9 All drain lines and piping shall be as short as practical and have a downward slope of at least 5 degrees (2.5 cm for every 30 cm of length). Except for the main liquid return piping, the drain lines shall terminate at a common point, convenient for the observation of draining liquid.

Figure 6: Drip line



"Drip drain" piping

- installed as short and straight as possible.
- slope of at least 5 degrees.
- installed so that air can freely escape when filling and liquid can drain entirely.
- only one valve shall control the " drip drain " piping system.
- the two connecting point and the drain point in the same axis

2.1.10 There shall be no piping ahead of the main valve except an elbow and two short nipples. The length of the pipe between the bottom cone and the main valve of the bottom loading stub must be as short and straight as practicable.

2.1.11 The prover drain valve and the bottom loading valve shall be a butterfly valve, a full bore ball valve or a large bore plug valve which can be operated with a 90 degree turn of the handle. For efficiency, the operating handles should be extended away from under the prover to a convenient location.

2.1.12 There shall be, immediately upstream of the main drain valve and the bottom loading valve, at the lowest point of the piping, a common drip line. The inside diameter of the drip line and the valve shall be 1.5 cm (0.5 inch) or larger. There shall be only one valve that controls the line. The drip line shall be as short and straight as practicable and have a slope of at least 5 degrees (see figure 6).

2.1.13 All piping and valves shall provide means to detect any leakage. A sight glass or a 1.5 cm (0.5 inch) drip connection and valve is suitable to detect leakage of the main drain valve.

2.1.14 The dimensions and configuration of the outlet piping and the size of a pump, if present, shall be such that the prover can be drained at a minimum rate of 250 litres per minute for provers of up to 2500 litres and at a minimum rate of 500 litres per minute for larger provers.

Narrow neck and funnel

2.1.15 The neck must not protrude into the top cone nor the outlet connection into the bottom cone.

2.1.16 The internal diameter of the neck shall be such that 0.25% of the prover's nominal capacity represents a displacement of at least 50 mm (2 inches) in height in the neck. However, the inside diameter of the neck does not have to be less than 10 cm (4 inches). The neck diameter shall be uniform so that the graduation marks remain exact although the scale plate is moved up or down along the neck (see Part II, Chapter II, Section 2.3).

2.1.17 The neck shall be of a sufficient diameter to permit inspection and cleaning.

2.1.18 The neck, when the prover is levelled and filled, shall be perpendicular to the liquid level.

2.1.19 The opening at the top of the neck shall be reinforced by a rolled bead or a welded band to prevent any deformation. This measure is not required if a funnel is permanently welded on the neck.

2.1.20 The prover must be provided with a foam/overflow funnel mounted on the top of the neck. This funnel may be permanently affixed to the neck or dismountable. The size of the funnel shall be such to permit a 20% overfill calculated from the capacity mark.

Inside finishing

2.1.21 The interior surface shall be corrosion resistant. The interior surface of provers constructed of material other than stainless steel, shall be galvanized or coated with a product resistant to petroleum, solvents or any other liquid the prover may measure. In the case of an open prover intended to be used on liquids such as petroleum products which can form explosive mixtures, an electrically conducting coating must be used.

2.1.22 All interior welded seams shall be ground flush and all interior surfaces shall be smooth and free of protrusions or cavities which may hinder the free flow of the liquid.

Glass tube and graduated plate

2.1.23 There shall be a glass tube and scale plate assembly mounted along the narrow neck as described in Chapter III of Part I.

Accessories

2.1.24 Portable and mobile provers shall be equipped with two permanently affixed levels. One must be located diametrically opposite the gauge glass and the other one at 90 degrees from it. Levels shall be installed to indicate a level condition when the neck is plumb (see figure 7).

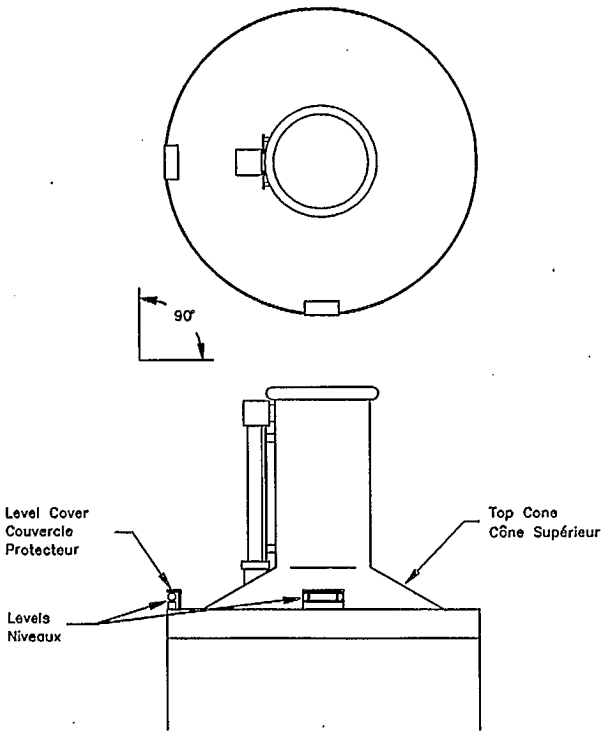
2.1.25 Portable and mobile provers shall be equipped with appropriate levelling feet or jacks.

2.1.26 Fixed provers must be installed on a rigid level base. The plumb condition of the neck shall be the level reference.

2.1.27 Any prover installed below or above ground level shall incorporate appropriate steps, safety rails and walkways to allow the inspector to safely examine all aspects of the prover and its components, to observe draining and read gauge plates with no possible error due to parallax.

2.1.28 Where appropriate, the top of the prover may incorporate an observation platform installed in close proximity to, but not in contact with the cone of the prover.

Figure 7: Location of the levels



2.1.29 On any prover where a gauge plate is higher than 150 cm (5 feet) from the ground or 1 m (3 feet) away from the reading position from the side of the prover, steps or a ladder, with safety rails shall be installed to allow for safe and accurate readings of the gauge.

2.1.30 All electrical lines and switches shall be approved for and compatible with the class of hazardous environment in which the prover will be used.

2.1.31 An adequate grounding system shall be installed on provers intended to be used with products that can form flammable mixtures and can generate static electrical charges. The grounding system shall permit an interconnection between the prover, a truck and a loading rack, and the top of the neck and the top loading spout (see figure 8).

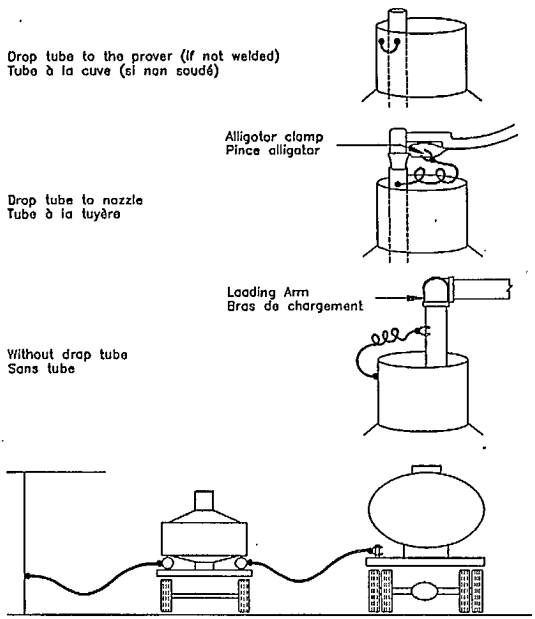
Marking

2.1.32 Provers shall be equipped with a marking plate made of a durable material resistant to corrosion or rust. The marking must be permanent. Provers shall be marked with the following information:

- name of the manufacturer
- serial number
- nominal capacity
- type of material of which the prover is made
- cubical coefficient of thermal expansion of the material

Figure 8: Grounding system

GROUNDING SYSTEM FOR PROVERS USED ON FLAMMABLE LIQUIDS
MISE À LA TERRE POUR LES CUVES UTILISÉES SUR PRODUITS INFLAMMABLES



Prover to the body of the truck and to the loading rack.
De la cuve au châssis du camion et à la rampe de chargement

2.2 VOLUMETRIC CALIBRATION

Equipment required

- A master local standard of an adequate size
- Glass graduates of 10, 50, 100, 250, 1000 ml
- Local standard thermometer graduated to 0.1°C
- Local length measure (tape)
- Stop watch
- Level
- Explosimeter
- Inclinometer
- Pipette

Visual examination and preparation

2.2.1 Examine the open prover to ensure that the design and construction conform to the specifications in 2.1 of this chapter. Ensure that the diameter of the neck, the slope of the cones and the dimension and installation of the piping comply with the requirement.

2.2.2 Examine the prover to ensure that:

- an adequate means of sealing the gauge plate is provided;
- there is no damage such as bumps, cracked glass tube, cracked welds or other damage;
- the internal coating does not flake off, there is no rust or any sign of deterioration;
- the prover is clean, and free of hazardous vapours. (Use a suitable explosimeter)
- the gauge plate is in good condition and properly installed

2.2.3 The calibration must be done in a suitable working area sheltered from significant variations of temperature and away from cold drafts of air.

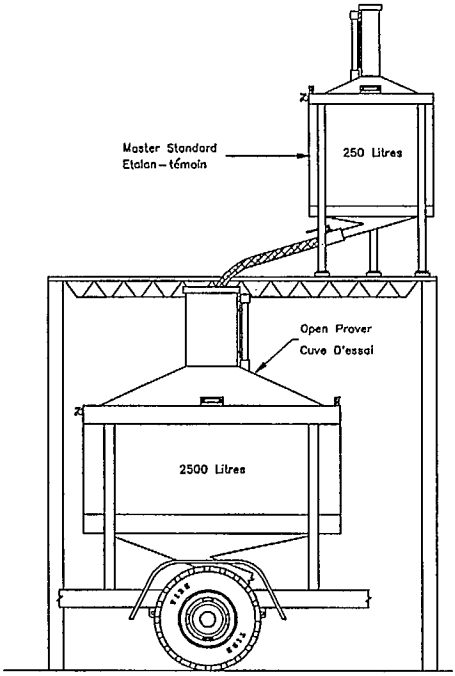
2.2.4 As it is not practical in most cases to accumulate, store and pre-condition enough water for the calibration of large provers, water from the tap will be used. In such cases, enough water must be circulated to get a constant temperature. The metal temperature of both the master local standard and the open prover must be brought and stabilized as close as practicable to the temperature of the water.

2.2.5 Examine the master standard to detect any damage. The seal must be intact.

Equipment set-up

2.2.6 The master standard must be placed on a rigid support structure above the open prover. The structure must be stable and strong enough to safely support the weight of the master standard full of water. A safe working platform must allow the inspector to manipulate the valves and read the gauge plate accurately (see figure 9).

Figure 9: Set-up for calibration



2.2.7 The prover must be located and properly levelled under the master standard. The levelling must be done using the neck as reference and the neck must be plumb. Once the neck is plumb, the two levels (portable and mobile provers) must indicate a level condition. If not, the prover must be adjusted.

2.2.8 A short hose must be connected to the outlet of the master standard to direct water down into the prover. The hose must be as short as possible and must be arranged so as not to retain or trap any water.

2.2.9 Close the main and drain valves of the prover and the master standard and fill them up to the top.

2.2.10 Examine both the prover and the master standard to ensure that there are no leaks. Pay particular attention to the welded joints, connections, sight glasses, glass tubes and valves.

2.2.11 Ensure that the prover and the master standard are still level once full of water.

2.2.12 During this verification, the temperature of both the prover and the master standard should have time to stabilize at the water temperature.

2.2.13 Empty the open prover and close the main valve. Open the drain valve located immediately upstream of the main valve, drain the open prover according to the procedure described in Part II, Chapter II, Section 2.1. Close the drain valve.

2.2.14 Take a temperature reading of the water in the master standard and record it on the work sheet. Adjust the level of water in the master standard as close as possible to the nominal capacity mark.

2.2.15 Deliver the water into the open prover. Be careful not to loose water during the transfer. Once the master standard is empty, let it drain for the time indicated on its certificate.

2.2.16 Repeat the above operation to fill the open prover up to its nominal capacity. Take the temperature of the water in the master standard for each draft and record it on the work sheet. Readings and measurements must be done accurately.

2.2.17 Take an accurate temperature reading of the water in the open prover filled to its nominal capacity. Calculate the quantity of water to add or remove for temperature/expansion compensation (see explanation and an example in Part II, Chapter II, Section 2.4).

2.2.18 Set the gauge plate as close to zero error as possible using the bottom of the meniscus as reference (see figure 13, Chapter I, Part II). Record the magnitude and direction of the adjustment performed for file purposes.

2.1.19 Repeat the test to confirm the result.

Checking the gauge plate

2.2.20 Check the graduation accuracy of the gauge plate using appropriate glass graduates. The main graduations must be volumetrically checked, other graduations can be checked simply by linear measurement (see detailed procedure in Chapter III, Part I).

Sealing, stamping and certification

2.2.21 Ensure that the serial number marked on the name plate is the same as the one that is marked on the graduated plate. Seal the gauge plate and stamp the date of calibration on the name plate (flag and date).

2.2.22 Write the certificate. A sample of the certificate is found in Appendix II.

CHAPTER III

GRADUATED PLATE, SIGHT WINDOW AND TUBE

3.1 GRADUATED PLATE (see figure 10)

3.1.1 The graduated plate shall be made of rigid, corrosion or rust resistant metal such as aluminum, brass or stainless steel.

3.1.2 The graduations, figures and other markings shall be permanent and of a colour contrasting with that of the plate.

3.1.3 The graduation lines shall be between 0.400 mm and 0.600 mm (0.015 and 0.025 inch) in width. The graduated plate shall allow readings of ± 1% of the nominal capacity in the case of a 5, 20 or 50 litre measure and ± 0.5% in the case of a prover having a capacity of more than 50 litres.

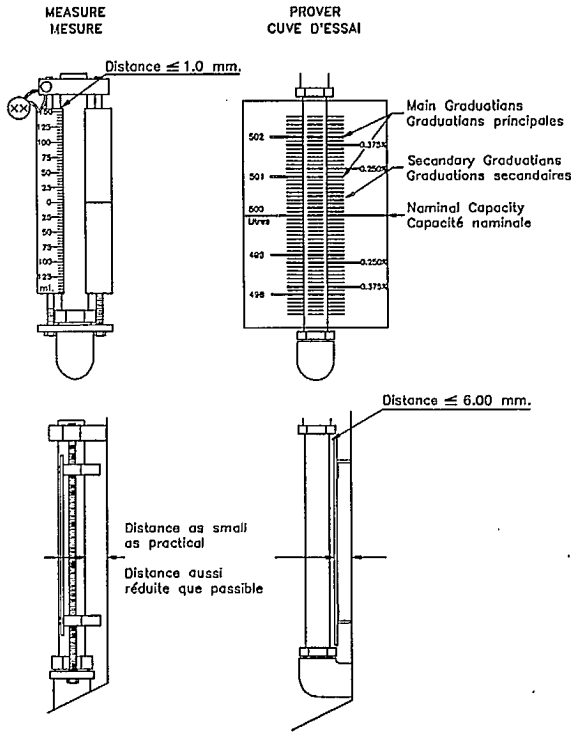
3.1.4 The graduation representing the nominal capacity and the main graduations shall be defined with their value accompanied by the unit of measurement.

3.1.5 The graduation corresponding to the nominal capacity shall extend the full width of the plate. When the plate is mounted on the side of the sighting tube, the main graduations shall be at least 0.600 cm (0.25 inch) in length and the secondary graduations at least 0.300 cm (0.125 inch) in length. In such cases, the graduations shall extend to the edge of the plate. When the plate is mounted behind the sight tube, the main graduations shall be at least 5 cm (2 inches) in length and the secondary graduations at least 2.5 mm (1 inch) in length.

3.1.6 The distance between each of the graduation lines shall be constant and at least 1.5 mm (0.06 inch).

3.1.7 Each graduated plate shall bear graduations in only a single unit of measurement. However, a measure or a prover may have two graduated plates, each bearing different units of measurement. There should be no possibility of confusion between the units. The permissible units of measurement are those appearing in schedules I and II of the Weights and Measures Act. Percentage may also be used.

Figure 10: Graduated plates and tubes



3.1.8 The value of the minimum graduation shall not be greater than the values indicated in the following table:

Capacity	Minimum graduation value
5 litres	10 ml
20 litres	10 ml
50 litres	20 ml
100 litres	20 ml
200 litres	50 ml
250 litres	50 ml
500 litres	100 ml
1000 litres	200 ml
1500 litres	500 ml
2000 litres	500 ml
2500 litres	500 ml

3.1.9 The plate shall be mounted parallel to the sight window or tube and as close as possible to it, to prevent parallax errors. In any case, the distance between the tube and the plate shall not exceed 6 mm (0.25 inch) if the plate is behind the tube, and 1 mm (0.04 inch) if it is beside it (see figure 10).

3.1.10 The graduated plate shall be solidly supported at both ends. The supports shall be strong and firmly attached to the neck. The plate shall be adjustable and sealable.

3.2 SIGHT WINDOW AND TUBE

3.2.1 The sight window or tube shall be transparent, clear, watertight, resistant to the liquid with which it will be in contact, and free of any flaws or malformations which could distort the image of the surface of the liquid. It should also be resistant to any shocks which may occur in normal use.

3.2.2 The internal diameter of the sighting tube shall be 1 cm (3/8 inch) or more but shall not exceed 1.27 cm (1/2 inch) in the case of 5, 20 or 50 litres measures or 1.6 cm (5/8 inch) in the case of provers having a capacity of more than 50 litres.

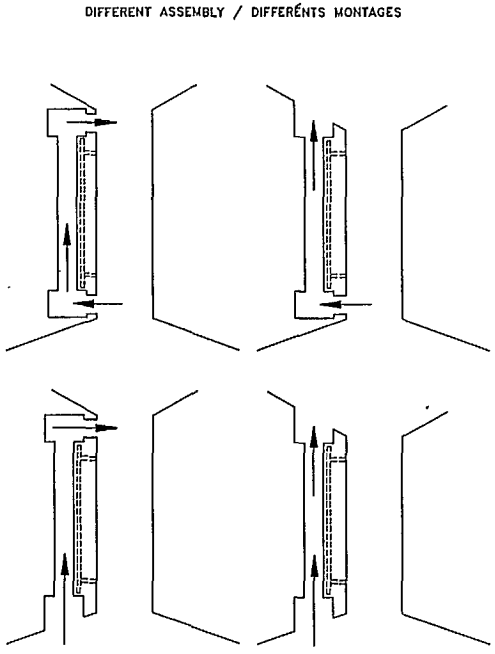
3.2.3 The sight tube shall be mounted parallel to the narrow neck and as close as possible to it, in order to minimize the possibility of parallax errors. It shall be mounted with watertight connections to permit ready removal or replacement of the tube for cleaning. The use of glue or cement to seal joints is not permitted.

3.2.4 The sight tube shall not contain valves or petcocks. It shall be mounted in such a way that it does not retain liquid during emptying or trap air during filling.

3.2.5 The top of the tube, in the case of 5, 20 and 50 litres measures, shall be at the same level as the top of the neck to avoid overflowing during filling. In the case of provers, both ends of the tube shall be connected to the interior of the tank (see figure 11).

3.2.6 The sight tube shall be protected by a shield or other appropriate means.

Figure 11: Different sight tube arrangements



3.3 ACCURACY TEST OF THE GRADUATIONS

Important recommendations

3.3.1 The purpose of this test is to ensure that the values of the graduations correspond to the volume of liquid displaced and to determine if the diameter of the neck is constant throughout its length.

3.3.2 The test will be done starting from a main graduation at the bottom of the plate and going up, meaning by adding a predetermine quantity of water. This method is easier than having to remove a pre-determined quantity of water from the prover or the measure. Moreover, it corresponds to the normal way of using a measure or a prover.

3.3.3 A high degree of precision is required in performing this test; be careful not to spill any water. Avoid multi-draft measurements: a quantity of 100 ml should be measured using a 100 ml glass graduate and not 10 drafts of 10 ml using a 10 ml glass graduate. Take into account any discrepancy between the indicated and the true values of the glass graduate as shown on the certificate. Before taking a reading, agitate the water in the glass tube to get a uniform meniscus.

3.3.4 Main graduations must be checked by adding a measured quantity of water; intermediate graduations may be checked by linear measurement.

Procedure

3.3.5 The graduated plate shown in figure 12 may serve to visualise the graduation test procedure.

3.3.6 Set the liquid level in the open prover or the measure so that the bottom of the meniscus is in line with the 498 litre graduation. Do not forget to agitate water in the glass tube before every reading. Measure 1000 ml of water using a 1000 ml graduate. Pour the water into the prover. The bottom of the meniscus should be in line with the 499 litres graduation. Measure and add another 1000 ml of water. The bottom of the meniscus should mow be in line with the 500 litres graduation. During this test record any error.

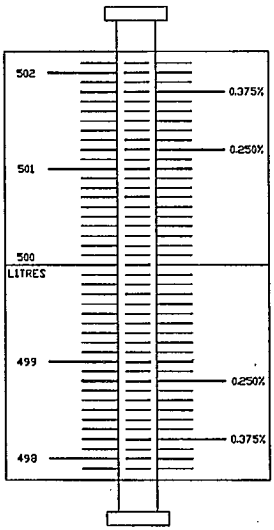
3.3.7 If needed, before going further, set the liquid level to the 500 litre graduation. Verify the 501 litres and 502 litres graduation using the same method.

3.3.8 If the results are conclusive, proceed with the verification of the intermediate graduations using a ruler or a compass. Ensure that the interval between graduations are equidistant.

Tolerances

3.3.9 Intervals between graduations of the same value shall be equal. There shall be no error greater than 1/4 of the smallest graduation as shown in the table of section 3.1.8 or 1 mm whichever is greater (see figure 12).

Figure 12: Tolerances



PART II

SPECIAL PROCEDURES

TABLES, TECHNICAL INFORMATION

AND CALCULATIONS

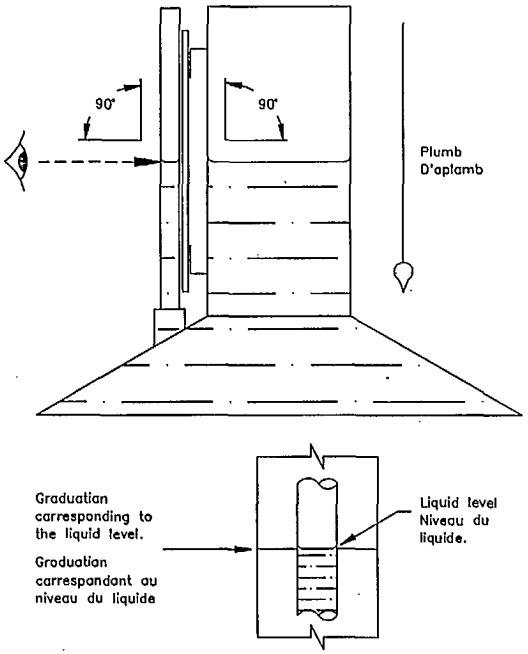
CHAPTER I

SPECIAL PROCEDURES

1.1 READING THE GAUGE PLATE

1.1.1 The open prover (or the measure) must be properly level; the neck must be plumb so that its axis is perpendicular to the surface of the liquid. To take a correct reading, it is necessary to face the graduated plate so that the line of vision forms an angle of 90 degrees with the narrow neck. The bottom of the meniscus is the reference point (see figure 13).

Figure 13: Reading the gauge plate



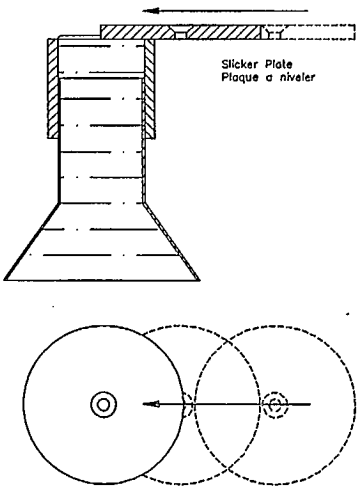
1.2 USING THE SLICKER PLATE

1.2.1 The slicker plate shall be clean and free of scratches, and shall not have any deformation.

1.2.2 Fill the measure so that the water is just ready to overflow the brim. You will notice that the surface of the water is slightly higher than the brim. This is due to the surface tension.

1.2.3 Use the slicker plate to remove the surplus water. To do so, lay down the slicker plate on one side of the brim, and simply slide it until it covers entirely the opening. The slicker plate must perfectly lay on the brim. The hollow side must be on top. Do not press down on the slicker plate or force it (see figure 14).

Figure 14: Slicker plate



1.2.4 There must be no air bubbles trapped underneath the plate once the slicker plate entirely covers the opening.

1.2.5 Wipe the surplus water off the outside of the master standard and carefully the excess of water on the plate.

1.2.6 Once the adjustment is done, empty the master standard into the test measure.

CHAPTER II

TABLES AND CALCULATIONS

2.1 "DRIP DRAIN" TIME

2.1.1 Working Volumetric Standards are calibrated "to deliver". It means that a standard will deliver a quantity corresponding to its nominal capacity, if the drainage procedure is done properly; or else, after being wetted and drained properly, a standard contains a volume corresponding to its nominal capacity.

2.1.2 The quantity of liquid remaining in the standard, after being wetted and drained, must be constant. The standard must be drained using the same procedure each time.

Measures

2.1.3 Hold the measure upside down with an angle so that there will be only one drip point. When the liquid flow breaks into distinct drops, drain for the time indicated in the table below. Return the measure to its upright position.

Open provers

2.1.4 Empty the prover through the main return piping. When the main flow stops, close the main valve immediately. Open the drain valve. When the liquid flow breaks into distinct drops, drain for the appropriate time indicated in the table below.

"Drip drain" times

Nominal capacity	Time
up to 5 litres	10 seconds
over 5 up to 20 litres	20 seconds
over 20 up to 500 litres	1 minute
over 500 up to 5 000 litres	2 minutes
over 5 000 up to 15 000 litres	3 minutes
over 15 000 up to 30 000 litres	4 minutes
over 30 000 litres	5 minutes

2.2 Tolerances

2.2.1 Refer to section 54 and schedule IV of the Weights and Measures Regulations for tolerances applicable to Volumetric Local Standards. The same tolerances apply to volumetric standards owned by the private industry.

2.2.2 The tolerances prescribed in the tables of Schedule IV are the maximum permissible errors in relation to the absolute value. These tolerances include any reading and measurement uncertainties gathered through the calibration chain from and including the Reference Standard. Therefore, calibrations must be done in such a way so as to minimize errors and uncertainties as much as possible.

2.2.3 The chart in Appendix III gives an idea of the hierarchy of volumetric standard owned by the Department of Consumer and Corporate Affairs.

2.3 Calculation of the diameter of the narrow neck

2.3.1 The diameter of the narrow neck shall be such that the addition of a quantity of liquid corresponding to 0.25% of the prover's nominal capacity will increase the liquid level by at least 50 mm (2 inches). The inside diameter of a narrow neck prover or measure does not need to be less than 10 cm (4 inches).

2.3.2 The following is an example of how the maximum diameter of the neck of a 1000 litre prover is calculated:

1000 l X 0.25 % = 2.5 litres (2 500 cc)

$$d = 2 \times \frac{\text{volume}}{3.1416 \times h}$$

$$d = 2 \times \frac{2500 \text{ cc}}{3.1416 \times 5 \text{ cm}}$$

d = 25.2313 cm or 9.93 inches

* Note that a 10 inch neck diameter would be acceptable.

2.3.3 The following table provides the maximum acceptable values for the inside diameter of the neck and the slope of the cones for different sizes of working standards.

Nominal Capacity	Neck diameter	Minimum top cone pitch	Minimum botton cone pitch
5 litres	10 cm (4")	35	-
20 litres	10 cm (4")	35	-
50 litres	10 cm (4")	20	-
100 litres	10.5 cm (4")	20	10
250 litres	12.6 cm (5")	15	10
500 litres	17.8 cm (7")	15	10
1 000 litres	25.2 cm (10")	15	10
1 500 litres	30.9 cm (12")	15	10
2 500 litres	39.9 cm (15.7")	15	10

2.4 CORRECTING THE VOLUME TO 15°C

2.4.1 By convention, volumetric standards, except those used for the inspection of milk meters, are referenced to a temperature of 15°C. Stainless Steel provers used for the inspection of milk meters are referenced to 4.4°C.

2.4.2 The volumetric calibration is, in most cases, done using water at a temperature different from 15°C. Therefore, it is imperative to compensate for the difference between the actual test temperature and 15°C. Correction factors are used to take into account the expansion/contraction of water and of both the prover and the master standard.

2.4.3 The manufacturer is responsable to provide the cubical coefficient of thermal expansion of the material of which the prover or the measure is made. The nameplate of a measure or prover must be permanently stamped with the cubical coefficient of thermal expansion for future reference.

The following table provides the cubical coefficient of thermal expansion for some metals or alloys.

Metal or Alloy	Cubical coefficient per °C
Stainless steel type 304 (used to fabricate CCAC provers)	51.84×10^{-6}
Stainless steel type 316	45.36×10^{-6}
Stainless steel (Alloy used by Seraphin test measure)	47.7×10^{-6}
Mild steel (CCAC provers)	33.48×10^{-6}
Invar	0.9×10^{-6}
Aluminium	71.41×10^{-6}
Brass	57.24×10^{-6}

Note: The cubical coefficient of thermal expansion (C_c) of a material is related to its linear coefficient of thermal expansion (C_L) as follows: $C_c = 3 \times C_L$.

2.4.4 Densities of water at different temperatures provided in Wagenbreth and Blanke table are used to calculate coefficients of expansion for calculating the volume correction of volumetric standards.

WAGENBRETH AND BLANKE TABLE

DENSITIES OF WATER

The values that are listed in the following table indicate the (mass) density of water in kg/m3 for each 0.1 °C.

t_{68} °C	0,0	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9
0	999,8396	999,8463	999,8528	999,8591	999,8653	999,8713	999,8771	999,8827	999,8882	999,8934
1	999,8985	999,9035	999,9082	999,9128	999,9172	999,9214	999,9254	999,9293	999,9330	999,9365
2	999,9399	999,9431	999,9461	999,9489	999,9516	999,9541	999,9565	999,9587	999,9607	999,9625
3	999,9642	999,9657	999,9670	999,9682	999,9692	999,9701	999,9708	999,9713	999,9717	999,9719
4	999,9720	999,9718	999,9716	999,9711	999,9705	999,9698	999,9689	999,9678	999,9666	999,9652
5	999,9637	999,9620	999,9602	999,9582	999,9560	999,9537	999,9513	999,9487	999,9459	999,9430
6	999,9399	999,9367	999,9334	999,9299	999,9262	999,9224	999,9184	999,9143	999,9101	999,9057
7	999,9011	999,8964	999,8916	999,8866	999,8815	999,8762	999,8708	999,8652	999,8595	999,8537
8	999,8477	999,8416	999,8353	999,8289	999,8223	999,8157	999,8088	999,8019	999,7947	999,7875
9	999,7801	999,7726	999,7649	999,7571	999,7492	999,7411	999,7329	999,7246	999,7161	999,7075
10	999,6987	999,6898	999,6808	999,6717	999,6624	999,6530	999,6434	999,6337	999,6239	999,6140
11	999,6039	999,5937	999,5834	999,5729	999,5623	999,5516	999,5408	999,5298	999,5187	999,5074
12	999,4961	999,4846	999,4730	999,4612	999,4494	999,4374	999,4253	999,4130	999,4007	999,3882
13	999,3756	999,3628	999,3500	999,3370	999,3239	999,3106	999,2973	999,2838	999,2702	999,2565
14	999,2427	999,2287	999,2146	999,2004	999,1861	999,1717	999,1571	999,1424	999,1276	999,1127
15	999,0977	999,0826	999,0673	999,0519	999,0364	999,0208	999,0051	998,9892	998,9733	998,9572
16	998,9410	998,9247	998,9083	998,8917	998,8751	998,8583	998,8414	998,8244	998,8073	998,7901
17	998,7728	998,7553	998,7378	998,7201	998,7023	998,6845	998,6665	998,6483	998,6301	998,6118
18	998,5934	998,5748	998,5562	998,5374	998,5185	998,4995	998,4804	998,4612	998,4419	998,4225
19	998,4030	998,3833	998,3636	998,3438	998,3236	998,3037	998,2836	998,2633	998,2429	998,2224
20	998,2019	998,1812	998,1604	998,1395	998,1185	998,0973	998,0761	998,0548	998,0334	998,0119
21	997,9902	997,9685	997,9467	997,9247	997,9027	997,8805	997,8583	997,8360	997,8135	997,7910
22	997,7683	997,7456	997,7227	997,6998	997,6767	997,6536	997,6303	997,6070	997,5835	997,5600
23	997,5363	997,5126	997,4887	997,4648	997,4408	997,4166	997,3924	997,3680	997,3436	997,3191
24	997,2944	997,2697	997,2449	997,2200	997,1950	997,1699	997,1446	997,1193	997,0939	997,0685
25	997,0429	997,0172	996,9914	996,9655	996,9396	996,9135	996,8873	996,8611	996,8347	996,8083
26	996,7818	996,7551	996,7284	996,7016	996,6747	996,6477	996,6206	996,5934	996,5661	996,5388
27	996,5113	996,4837	996,4561	996,4284	996,4005	996,3726	996,3446	996,3165	996,2883	996,2600
28	996,2316	996,2032	996,1746	996,1460	996,1172	996,0884	996,0595	996,0305	996,0014	995,9722
29	995,9430	995,9136	995,8842	995,8546	995,8250	995,7953	995,7655	995,7356	995,7056	995,6756
30	995,6454	995,6152	995,5848	995,5544	995,5239	995,4934	995,4627	995,4319	995,4011	995,3701
31	995,3391	995,3080	995,2768	995,2456	995,2142	995,1828	995,1512	995,1196	995,0879	995,0561
32	995,0243	994,9923	994,9603	994,9282	994,8960	994,8637	994,8313	994,7988	994,7663	994,7337
33	994,7010	994,6682	994,6353	994,6024	994,5693	994,5362	994,5030	994,4697	994,4364	994,4029
34	994,3694	994,3358	994,3021	994,2683	994,2345	994,2005	994,1665	994,1324	994,0982	994,0640
35	994,0296	993,9952	993,9607	993,9261	993,8915	993,8567	993,8219	993,7870	993,7521	993,7170
36	993,6819	993,6467	993,6114	993,5760	993,5406	993,5050	993,4694	993,4338	993,3980	993,3622
37	993,3263	993,2903	993,2542	993,2181	993,1818	993,1455	993,1092	993,0727	993,0362	992,9996
38	992,9629	992,9261	992,8893	992,8524	992,8154	992,7784	992,7412	992,7040	992,6668	992,6294
39	992,5920	992,5545	992,5169	992,4792	992,4415	992,4037	992,3658	992,3279	992,2899	992,2518
40	992,2136									

2.4.5 Formulae to use for volume correction to 15°C

$$VCF = \frac{[\ 1+(\ Tm - 15\ )(\ a\ )\ ]\ Dm}{[\ 1+(\ Tp - 15\ )(\ b\ )\ ]\ Dp}$$

Tm = average temperature in the master standard

Tp = temperature in the prover

a = cubical coefficient of expansion/°C of the master standard

b = cubical coefficient of expansion/°C of the prover

Dm = water density in the master standard from the Wagenbreth and Blanke table

Dp = water density in the prover from the Wagenbreth and Blanke table

2.4.6 Example

A 500 litre prover made of mild steel is calibrated using a 100 litre master standard made of stainless steel. The temperature recorded in the master standard for each draft is respectively 7.4, 7.6, 7.5, 7.6, 7.7°C. The temperature recorded in the prover after filling is 8.2°C.

$$Tm = \frac{Tm1 + Tm2 + Tm3 + Tm4 + Tm5}{n}$$

$$Tm = \frac{7.4 + 7.6 + 7.5 + 7.6 + 7.7}{5}$$

$$Tm = 7.56°C$$

$$VCF = \frac{[\ 1+(\ 7.56 - 15\ )(\ 0.00005184\ )]\ 999.8708}{[\ 1+(\ 8.2\ - 15\ )(\ 0.00003348\ )]\ 999.8353}$$

$$VCF = \frac{[\ 1+\ (\ -0.0003853\ )]\ 999.8708}{[\ 1+\ (\ -0.0002271\ )]\ 999.8353}$$

$$VCF = \frac{0.9996147 \times 999.8708}{0.9997729 \times 999.8353}$$

$$VCF = \frac{999.48554}{999.60823} = 0.999877261$$

True volume = nominal capacity x VCF

500 litres x 0.999877261 = 499.938631 litres

500 litres - 499.938631 = 0.061369 litres

An additional 61 ml of water (at 15°C) must be added to achieve a true 500 litres at 15°C.

APPENDIX I

Delegation of Authority

Ministre
des Consommateurs
et des Sociétés

Minister
of Consumer
and Corporate Affairs

CANADA

DELEGATION OF AUTHORITY
WEIGHTS AND MEASURES ACT

DELEGATION DE POUVOIRS
LOI SUR LES POIDS ET MESURES

With respect to the powers and duties conferred upon the Minister of Consumer and Corporate Affairs by the Weights and Measures Act, I, the Minister of Consumer and Corporate Affairs, do hereby authorize the person or persons occupying the position in the Department of Consumer and Corporate Affairs listed in Column 1 of Schedule A hereto to exercise the powers and perform the duties conferred upon the Minister of Consumer and Corporate Affairs under the provisions of the said Act set out in Column 2 of that Schedule.

En vertu des pouvoirs et des tâches conférés au Ministre des Consommateurs et des Sociétés par la Loi sur les Poids et mesures, je, le Ministre des Consommateurs et des Sociétés, autorise par la présente, la ou les personnes occupant au ministère des Consommateurs et des Sociétés le poste indiqué dans la colonne 1 de l'Annexe A ci-après à exercer les pouvoirs et à accomplir les tâches conférées au Ministre des Consommateurs et des Sociétés en vertu de ou des articles de la dite loi qui sont indiqués dans la colonne 2 de cette Annexe.

Minister of Consumer and
Corporate Affairs
Ministre des Consommateurs
et des Sociétés

MAY - 1 1990
Date

K1A 0C9

SCHEDULE A

DELEGATION OF AUTHORITY
WEIGHTS AND MEASURES ACT

COLUMN 1	COLUMN 2	
Position	Section	Description
Assistant Deputy Minister, Consumer Affairs.	17(2)	furnishing inspectors with certificates.
Regional Director; Regional Manager, Weights and Measures.	40(1)	application for further detention.
Director, Legal Metrology Branch; Chief, Legal Metrology Laboratories.	3	approval of devices, or class, type or designs of devices;
	12	request for certification of standards.
Director, Legal Metrology Branch; Chief, Legal Metrology Laboratories; Manager, Gravimetric Laboratory; District Manager, Weights & Measures; Manager, Volumetric Laboratory; Manager, Electricity Laboratory; Manager, Gas Laboratory; Gravimetric Specialist; Volumetric Specialist.	13(1)	designation of local standards;
	14	replacement or restoration of standard;
	38(1)	issuance of standard certificates.

APPENDIX II

Certificate

Consumer and Corporate Affairs Canada | Consommation et Corporations Canada

Weights and Measures | Poids et mesures

Certificate of Calibration

Certificat d'étalonnage

Granted to: / Emis à:
Name/Nom: _____
Address/Adresse: _____
Tel/Tél.: _____

Certificate No./no. certificat	Issue date/Emis le:

Recalibration due:/ Date prévue de ré-étalonnage:	File No./no. de dossier:

IDENTIFICATION

Manufacturer/Fabricant:

Model number/no. de modèle:

Serial number/no. de série:

Type/Genre:

REFERENCE CONDITIONS/CONDITIONS DE REFERENCE

Nominal value/Valeur nominale:

Reference temperature/température de référence:

Reference pressure/pression de référence:

See reverse for other conditions of certification
Voir verso pour les autres conditions du certificat

Designation as a local standard

I, the undersigned, being authorized by the Minister of Consumer and Corporate Affairs to exercise the powers pursuant to Section 13 of the Weights and Measures Act, hereby designate the standard identified above as a local standard.

☐ **Désignation à titre d'étalon local**

Je, soussigné(e), étant autorisé(e) par le Ministre des Consommateurs et des Sociétés à exercer les pouvoirs conférés par l'article 13 de le Loi sur les poids et mesures, désigne l'étalon identifié plus haut à titre d'étalon local.

Certificate of calibration for non-government standards

I, the undersigned, hereby certify that the standard identified above has been calibrated in relation to relevant local standards and it is accurate within the tolerances prescribed by the Weights and Measures Regulations, subject to the conditions stated on this certificate.

☐ **Certificat de calibration pour les étalons autres que ceux du gouvernement**

Je, soussigné(e), certifie que l'étalon identifié plus haut a été calibré en relation d'étalons locaux appropriés et qu'il est précis, compte tenu des tolérances prescrites par le Règlement sur les poids et mesures et sous réserve des conditions énoncées sur ce certificat.

Position Title/Titre du poste	Signature:

Canada

Test Conditions - Conditions d'essai

The test conditions indicated by an asterisk shall apply.

Les conditions d'essai indiquées par un astérique s'appliquent.

1) The measure will deliver the indicated quantity if, after being filled to the appropriate graduation, the measure is emptied by pouring so that the liquid runs off only over one side of the rim, and after the stream breaks into drops, is drained by holding it upside down for _____ seconds, then returned to the upright position.

☐ La mesure livrera la quantité indiquée si, après avoir été remplie à la graduation appropriée, elle est vidée de façon à ce que le liquide s'écoule sur un seul côté du rebord, puis dès que le liquide se brise en gouttes, qu'elle soit maintenu _____ secondes en position renversée pour ensuite la remettre dans sa position normale.

2) The wetted measure after being filled, emptied and drained as provided herein, will require _____ litres of liquid to fill it to the _____ litre graduation.

☐ Lorsque la mesure a été remplie, vidée et égoutée de la manière indiquée par la présente, il faut _____ litres pour la remplir jusqu'au repère de _____ litre(s).

3) This measure will deliver or receive the certified volume if used with liquids having a viscosity not greater than that of No. 2 fuel oil at a temperature of 15°C.

☐ Cette mesure pourra livrer ou recevoir le volume certifié, à condition que le liquide employé ait un coefficient de viscosité inférieur ou égal à celui du mazout no 2 à la température de 15°C.

4) The certified capacity is accurate at a temperature of 4.4°C.

☐ La capacité certifiée est exacte à la température de 4.4°C.

5) The certified volume is determined by completely filling the liquid measure to its full capacity and then sliding the glass slicker plate over the top of its rim.

☐ Le volume certifié a été déterminé en remplissant la mesure à pleine capacité et en glissant le disque de verre à plat sur le rebord de son col.

6) Before being used, the liquid measure must be wetted by being filled with liquid and then drained of that liquid through the outlet valve.

☐ Avant usage, la mesure doit être mouillé en la remplissant avec du liquide et égouttée de ce liquide par la valve d'écoulement.

7) The LPG outlet valve is to be closed immediately when the liquified product appears in the lower sight glass. A one-minute drainage of the tank is allowed and then the meniscus is adjusted at the "0" graduation on the bottom sight glass.

☐ La valve d'écoulement doit être fermée dès qu'apparait le produit liquéfié dans la gauge vitrée à la base. Laissez égoutter pendant une minute et puis ajustez le ménisque sur la graduation "0" de la gauge vitrée à la base.

8) When the liquid measure is emptied by gravity or by the pump, the outlet valve of the measure is to be closed immediately on cessation of the main flow, and at the same time the petcock ahead of the outlet valve opened and kept open for _____ minute(s) after the flow from it breaks into drops, then closed.

☐ Lorsque la vidange de la mesure se fait par gravité ou par la pompe, la valve d'écoulement doit être fermée dès que cesse le flot et au même moment, la robinet de purge en avant de la valve d'écoulement doit être ouvert, lorsque le filat de liquide se brise en gouttes, laissez égoutter pendant _____ minute(s), puis le farmer.

9) When the liquid measure is emptied by gravity, the outlet valve is to be kept open for _____ minute(s) after the flow from it breaks into drops and then closed.

☐ Lorsque la vidange de la masure se fait par gravité, la valve d'écoulement doit être gardée ouverte quand le filet de liquide se brise en gouttes pendant _____ minute(s), puis la fermer.

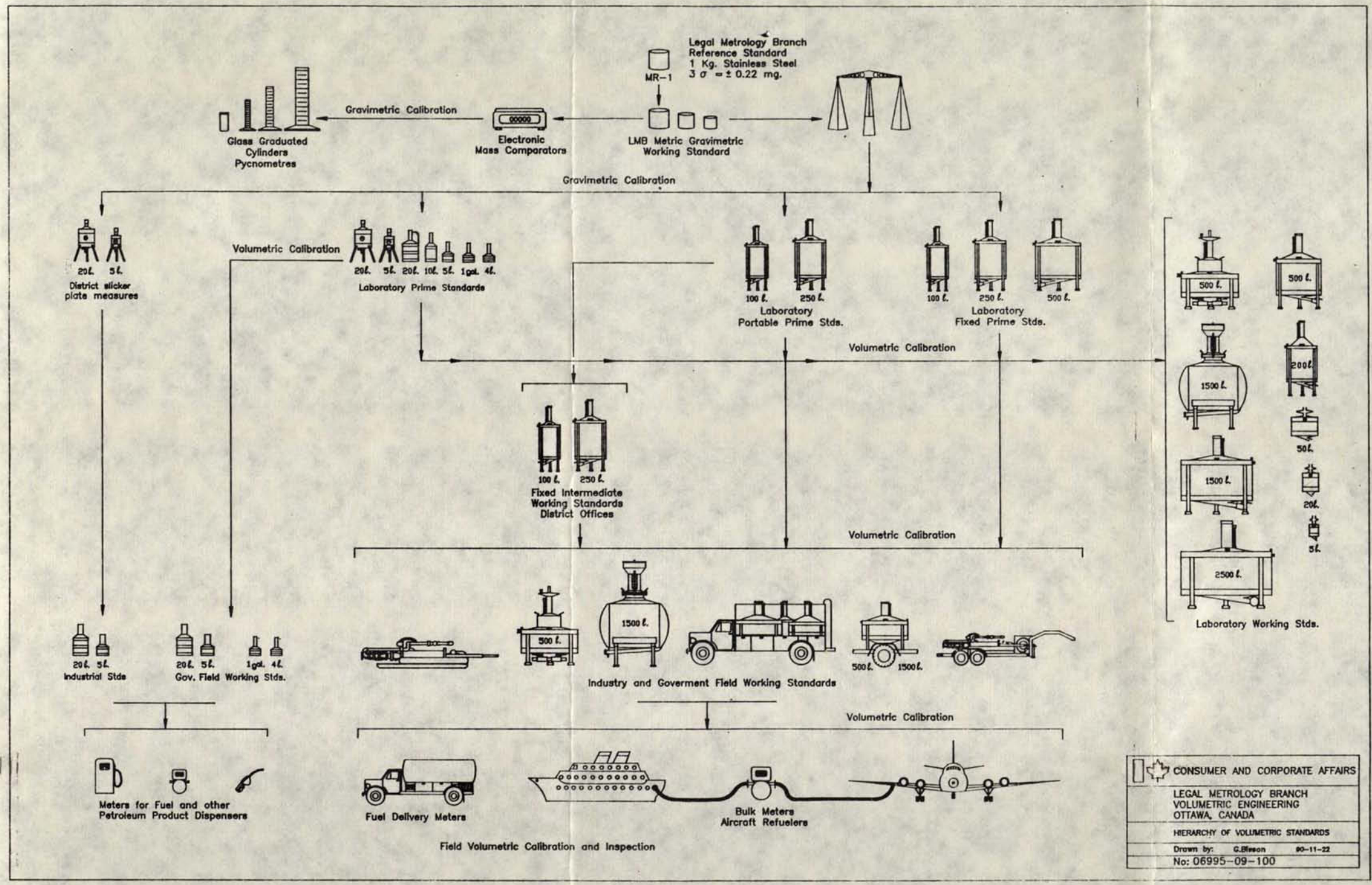
10) Other test conditions:

Autres conditions:

Local Standards Used /Etalons locaux utilisés:

APPENDIX III

Hierarchy of Volumetric Standards



CONSUMER AND CORPORATE AFFAIRS

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VOLUMETRIC ENGINEERING
OTTAWA, CANADA

HIERARCHY OF VOLUMETRIC STANDARDS

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