Manual of Petroleum Measurement Standards Chapter 19.3—Evaporative Loss Measurement

Part F—Evaporative Loss Factor for Storage Tanks Certification Program

FIRST EDITION, MARCH 1997
Reaffirmed 3/2002

American Petroleum Institute

Manual of Petroleum Measurement Standards
Chapter 19.3— Evaporative Loss Measurement

Part F—Evaporative Loss Factor for Storage Tanks Certification Program

Measurement Coordination

FIRST EDITION, MARCH 1997

American Petroleum Institute

SPECIAL NOTES

API publications necessarily address problems of a general nature. With respect to particular circumstances, local, state, and federal laws and regulations should be reviewed.

API is not undertaking to meet the duties of employers, manufacturers, or suppliers to warn and properly train and equip their employees, and others exposed, concerning health and safety risks and precautions, nor undertaking their obligations under local, state, or federal laws.

Information concerning safety and health risks and proper precautions with respect to particular materials and conditions should be obtained from the employer, the manufacturer or supplier of that material, or the material safety data sheet.

Nothing contained in any API publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use of any method, apparatus, or product covered by letters patent. Neither should anything contained in the publication be construed as insuring anyone against liability for infringement of letters patent.

Generally, API standards are reviewed and revised, reaffirmed, or withdrawn at least every five years. Sometimes a one-time extension of up to two years will be added to this review cycle. This publication will no longer be in effect five years after its publication date as an operative API standard or, where an extension has been granted, upon republication. Status of the publication can be ascertained from the API Authoring Department [telephone (202) 682-8000]. A catalog of API publications and materials is published annually and updated quarterly by API, 1220 L Street, N.W., Washington, D.C. 20005.

This document was produced under API standardization procedures that ensure appropriate notification and participation in the developmental process and is designated as an API standard. Questions concerning the interpretation of the content of this standard or comments and questions concerning the procedures under which this standard was developed should be directed in writing to the director of the Authoring Department (shown on the title page of this document), American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.

API standards are published to facilitate the broad availability of proven, sound engineering and operating practices. These standards are not intended to obviate the need for applying sound engineering judgment regarding when and where these standards should be utilized. The formulation and publication of API standards is not intended in any way to inhibit anyone from using any other practices.

Any manufacturer marking equipment or materials in conformance with the marking requirements of an API standard is solely responsible for complying with all the applicable requirements of that standard. API does not represent, warrant, or guarantee that such products do in fact conform to the applicable API standard.

FOREWORD

API publications may be used by anyone desiring to do so. Every effort has been made by the Institute to assure the accuracy and reliability of the data contained in them; however, the Institute makes no representation, warranty, or guarantee in connection with this publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or for the violation of any federal, state, or municipal regulation with which this publication may conflict.

Suggested revisions are invited and should be submitted to the Measurement Coordinator, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.

CONTENTS

Chapter 19.3—Evaporative Loss Measurement

PART F—EVAPORATIVE LOSS FACTOR FOR STORAGE TANKS CERTIFICATION PROGRAM

1 Scope

1.1 BACKGROUND

The purpose of this standard is to provide a mechanism for users of the API evaporative loss standards, and related documents, to verify the accuracy of device specific loss factors that they are requested to use. The certified loss factors developed under this standard denotes that an API certified facility certifies that the factors published for certain specific devices have been developed in a way that is consistent with that used for the generic or default factors published in the API standards. Use of the certified factors is believed to improve the accuracy of the calculated evaporative loss. The generic factors are not being withdrawn and are still published by API; this is an extension of the standards to incorporate new and more specific information.

API does not make any recommendation, conclusion, or warranty concerning a device having a certified loss factor. Likewise, the user should not draw any inference concerning the differences between devices that have certified factors and those that do not. Participation in the certified loss factor program is strictly voluntary.

API publishes certain standard methods for estimating the evaporative losses from storage tanks. These methods, namely MPMS 19.1 and 19.2, require inputs for various parameters that affect the quantity of material evaporated. Some of these inputs are loss factors that are specific to the type of equipment being considered. API has traditionally supplied default factors for these values that were developed from API's own testing programs. These factors are not meant to represent all equipment types or to specifically represent a particular device. They are referred to as generic loss factors. Specific devices may have loss factors that are different from those listed in 19.1 or 19.2. Users of the API calculation methods may have a need to reflect the capabilities of a specific device in their evaporative loss calculations.

The document covers the methods and procedures that shall be used to petition API to certify a device-specific evaporative loss factor for use in place of those default factors listed in MPMS 19.1, and 19.2. These factors may also be applicable for use with other calculation techniques that are comparable to or derived from the above API documents. The process of applying to API for a device specific loss factor and receiving a certified factor for API is referred to here as the certification process.

This standard describes the specific test protocols required to be performed, the certification requirements for the testing facility, the manner in which the data must be submitted, and the reviews and procedures that API will use to review the submitted data. Options available to API to publish the results of its review are addressed in this document but not defined.

1.2 LIMITATIONS

The certification of a loss factor for a device does not in any way imply that the device is acceptable, effective, or safe for any proposed service. It does not imply recommendation of the device by API or enhanced quality or features as compared to other similar devices.

Evaporative loss control devices are not primarily chosen based on their loss rate, but on a variety of other factors. Certification of a loss factor for a device does not imply that the device is of higher quality or in any way better than any other device, with or without a certified loss factor.

The use of a certified factor does not remove or mitigate the limitations or restrictions on the API evaporative loss standards. The certified factors are to be used as substitutes for factors in API or related documents.

2 Standards Incorporated by Reference

The following API standards listed in Table 1 are incorporated by reference. Modifications, updates, and changes to these standards are automatically incorporated in this standard and are binding on compliance with this standard. The effective date of incorporation of such changes is immediately upon publication.

2.1 REQUIRED TEST PROTOCOLS

Testing shall be performed by a facility certified under the Certified Loss Factor Testing Laboratory Registration Standard. At the time of the test, the facility shall be certified by API to perform the specific test for which certification of a device specific loss factor is being requested. Testing prior to the facility receiving certification or after certification has been suspended or revoked, shall render the results of the test invalid for certification.

Devices shall be tested using the protocol(s) that most closely simulates the method of evaporative loss in service. The test protocol used must be chosen from the appropriate choices listed in Table 2. If a petitioner wishes to use a different approved test method from Table 2 instead of that identified, the petitioner can request a review on a case-by-case basis by the API Exploration and Production Department, Measurement Coordination.

The request must be in writing and demonstrate that objective physical characteristics of the device or its intended use

Table 1—API Standards Incorporated by Reference

Title	Document Number	Referred to Herein as
Evaporative Loss from Fixed Roof Tanks	MPMS Chapter 19.1	
Evaporative Loss from Floating-Roof Tanks	MPMS Chapter 19.2	
Wind Tunnel Test Method for the Measurement of Deck Fitting Loss Factors for External Floating Roof Tanks	Chapter 19.3, Part A	Wind tunnel test
Weight Loss Test Method for the Measurement of Deck Fitting Loss Factors for Internal Floating Roof Tanks	Chapter 19.3, Part E	Zero wind speed test
Certified Loss Factor Testing Laboratory Registration	Chapter 19.3, Part G	Facility certification standard
Test Protocols	Chapter 19.3, etc., as published	

Table 2—Appropriate Test Protocols by Device Type

Type of Device	Primary Testing Protocol	Alternative Protocol
Guidepoles, stilling wells for EFR	Wind tunnel test	None
Internal floating roof fittings	Zero wind speed test	Wind tunnel test
External floating roof fittings	Zero wind speed test and wind tunnel test	None
Internal floating roof deck seams	Deck seam weight loss test	None
Rim seals	Air concentration test	Rim seal weight loss test

make an alternative procedure more accurate in this particular case. If in API's opinion, the results of another or modified approved test would yield more representative and reproducible results, permission to use an alternate test may be designated in writing. Decisions on the use of alternative tests are at the discretion of API.

3 Definitions

3.1 certification process: Process that the petitioner goes through to obtain an API certified loss factor for a given device.

3.2 certified loss factor: Loss factor that has been obtained using API approved testing procedures for which the testing has been reviewed and approved by API.

3.3 device: Element attached to or incorporated in an internal or external floating roof tank where evaporative losses are possible.

3.4 device specific: Characteristic of a unique device.

3.5 facility: the person(s), corporate entity, or collection of equipment that is certified or proposed to be certified under this standard. The facility does not include those operations not associated with the evaporative loss testing for the purpose of certification by API.

3.6 laboratory: Used interchangeably to mean facility.

3.7 loss factors: Factor that indicates the average amount of evaporative loss associated with a device.

3.8 MPMS: Manual of Petroleum Measurement Standards.

3.9 petitioner: Party who seeks to obtain API approval for a loss factor for a given device.

3.10 proposed device: Device for which the petitioner seeks a certified loss factor.

3.11 review: Analysis by API of loss factor data obtained using the API test procedure for a given device.

3.12 testing process: An API approved procedure the petitioner uses to determine the loss factor for a given device.

4 Physical Identification of Tested Device

4.1 PURPOSE

The device proposed for certification must be identified to API in a manner that ascertains that the tested device can be distinguished from other devices of similar type and construction. Should retesting of the device be needed in the future, the data gathered during the certification process should be sufficient to reproduce the device. Identification of the device shall be the responsibility of the testing facility and of the petitioner.

4.2 PETITIONER'S RESPONSIBILITIES

The petitioner shall inform the testing laboratory of any features that the petitioner believes to distinguish the evaporative loss performance of the device to be tested from other similar devices, previously tested by the petitioner.

The recommended installation procedure for the device must be described in writing, including sketches and drawings, so that the facility can properly mount the device in the test apparatus in a manner consistent with its intended use.

The petitioner shall prepare for API a description of the device to be certified that sufficiently identifies the proposed device. The description must be detailed enough to distinguish the device from other devices of similar construction by inspection of installed components in the field. All tolerances on dimensions, variations on configuration or substitution of material that the petitioner intends to include in the description of the devise shall be identified. These drawings shall not identify proprietary compositions of matter except in general terms, or internal mechanical details that have no impact on the evaporative loss performance. The material shall be sufficiently detailed to conclusively identify the device that was tested, distinguish the device from similar devices, and permit the reconstruction of the device should retesting be necessary.

The petitioner shall agree to affix a permanent marking to each device offered for sale after certification that bears the registration identifier assigned to that device by API.

4.3 INDEPENDENT TESTING FACILITIES' RESPONSIBILITIES

The testing laboratory shall positively and permanently mark each device received or prepared for testing with a unique alphanumeric identifier. The identifier shall be included in all records of testing for which certification is requested.

The testing facility shall possess accurate mechanical drawings of the device to be tested and its configuration during testing. This drawing will show all details that are relevant to reproducing an identical device should retesting be necessary.

The testing facility shall photograph the tested device in as much detail as necessary to show clearly the important features of the tested device and to allow identification of the device tested at a later date.

The test facility will retain the tested device, the identifying photographs and the mechanical drawings securely and under its control for a period of 5 years or until delivered to API as part of a certification petition.

5 Submission of Test Results

The petitioner shall submit or arrange for the testing facility to submit to API any data API deems necessary to effectively review the application for a certified loss factor.

The petitioner shall provide to API copies of the reports of the certified testing laboratory demonstrating the evaporative loss performance of the device, suitable descriptions of the device, its use, and features.

All tests of the device shall be submitted. Tests that were conducted for product development, at conditions not permitted by the test protocols, or on objectively different devices should not be included in the material submitted to API. It is the intent of this standard that the factors certified be based on the widest available pool of information.

The petitioner shall direct the certified testing laboratory to provide directly to API copies of all test measurements, drawings, specifications and reports required by the test protocols used, as well as any additional data that API considers material to the evaluation of the application. The laboratory will communicate to API the existence of any other protocol tests of the same device by the manufacturer that it has conducted. The testing laboratory will deliver to API or arrange for API to inspect the device tested and submitted for certification if API so requests.

The petitioner shall provide API an initial calculation of the device specific loss factor using the test data submitted in the application.

The petitioner shall certify to API that all statements, representations, data, and reports provided to API by or on behalf of the petitioner are accurate and complete to the best of the petitioner's knowledge. Failure to certify the information submitted, or the submission of inaccurate, false, or misleading information shall result in the application being rejected, or if previously approved, revoked. Any test data submitted must have been generated subsequent to the prior notification that is required by API under the Loss Factor Testing Laboratory Registration standard.

6 Review by API

6.1 COMPLETE APPLICATION

API will identify those specific documents, test results and petitioner certifications that it considers necessary to evaluate an application for a device specific loss factor. API can at its discretion request from a petitioner any additional documentation that API in its sole judgment believes is necessary.

The petitioner may be required to submit an application fee to reimburse API for its expenses evaluating the application.

If the petitioner fails to submit the required documents or suitable alternatives within 90 days of a request from API, the application shall be considered inactive.

API may require that petitioners who met the technical requirements of this and incorporated standards enroll in the monogram program as a requirement for obtaining and maintaining a certified loss factor. The requirements of such a program are outside the scope of this standard.

API may require that petitioners periodically certify that the devices currently being produced bearing the certified registration number are substantially identical to the device tested upon which the registration is based.

6.2 CONFIDENTIALITY

In no case can any information received under this standard be construed to have induced any obligation on API's part that would interfere with the evaluation or administration of the certified loss factor program or other applications.

Documents submitted by the petitioner to API or specific test results obtained as part of the certification process will not be released by API to third parties not involved in the certification process without permission from the petitioners. API may release information concerning test procedures and test results provided that this information does not identify specific manufacturers.

6.3 ACCEPTABLE VARIABILITY IN TEST DATA

6.3.1 Requirements

API shall establish acceptable levels of variability in the testing data submitted as part of an application. The level of acceptable variability shall be redefined by API periodically as additional data and testing improvements allow and shall apply to all applications from that point forward. The current acceptable level of variability shall be dependent on the type of test performed and are listed in Table 3. These limits are based on tests results achieved by API in previous testing programs.

As part of the submission to obtain a loss factor for a specific device, the test procedure will be performed three (3) times. The repetition of the test shall include removal of the tested device from the test apparatus, disassembly and reassembly or replacement with a new device, and retesting through the entire specified test sequence. In those situations where the design or number of the test equipment at a specific registered facility could permit it, simultaneous tests of multiple test devices can be used to satisfy this requirement.

The loss factor shall be the average of the three values obtained whereby the result of the three tests are summed and divided by three. In order to determine if these three values are within an acceptable level of variability the statistical test shown in 6.3.2 shall be used.

6.3.2 Statistical Test for Variability

Step 1: Determine the sample standard deviation (S) of the sample using the following formula:

$$S = \sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n-1}} \quad (1)$$

Where:

x_i is the value of the loss factor at the specified wind speed for a given test.

$\bar{x}$ = the average of the loss factors for a given set of tests.

n = the number of tests.

Step 2: Determine the 95 percent confidence (Z) of the sample using the following formula:

$$Z = t0.025\left(\frac{S}{\sqrt{n}}\right) \quad (2)$$

Where:

$t0.025$ is the Student's t Test value for 95 percent probability at the appropriate degrees of freedom. The degrees of freedom is n-1.

S = the sample standard deviation.

n = the number of tests.

Step 3: Express the percent confidence interval (PCI) using the following formula:

$$PCI = \left(\frac{Z}{\bar{x}}\right)100 \text{ percent} \quad (3)$$

Where:

PCI = 95 percent confidence as a percent of the mean.

Z = the confidence interval (Student's t Test).

$\bar{x}$ = the average of the loss factors for a given set of tests.

Step 4: The 95 percent confidence as a percentage of the mean (PCI) as calculated by Equation 3 should not exceed the limits for each device as shown in Table 3.

If the PCI as calculated by Equation 3 exceeds the number listed in Table 3, the test must be repeated three more times. The new average will be the sum of all loss factors divided by six. If the variability is not within the limit set in Table 3 after six tests, the application must include a written explanation from the certified testing facility of the excess variability, perceived causes, and potential alternatives to improve the retesting of the device.

Applications based on testing with excessive variability may be rejected or accepted by API based on the written explanation from the testing laboratory and API's judgment as to the impact of the uncertainty on the reliability of the certified loss factor system as a whole.

7 Publication of Results

If API after evaluation believes that a certified loss factor is justified for the specific device submitted, it will publish the device-specific certified loss factor and its 95 percent confidence limit in an API document with all other current certified loss factors. The document shall list the API registration number, the loss factors for use in API evaporative loss calculation methods, the 95 percent confidence limits for the factors, and a physical description of the device.

This document will be updated no less than quarterly, and will be available from API. Copies of the current version of the document shall also be forwarded annually to the U. S. Environmental Protection Agency and to each state environmental agency. API may additionally publish the list electronically or make it available to others to publish.

If API revokes the certified loss factor for any device, it shall remove the listing for that device from the current and future versions of the publication. Revocation may be for

Table 3—Acceptable Levels of Variability in Testing Data

Device	Type of Test	Maximum 95% Confidence Limit as a Percent of Mean (PCI)	Wind Speed Used for Calculation (miles/hr)
Slotted guide poles	Wind tunnel	25	10
Roof legs	Wind tunnel	35	10
Gauge hatch/sample well	Wind tunnel	75	10
Vacuum breaker	Wind tunnel	75	10
Gauge-float well	Wind tunnel	65	10
Access hatch	Wind tunnel	50	10
Internal rim seals	Weight loss test or Air concentration test	10	Not applicable
External rim seals	Air concentration test	5	10
Deck seams	Weight loss test	15	Not applicable

technical reasons or because the petitioner no longer wishes to participate in the certified loss factor programs.

API shall also provide the petitioner with a certificate denoting the API registration number of the device, its loss factor, confidence interval, and physical description. API shall not acknowledge the manufacturer of a device listed in the certified loss factor documents except upon submission of a written authorization from the manufacturer.

8 Falsified Data or Fraudulent Data Submission

8.1 REVOCATION OF CERTIFICATION

The petitioner has a responsibility to assure API that the data, measurements, and representations submitted to API on its own behalf or on behalf of the testing facility are true and accurate to the best of its knowledge. Deliberate falsification of data, submittal of misrepresented information to API, or grossly negligent performance of test protocols shall be grounds for API to immediately revoke the certification of the submitted device. If API revokes a device's certification for fraud or misleading submissions, it may do so retroactively. API will publish notification of such cases in its documents.

8.2 LOSS FACTORS ALREADY CERTIFIED

API may postpone the revocation of a certified loss factor, providing that (a) the petitioner was not a party to the circumstances of the certification revocation, (b) the petitioner agrees to retest the device and resubmit the data to verify the published certified factor in a timely manner, and (c) the resubmitted data substantiates the previously certified factor. Petitioners other than the manufacturer of the device may pursue recertification to cover those devices already in service.

8.3 APPEAL OF DECISIONS

Appeals of decisions, actions, or inaction by API must be made in accordance with API Policy 104.

9 Other Devices of Similar Construction

9.1 SPECIFIC DEVICE

Certification of a loss factor shall be for individual devices by a specific manufacturer. The certified loss factor shall not apply or be represented to apply to any other device other than that listed by API, including devices of similar construction by the same manufacturer or other manufacturers.

The certification of a device specific loss factor only applies to marked devices sold after the effective date of the API certification. It is not retroactive to the previously installed devices for which certification is sought, even if they are thought to be identical to the device that is certified.

9.2 REVOKED CERTIFICATIONS

Certification may be dependent on a petitioner's participation in a monogram or certification program. If a manufacturer ceases to participate in a required program the certified loss factor may be revoked by API. Participation requires that the petitioner agrees to pay associated application and usage fees associated with the device being certified. The devices installed during the manufacturer's participation shall be acknowledged by API as having certified loss factors, but factors for such devices may not be published.

PD-01200—3/97—1C (3E)

Additional copies available from API Publications and Distribution:
(202) 682-8375

Information about API Publications, Programs and Services is
available on the World Wide Web at: http://www.api.org

American
Petroleum
Institute

1220 L Street, Northwest
Washington, D.C. 20005-4070
202-682-8000

Order No. H1903F