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API MPMS Chapter 17.1
Manual of Petroleum Measurement Standards Guidelines for Marine Cargo Inspection
Eighth Edition

XXX 202X

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Introduction

These guidelines are intended to encourage uniform inspection practices for marine cargo quantity and quality control. The use of these guidelines is intended to simplify the documentation and interpretation of marine cargo inspection. These guidelines are not the only acceptable method of custody transfer measurement or inspection practices. Guidelines for the inspection of marine cargo are subject to ongoing reappraisal and periodic change.

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Guidelines for Marine Cargo Inspection

1 Scope

This document contains recommended practices for manual and automatic measurement, sampling, and reconciliation for bulk quantities that are transported on marine vessels. The activities described in these guidelines include actions by producers, buyers, sellers, terminal operators, vessel owners and their crews, regulatory agencies, independent inspectors, and other parties with an interest in measurements.

Certain vessel or terminal configurations and cargo characteristics, particularly chemicals, may require extensive procedures and calculation methods not covered in this chapter.

The procedures stated in this document are equally valid and applicable for either metric or customary units of measurement, provided that the same types of units are used consistently.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API. *Manual of Petroleum Measurement Standards* (*MPMS)* Chapter 3.1A, *Standard Practice for the Manual Gauging of Petroleum and Petroleum Products*

API. *MPMS* Chapter 3.1B, *Standard Practice for Level Measurement of Liquid Hydrocarbons in Stationary Tanks by Automatic Tank Gauging*

API. *MPMS* Chapter 7 (All sections), *Temperature Determination*

API. *MPMS* Chapter 8.1, *Standard Practice for Manual Sampling of Petroleum and Petroleum Products*

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API. *MPMS* Chapter 12.1.1, *Calculation of Static Petroleum Quantities, Part 1—Upright Cylindrical Tanks and Marine Vessels*

API. *MPMS* Chapter 12.2, *Calculation of Petroleum Quantities Using Dynamic Measurement Methods and Volumetric Correction Factors*

API. *MPMS* Chapter 12.3, *Calculation of Volumetric Shrinkage from Blending Light Hydrocarbons with Crude Oils*

API. *MPMS* Chapter 17.2, *Measurement of Cargoes On Board Tank Vessels*

API. *MPMS* Chapter 17.10.1/ISO 10976 [1] , *Measurement of Cargoes on Board Marine Gas Carriers, Part 1—Liquefied Natural Gas*

API. *MPMS* Chapter 17.12/EI HM 51, *Procedure for Bulk Liquid Chemical Cargo Inspections*

API. *MPMS* Chapter 17.4, *Method for Quantification of Small Volumes on Marine Vessels (OBQ/ROB)*

3 Terms and Definitions

For the purposes of this document, the following definitions apply. Terms of more general use may be found in the API *MPMS* Chapter 1, *Online Terms and Definitions Database*.

3.1
API Gravity
A means used by the petroleum industry to express the density of petroleum liquids. API gravity is measured by a hydrometer instrument having a scale graduated in degrees API. The relation between API gravity and relative density (formerly called specific gravity).

3.2
Automatic Sample Probe
A sample probe with an integrated sample extractor mechanism that is inserted into the flowing stream and which, upon a signal from the controller device, which is monitoring a flow measuring device, is used to extract a representative sample from the fluid flowing in the pipe.

3.3
Ballast
The water that is taken on when a vessel is empty or partly loaded to increase draft to properly submerge the propeller and maintain stability and trim

3.4
Cargo Quantity Option Certificate
A certificate signed by vessel and shore representatives acknowledging the amount of cargo intended to load. Generally, most product cargoes have a tolerance based on either supplier, receiver, or vessel capabilities. Each party involved with the loading shall agree to the quantity to be loaded.

3.5
Clingage
The film of liquid that adheres to the inside surface of a field standard test measure after it has been drained and is considered empty.

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[1] Energy Institute, 61 New Cavendish Street, London W1G 7AR, United Kingdom, www.energyinst.org.

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3.6
Crude Oil Washing
The use of a high-pressure stream of the crude oil cargo to dislodge or dissolve clingage and sediment from the bulkheads, bottom, and internal tank structures of a vessel during the discharge operation.

3.7
Draft
The depth of a vessel below the water line measured from the surface of the water to the bottom of the vessel's keel.

3.8
Free Water
Water that exists as a separate phase.

3.9
First-Foot Sample

A sample taken after approximately 1 ft (0.3m) of cargo has been loaded into a vessel's tank.

3.10
Gross Observed Volume
The total weight of all petroleum liquids and sediment and water (S&W) (if any), excluding Free Water (FW), as determined by applying the appropriate weight conversion factors to the Gross Standard Volume (GSV).

3.11
Gross Standard Volume (GSV)
The GOV gross observed volume corrected by the appropriate factors from the observed temperature and pressure to the specified reference conditions.

3.12
Gross Standard Weight
The weight of the GSV quantity.

3.13
Indicated Volume
Is the difference between opening and closing meter readings.

3.14
Inerting
A procedure used to reduce the oxygen content of a vessel's cargo spaces by introducing an inert gas such as nitrogen or carbon dioxide or a mixture of gases such as processed flue gas.

3.15
Innage Gauge
The depth of liquid in a tank measured from the datum plate or tank bottom up to the surface of the liquid.

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3.16
Letter of Protest (LOP) or Notice of Apparent Discrepancy (NOAD)
A letter issued by any participant in a custody transfer citing any condition in dispute. This serves as a written record

3.17
Line Fullness Verification
The activity of verifying the fill condition of the shore and vessel cargo transfer lines before and after a cargo transfer.

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3.18
List
The leaning or inclination of a vessel, expressed in degrees port or starboard away from the vertical.

3.19
List Correction
The correction applied to the volume or gauge observed in a vessel's tank when the vessel is listing, provided that liquid is in contact with all bulkheads in the tank. List correction may be accomplished by referring to the list correction tables for each of the vessel's tanks or by mathematical calculation.

3.20
Net t Standard
Volume
The total volume of all petroleum liquids, excluding sediment and water and free water, correct by the appropriate volume correction factor (C sub tl) for the observed temperature and API gravity, relative density, or density to a standard temperature such as 60 degrees F or 15 degrees C and also corrected by the applicable pressure correction factor (C sub pl) and meter factor.

3.21
Net Standard Weight
The total weight of all petroleum liquids, excluding sediment and water (S&W) and Free Water (FW), determined by deducting the S&W weight from the Gross Standard Weight (GSW).

3.22
Observed Reference Height
The distance actually measured from the tank bottom or datum plate to the established reference point.

3.23
Onboard Quantity
(OBQ)
Refers to materials present in a vessel’s cargo tanks, void spaces, and/or pipelines before the vessel is loaded. Onboard quantity includes a combination of water, oil, slops, oil residue, oil/water emulsions, sludge, and sediment.

3.24
Reference Height
The distance from the tank bottom or datum plate to the established reference point or mark.

3.25
Reference Gauge Point
The point from which all liquid level measurements shall be taken: (a) as determined at the time of the tank calibration and as reflected by the tank capacity table; or, (b) as modified in keeping with guidelines in API MPMS Chapters 2 and 3, and for which either adjustment calculations shall be made or a new tank capacity table issued reflecting the new location of the reference gauge point.

3.27
Remaining On Board
(ROB)
The material remaining in a vessel’s cargo tanks, void spaces, and pipelines after the cargo is discharged. Remaining On Board quantity may include any combination of water, oil, slops, oil residue, oil/ water emulsions,

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and sediment.

3.28
Sediment and Water
(S&W)
Material that coexists with, yet is foreign to, a petroleum liquid. S&W may include dissolved water, free water, and sediment, and emulsified water and entrained or suspended sediment and water..

3.29
Slops
Oil, oil/water/sediment, and emulsions contained in slop tanks or designated cargo tanks. The mixture usually results from tank stripping, tank washing, or dirty ballast phase separation.

3.30
Stop Gauge
A pre-transfer determination of a specific volume of cargo represented by a specific tank level, which, when reached, results in cargo completion of the transfer. This determination may be done by either shore or vessel personnel.

3.31
Tank Washing
1) Divided into two types of activities: Water washing involves the use of a high-pressure water stream to dislodge clingage and sediment from the bulkheads, bottom, and internal tank structures of a vessel. Crude oil washing involves the use of a high-pressure stream of the crude oil cargo to dislodge or dissolve clingage and sediment from the bulkheads, bottom, and internal tank structures of a vessel during the discharge operation. Note: Regulatory agencies require the vessel's tanks to be inverted during this tank cleaning method.

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3.32
Total Calculated
Volume
The total volume of all petroleum liquids and sediment and water, corrected by the appropriate volume correction factor (Ctl) for the observed temperature and API gravity, relative density, or density to a standard temperature such as 60 degrees F or 15 degrees C and also corrected by the applicable pressure correction factor (Cpl) and meter factor, plus all free water measured at observed temperature and pressure (gross standard volume plus free water).

3.33
Total Observed Volume
(TOV)
The total measured volume of all petroleum liquids, sediment and water (S&W), and Free Water (FW) at observed temperature and pressure.

3.34
Trim
Refers to the condition of a vessel in terms of its longitudinal position in the water. Trim is the difference between the forward draft and the aft draft and is expressed by the head or by the stern to indicate the end of the vessel that is deeper in the water.

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3.35
Trim Correction
The correction applied to the volumes or gauge observed in a vessel's tank when the vessel is out of trim, provided that the liquid is in contact with all bulkheads in the tank. Trim correction may be accomplished by referring to the trim correction tables for each of the vessel's tank or by mathematical calculation.

3.36
Ullage (Outage) Gauge
The vertical distance from the reference gauge point downward to the liquid surface in a tank.

3.37
Vessel Experience Factor
(VEF)
A compilation of the history of the total calculated volume (TCV) vessel measurements, adjusted for onboard quantity (OBQ) or remaining onboard (ROB), to the TCV shore measurements. Separate VEFs should be developed for both load and discharge terminals. Preferably, information used in calculating a VEF should be based on documents that follow accepted industry standards and practices, such as inspection company reports.

3.38
Wall Wash Test
The procedure for washing selected areas such as the interior bulkheads, tank bottoms, and sumps of cargo tanks with an appropriate medium and testing the wash liquid for the presence of material that might contaminate cargo to be loaded (refer to API MPMS Chapter 17.8).

3.39
Water-Cut Measurement
The procedure for locating the oil/water interface for the purpose of determining the volume of FW in a shore tank or vessel compartment. The term is also used to refer to the line of demarcation of the oil/water interface.

3.40
Wedge Formula
A mathematical means of approximating the small quantities of liquid and solid cargo and free water onboard before a vessel is loaded and after its cargo is discharged. The formula is based on cargo compartment dimensions and vessel trim. The wedge formula shall be used only when a wedge exists and when the liquid does not touch all bulkheads of the vessel's tank.

3.41
Wedge Table
A pre-calculated vessel table based on the wedge principle and displayed much like the vessel's usual innage/ullage tables. These tables, however, are for small quantities (On-board Quantities, Remaining On Board) when the cargo or Free Water (FW) does not touch all the bulkheads of the vessel's tank.

3.42
Wipe Test
The procedure of physically wiping random interior areas and steam coils of the vessel's tanks with absorbent white rags. This procedure is used to test the tank's coating for possible color contamination.

4 Safety and Health Considerations

4.1 General

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Personnel involved with the gauging and sampling of hazardous cargoes should be familiar with their physical and chemical characteristics, including potential for fire, explosion, and reactivity, along with the appropriate emergency procedures, potential toxicity, and health hazards. Personnel should comply with the individual company safe operating practices and with all applicable local, state, federal, and

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national regulations, including the use of proper protective clothing and equipment. Personnel are encouraged to refer to the applicable Safety Data Sheets (SDS) for guidance. Personnel involved in inspection, measurement, or sampling on board a vessel should be accompanied by a designated ship's representative.

4.2 Static Electricity Hazards

If the tank is in a non-inert condition, specific precautions shall be taken with regard to safe measurement and sampling procedures when handling static accumulating commodities. During loading, and for 30 minutes after the completion of loading, metallic equipment for dipping (gauging), ullaging, or sampling shall not be introduced into or remain in the tank. Examples of equipment may include, but are not limited to, manual steel gauging tapes, portable gauging devices mounted on deck standpipes, metal sampling apparatus, and metal sounding rods.

Nonconducting equipment with no metal parts may, in general, be used at any time. However, ropes or tapes used to lower equipment into tanks shall not be made from synthetic materials. After the 30-minute waiting period, metallic equipment may also be used for dipping (gauging), ullaging, and sampling, but it is essential that it is effectively bonded and properly grounded before it is introduced into the tank and that it remains grounded until after it has been removed.

Operations performed through standpipes which are in contact with the surface of the liquid are permissible at any time because it is not possible for any significant charge to accumulate on the surface of the liquid within a correctly designed and installed standpipe. A standpipe should extend the full depth of the tank and be effectively bonded and earthed to the tank structure.

4.3 Health Hazards

Cargo Vapors can pose serious health, safety, and environmental hazards if not properly managed. Hydrogen sulfide (H_2S) vapors are particularly hazardous. Cargo vapors with relatively low concentrations of hydrogen sulfide may cause unconsciousness or death. During and after the opening of any tank or vapor control valve, personnel should position themselves to avoid any gas vapors which may be released. Harmful vapors or oxygen deficiency cannot always be detected by smell, visual inspection, or judgment. Appropriate precautions should be used for the protection against toxic vapors or oxygen deficiency. It is recommended that users always wear gas monitors that, as a minimum, measure gas concentrations of H_2S.

Procedures should be developed to provide for the following:

a) Job Hazard Analysis,

b) Exposure Monitoring,

c) Need for Personal Protective Equipment,

d) Emergency Rescue Precautions,

e) Respiratory Protection Program.

When necessary, suitable fresh air breathing equipment should be worn prior to entering the gauge site and during the gauging and sampling procedure.

This discussion on safety issues is not exhaustive and the appropriate API or Energy Institute publications, together with the United States Occupational Safety and Health Administration (OSHA), European Agency for

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Safety and Health at Work (EU-OSHA), World Health Organization (WHO), International Chamber of Shipping Oil (ICSO) [15], Safety of Life at Sea (SOLAS) [17], and Oil Companies International Marine Forum (OCIMF) [16] publications should be consulted for applicable safety precautions.

4.4 Entry Into Confined Spaces

It is the responsibility of vessel personnel to identify confined spaces and to ensure that established procedures for safe entry are followed. Inspectors shall consult the qualified person to determine whether entry into such confined spaces is permitted and shall be accompanied by a representative of the vessel at all times (*ISGOTT*).

No one should enter a confined space unless an entry permit has been issued by a qualified person or certified marine chemist who has ascertained before entry that the tank atmosphere is in all respects safe for entry. Before issuing an entry permit, the qualified person shall at least ensure that:

— the appropriate atmosphere checks have been carried out;

— effective ventilation will be maintained continuously while personnel are in the confined space;

— lifelines and harnesses are ready for immediate use;

— approved and pre-tested breathing apparatus and resuscitation equipment are ready for use at the entry to the confined space;

— personnel protective equipment shall be worn as appropriate for the task;

— where possible, a separate means of access is available for use as an alternative means of escape in an emergency;

— a standby person shall be in constant attendance outside the confined space;

— A means of communication between the confined space entrant and standby person shall be established prior to entry and tested throughout the duration of the entry; prior to commencing confined space entry, the lines of communication for dealing with emergencies shall be clearly established and understood by all concerned.

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5 General Information

Gauging may be performed manually or by automatic systems in accordance with procedures appropriate to the type of vessel, cargo, and location (see API *MPMS* Chapter 3.1A, Chapter 3.1B, Chapter 3.4 [2], Chapter 3.5 [3], Chapter 17.2, Chapter 17.4, Chapter 17.10.1 [13], Chapter 17.10.2 [14], Chapter 17.11, and Chapter 17.12).
.
The procedures described in this publication should be performed by properly trained personnel. If the procedures cannot be performed for any reason (such as safety, environmental, or physical constraints; governmental restrictions; conflicts with contractual agreements; or other problems), all interested parties are to be notified immediately. The inspection report shall include a complete, detailed explanation and an LOP or NOAD issued unless resolved. Measurement personnel are responsible for ensuring the use of proper safety, measurement, and sampling equipment.

The vessel's master or designated representative, the supervisory shore personnel, and the measurement personnel conducting the inspection should be familiar with the scope of the cargo inspection procedures and aware of the safety procedures unique to the product being transferred.

Petroleum products and chemicals require stringent quality control during loading, transport, and discharge operations. Vessels designated to carry these products should meet compatibility criteria. They should also be inspected for cleanliness prior to loading so that the shipment is not contaminated (see API *MPMS* Chapter 17.8 [11]). If there are any questions concerning compatibility or contamination, all interested parties shall be notified immediately and the questions resolved prior to commencement of loading.

Cargo calculations, including quantity and quality determination, are performed independently by the responsible parties or by their authorized representatives. These calculations should be reconciled to identify and resolve any differences.

6 API MPMS Chapter 17 Standards Overview

6.1 General

Chapter 17.1 is a summary of the remainder of API *MPMS* Chapter 17. This section presents a brief description of the content of each of the other Chapter 17 standards.

6.2 Chapter 17.2—Measurement of Cargoes on Board Tank Vessels

Provides guidelines and procedures to accurately gauge, sample, and calculate the quantity and quality of cargo on a marine vessel. Automatic and manual vessel gauging methods are discussed. Measurement of pressurized or refrigerated cargoes is not discussed.

6.3 Chapter 17.3—Guidelines for Identification of the Source of Free Waters Associated with Marine Petroleum Cargo Movements

Provides guidelines for identifying the source of free water associated with marine petroleum cargo movements. Basic sampling, on-site testing, analytical procedures, and examples are discussed. This procedure should be considered when FW is detected or suspected on a marine petroleum cargo movement.

6.4 Chapter 17.4—Method for Quantification of Small Volumes on Marine Vessels (OBQ/ROB)

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Provides guidelines and procedures to allow for the measurement of small quantities of cargo on marine vessels, which may require special strapping tables, gauging locations, and adjustments. Information and calculation examples are included.

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6.5 Chapter 17.5/EI HM 64—Voyage Analysis and Reconciliation of Cargo Quantities

Provides guidelines and procedures for the reconciliation of marine cargo quantities throughout a voyage. The standard contains an example Voyage Analysis Report (VAR), which helps to identify the source of quantity differences (gains/losses).

6.6 Chapter 17.6—Guidelines for Determining the Fullness of Pipelines Between Marine Vessels and Shore Tanks

Provides guidelines and procedures for determining the fill condition of pipeline systems used for the transfer of liquid before and after the liquid is loaded onto or discharged from marine vessels.

6.7 Chapter 17.8—Pre-loading Inspection of Marine Vessel Cargo Tanks and Their Cargo-handling Systems

Provides guidelines and procedures to determine that cargo tanks and transfer equipment are suitably clean. Vessel and shore responsibilities are outlined.

6.8 Chapter 17.9/EI HM 49—Vessel Experience Factor (VEF)

Provides guidelines and procedures for calculating VEF, guidance for data collection, and instructions for more complex VEF calculations. The standard contains an example of VEF calculation.

6.9 Chapter 17.10.1/ISO 10976—Measurement of Cargoes on Board Marine Gas Carriers, Part 1—Liquefied Natural Gas

Provides guidelines and procedures to vessel and shore personnel for determining quantities of liquefied natural gas cargoes on board marine gas carriers. It includes recommended methods for measuring, sampling, documenting, and reporting quantities on board these vessels.

6.10 Chapter 17.10.2/EI HM 55—Measurement of Cargoes on Board Marine Gas Carriers, Part 2—Liquefied Petroleum and Chemical Gases

Provides guidelines and procedures to vessel and shore personnel for determining quantities of liquefied petroleum and chemical gas cargoes on board refrigerated and pressurized gas carriers. It includes recommended methods for measuring, sampling, documenting, and reporting quantities on board these vessels.

6.11 Chapter 17.11/EI HM 52—Measurement and Sampling of Cargoes Using Closed and Restricted Equipment

Provides the safety precautions, equipment, guidelines, procedures, and limitations of closed and restricted measurement and sampling equipment.

6.12 Chapter 17.12/EI HM 51—Procedure for Bulk Liquid Chemical Cargo Inspection by Cargo Inspectors

Provides guidelines and procedures for safety, marine loading, and unloading for the transfer of bulk liquid chemicals. Guidelines and procedures related to the maintenance of chemical quality are specifically outlined.

6.13 Chapter 17.14.1—Measurement of Bulk Cargoes by Draft Survey—Part 1: Ocean-Going Vessels

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Describes the procedure for determining the transferred quantity of non-liquid petroleum products loaded onto or discharged from ocean-going vessels by draft survey. This procedure is not an alternative where effective static or dynamic liquid measurement methods can be used.

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6.14 Chapter 17.14.2—Measurement of Bulk Cargoes by Draft Survey—Part 2: Inland Barges

Describes the procedure for determining the transferred quantity of non-liquid petroleum products loaded onto or discharged from inland barges by draft survey. This procedure is not an alternative where effective static or dynamic liquid measurement methods can be used.

7 Operations Overview

7.1 General

Before operations begin, a key meeting should be held among cargo inspectors, vessel representatives, and shore operational personnel who are involved in the cargo transfer operation. At the key meeting, critical operational people are identified, responsibilities are defined, safety risks are identified, communication procedures are arranged, and everyone concerned reviews transfer procedures and plans to ensure a full understanding of all activities.

All responsible parties should be informed if any of the gauging equipment or tank or meter facilities have a known bias. Documentation of these deviations should be available for inspection by all responsible parties.

7.2 Vessel/Shore Communication

A reliable means of communication between the shore and vessels should be arranged. Vessel, shore, or measurement personnel who notice an event during any stage of the transfer that could affect subsequent events shall promptly notify all key personnel so that timely action can be taken. The Inspector shall record these events in the inspection report.

When more than one product or grade is to be transferred, close communication shall be maintained between personnel on shore and on the vessel to avoid contamination and off-specification material.

7.3 Key Meeting

The following items should be discussed at the key meeting:

— All parties shall be advised of local safety procedures, vessel safety procedures, required PPE, and hazards associated with the cargo.

— All parties should review the cargo's quality specification and quantity nominated record in the Key Meeting Summary document, Annex A).

— An agreement should be reached on whether shore or ship personnel terminate the transfer.

— If applicable, the vessel's representative should confirm the vessel's ability to heat the cargo as instructed.

— Check with the vessel's representative for reports of any unusual events that may have occurred during the sea passage or at the previous port that may require special vigilance during transfer.

— Check with shore personnel to agree on procedures for handling any special conditions that exist on shore that may adversely affect the transfer operation or measurements.

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- As applicable, determine which vessel tanks are to participate in cargo transfer, the capacity of the tanks, the condition of the lines, the nature of the vessel's last three cargoes, and the method of cleaning the cargo tanks (see API *MPMS* Chapter 17.8).

- Agreement should be reached on the method to be used to determine line fullness and the agreed tolerance (see API *MPMS* Chapter 17.6).

- Determination should be made as to whether First-foot samples will be taken, and in which tanks this volume will be placed.
- On multi-grade vessels, discuss transfer sequence based on grade and

  product to avoid contamination

NOTE The Inspection Checklist (see Annex A) or a similar document should be used.

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7.4 Blending Operations

Product contamination may result in unsafe conditions for the terminal, vessel, or all personnel.

If blending on board the vessel, it is critical that all volumes loaded are consistent with the proportional hand-blend before loading. If the material contained in the shorelines is to be loaded as part of the blend, a shoreline sample should be taken and tested.

To aid blending, the heaviest component may be loaded first, followed by the lighter components. The cargo may be gauged and sampled after each component is loaded. The contents of the shoreline, the vessel's previous cargo, and any OBQ should be taken into consideration for their effect on the blending operation. Adjustment to blend components may be required to maintain the mutually agreed upon blend specifications.

Due to incomplete mixing, sampling limitations, and other operational restrictions, vessel tank samples may not be representative of proportional hand-blends tested at the port of loading.

When blending products with substantially different densities, volumetric shrinkage may occur which will result in the volume reduction of the final blend compared with the combination of volumes of individual blend components. Refer to API *MPMS* Chapter 12.3 for further details.

8 Vessel Inspection Measurement and Sampling

8.1 Vessel Measurement and Volume Calculation

8.1.1 Draft, Trim, and List

Record the draft, trim, and list. Visually verify vessel drafts when possible. The preferred condition of the vessel is to be on an even keel (i.e. with zero trim) and no list, which eliminates the need for any trim or list corrections to be applied to the gauge readings. If the vessel is unable to be on an even keel and no list, and when vessel has no trim or list correction tables, refer to API *MPMS* Chapter 2.8A and API *MPMS* Chapter 12.1.1.

8.1.2 Vessel Gauges

Record cargo measurements, water measurements, and temperatures on all cargo compartments at the reference gauge point indicated on the vessel's capacity tables. Vessel capacity tables shall be certified by the shipbuilder, classification society, independent inspection company, or other approved third party for accuracy of use on board the particular vessel for which they are issued. The report should indicate whether measurements were manual or automatic, whether tanks on the vessel were inerted during gauging, and if open or closed/restricted equipment was used (see API *MPMS* Chapter 17.11).

Inspect for the presence of cargo in void spaces, ballast tanks, cofferdams, and non-designated cargo compartments. If cargo is found, measure and report it in the same manner as the designated cargo compartments (see API *MPMS* Chapter 17.2) and notify all concerned parties.

Observed gauge heights shall be recorded and compared with reference gauge heights. Investigate and report any discrepancies. The location of the reference gauge point should be noted in the inspection report.

Vessel measurements taken through non-slotted standpipes are inaccurate and shall not be used for custody transfer purposes. Additional measurements may be needed from other locations if this condition exists. Note in the report the existence of this condition, issue a Letter of Protest (See Annex A), and notify all concerned parties.

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In the case of heavy viscous cargo, before a tank is gauged, time should be allowed to permit the oil to free itself of entrained air, gas, and water.

In operations involving lightering, both vessels shall be gauged before and after lightering.

Vessel cargo measurements shall not be taken during bunkering operations.

8.1.3 Vessel Lines and Tanks

All vessel tanks, including, but not limited to, cargo compartments, bunker tanks, ballast tanks, void spaces, and cofferdams, shall be inspected before and after the cargo transfer operation.

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Before measuring OBQ/ROB, the condition of the vessel's lines should be determined. The inspector may request that the vessel lines be drained, and the valves opened. Caution shall be exercised on multigrade cargoes to avoid commingling the line contents of different products. Measure the amount of cargo or ballast water drained into the tank and sample, if possible. Record the capacity of the lines that were drained. Report the transfer of any engine room slops or other liquid into the cargo or slop tanks.

If the previous cargo poses a safety or contamination problem, all lines and pumps shall be cleaned thoroughly and drained. Note on the inspection report how cleaning and draining was performed.

When the vessel is inspected for tank acceptability prior to loading, tank inspection shall be performed in accordance with API *MPMS* Chapter 17.8.

8.1.4 OBQ Measurement

Obtain and record reference heights from the calibration tables prior to taking opening cargo and water measurements. Record the observed gauge heights; investigate and report any discrepancies between the reference and observed gauge heights. Determine the amount and classify (i.e. liquid, non-liquid) any material on board (OBQ) prior to loading including all in-transit cargo and material in non-designated cargo compartments (see API *MPMS* Chapter 17.4).

8.1.5 ROB Measurement

After discharge, verify the condition of the cargo lines; if cargo lines are not drained, the quantity of cargo in the lines should be accounted for as ROB. Determine the amount and classify (i.e. liquid, non-liquid) any material ROB. Include in-transit cargo that was not discharged and material in non-designated cargo compartments (see API *MPMS* Chapter 17.4 [8] and Chapter 17.11). If inspection, measurement, and bottom sampling reveals that any cargo remains on board, concerned parties should determine whether further attempts should be made to pump the remaining quantities ashore. If this is not done, report the reasons. An LOP shall be issued if applicable.

8.1.6 OBQ/ROB Volume Calculation

The OBQ/ROB Report is to be completed prior to loading or after discharging. Gauging OBQ/ROB at several points in a vessel compartment is very useful to establish whether material is or is not evenly distributed across a tank bottom. When multiple gauging points in a compartment are available, manual gauges from each gauge point should be taken and recorded.

a) For liquid material and water, use trim/list corrections if the liquid is in contact with all bulkheads in the compartment and the vessel is not on an even keel or has list. Use a wedge formula if the liquid does not touch all the bulkheads of the vessel's compartments.

b) For nonliquid material, multipoint gauging is recommended to determine if a wedge condition exists. If the material measured is not a wedge, the average of the multiple readings should be used for volume determination. However, if only one gauge point is available, the material shall be assumed to be evenly distributed over the tank bottom.

For additional information refer to API *MPMS* Chapter 17.2 and Chapter 17.4 [8].

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8.1.7 Small Volume (OBQ/ROB) Temperatures

Temperatures shall be obtained, recorded, and used for cargo volume correction whenever depth of material and the nature of the material permits. If the temperature cannot be measured, the gross observed volume (GOV) shall be reported as GSV.

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Temperature measurements shall be obtained in accordance with API *MPMS* Chapter 7, Chapter 17.2, Chapter 17.11, and Chapter 17.12.

8.1.8 Small Volume (OBQ/ROB) Sampling

When OBQ/ROB is accessible, samples shall be obtained from all compartments containing liquid volume. An attempt should also be made to sample nonliquid volumes. Samples taken should be in sufficient quantity to permit any required analysis. Samples shall be taken in accordance with API *MPMS* Chapter 8.

8.1.9 Free Water Measurement

Measure the FW of each compartment during inspection. Record whether water indicating paste(s) or a device is used to determine the oil/water interface. Record the interface and any oil emulsion that is detected. FW shall be sampled when possible (see API *MPMS* Chapter 3.1A, Chapter 17.2, Chapter 17.3, and Chapter 17.11).

Products with densities heavier than water may need to be water cut on top of the product. If it proves impossible to take a water-cut measurement, then alternative sampling measures should be taken (see API *MPMS* Chapter 3.1A).

When FW is detected in products whose specifications are sensitive to the presence of FW, the vessel shall be given an LOP on that account and all interested parties should be notified immediately.

8.1.10 Vessel Temperature

Individual compartment temperatures on the vessel should be taken concurrent with ullaging. Single or multilevel temperatures may be required as outlined in API *MPMS* Chapter 7, Chapter 17.2, or Chapter 17.11, as applicable. Measurements shall be averaged to determine the temperature of each compartment – do not use an average temperature for the entire vessel. The temperature measurement device shall have a calibrated range of accuracy that meets the desired temperature range of the material to be checked.

NOTE Temperatures taken at or near heating elements may distort temperature profiles.

8.1.11 Volume Calculations

Report both the actual innage/ullage as measured and the innage/ullage corrected for trim and list; including but not limited to the measurements (FW, TOV, Temperature, Density) and quantities necessary to determine the GSV for each tank, using the average temperature for each tank and the density. (See API *MPMS* Chapter 17.2 and Chapter 12.1.1.)

8.1.12 Vessel Experience Factor (VEF)

Data from previous voyages shall be obtained for use in calculating the VEF (see API *MPMS* Chapter 17.9/EI HM 49 [12]). Valid VEFs should be used for volume reconciliation. Data not provided by the vessel or independent inspection companies may only be used if agreed to by the commercial parties.

8.1.13 Ballast Operations

All cargo tanks, cargo lines, and cargo pumps shall be verified as free of ballast. Any ballast on board shall be contained within tanks that are fully segregated from the cargo system. The presence of any measurable petroleum or cargo contamination within ballast tanks prior to operations shall be recorded. Where practical, samples shall be

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collected and retained in accordance with standard sampling procedures. The Ballast Report should be obtained from the vessel, before and after operations. The inspector shall record the type of segregation between the ballast system and the cargo system and verify if segregation is achieved. Tank gauging should not be conducted while ballasting/deballasting operations are in progress; if this cannot be achieved, an LOP shall be issued.

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8.1.14 Slop Tanks

The inspector shall obtain gauges and temperatures of the contents of slop tanks to determine the interface and the separate quantities of FW and slop oil. The inspector shall take a sample of the water layer. Slop tank quantities shall be calculated and reported. If any slops are to be commingled with the cargo, they shall be treated as cargo tanks and recorded appropriately.

8.1.15 Sea Valves

If previously sealed valves are not intact, inspector shall investigate why the seals were broken, notify all interested parties, and record the findings in the inspection report. Previous seal numbers shall be recorded and reported on a Vessel Ullage/Sounding and Capacity Report (see Annex A). If these numbers differ from those recorded at the load port, the inspector shall investigate the reason for the discrepancy and notify all concerned parties.

8.1.16 Bunker Inspection

When requested, a bunker inspection should be performed before and after the cargo transfer operation. Measure the contents of all service, settling, and bunker storage tanks before and after load or discharge operations. If bunkering was conducted during load/discharge operations, request from vessel personnel a copy of the BDR (Bunker Delivery Receipt). Bunker consumption shall be calculated, compared, and documented. Each grade of Bunker Fuel shall have its own report. If bunker inspection is not performed, obtain all bunker documentation from vessel before and after the cargo transfer operation. Vessel cargo gauging should not be performed during bunkering operations.

8.1.17 Crude Oil Washing (COW)

Obtain the completed Crude Oil Washing (COW) log including the dates and times the COW procedure was started and stopped. Record in the inspection report which tanks were washed with crude oil, the material used as an agent, and the extent of the washing.

8.1.18 Line Pressure (During Transfer)

Obtain the completed line pressure and flow rate log from the vessel.

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8.2 Vessel Sampling

8.2.1 General

Representative samples shall be taken from each nominated vessel cargo tank if required, these samples shall be prepared for testing (see API *MPMS* Chapter 8.1). This composite is made by combining the vessel's individual tank samples in proportion to the

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volume of each tank to the total volume of the grade of cargo transferred. Appropriate containers shall be used that do not contaminate the samples.

When the material is known or suspected to be stratified, additional instructions may be given by the hiring party for spot samples to be drawn and analyzed to determine the degree of stratification. Due to incomplete mixing, sampling limitations, and other operational restrictions, vessel tank samples cannot be representative of proportional hand-blended samples that were tested at the port of loading. All interested parties shallbe notified immediately.

When sampling individual tanks, it is important that each container be flushed with the product before the sample is drawn to ensure the cleanliness of the sample containers. Care shall be taken to handle samples in a manner that does not compromise the analysis. Commingling of samples of different products or grades, or both, shall be avoided (see API *MPMS* Chapter 8 [5]).

Immediately label each sample with the appropriate tank number and other pertinent data.

If the presence of FW is found or suspected, every effort should be made to obtain samples of any FW in the cargo compartment in accordance with API *MPMS* Chapter 17.3 [7].

Samples shall be obtained to meet the requirements of interested parties. Interested parties generally specify sampling and testing requirements. Identical samples should be provided for the following:

a) the loading terminal,

b) the receiving terminal via the vessel master,

c) the independent inspector,

d) all other parties designated to receive the samples.

Samples that are placed on board the vessel for delivery to the representative at the discharge port (consignee) shall be sealed and recorded on a Sample Receipt, signed by the vessel's representative. A copy of the signed receipt should be included in the loading inspection report.

The length of time for samples to be retained should be established in a manner that is consistent with regulatory agencies' requirements, and the policies of the parties involved in the custody transfer.

8.3 During Transfer

8.3.1 First-foot Sample

During loading, if a first-foot sample is required, the inspector shall obtain the sample(s)when ~1 ft (0.3 m) of cargo, or minimum level needed for sampling, has been loaded into the tank. The sample should be examined or tested to determine conformity with cargo specifications. If the sample indicates potential contamination, cargo transfer operations should be suspended, and all interested parties should be notified before resuming operations.

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9 Shore Inspection and Sampling

9.1 Shore Lines

9.1.1 Shore Line Samples

When possibility of cargo contamination exists, line samples should be taken and inspected visually or tested to verify compatibility with the cargo that will be transferred. Alternatively, shoreline contents could be loaded into one cargo compartment on the vessel to be gauged, sampled, and tested. Line samples may not be representative of the complete line contents due to sample location limitations. Line samples shall be retained in accordance with contractual obligations and regulations.

9.1.2 Shore Line Fullness

Determine the fullness of the shoreline(s) (see API *MPMS* Chapter 17.6 [10]) before and after transfer, when possible. Record the method used for line verification, total capacity of the shorelines used, and the line condition. If the line condition after transfer differs from the condition before transfer, record and notify all interested parties.

It is the terminal's responsibility to ensure that all lines and valves are set in the correct position for the operation. These settings should be confirmed by the inspector and valves sealed when appropriate. After the transfer, verify that all seals installed remain intact. If any seals are not intact, record and notify all interested parties.

When nondedicated lines are used, consider transfer sequences of products flowing through the lines to minimize the potential for contamination caused by displacement of line contents. This determination should include an agreement on how the lines shall be displaced or how the different product interfaces will be handled.

If the cargo requires heating, report whether the shorelines are insulated and record the line temperature.

9.2 Shore Tank Gauges

9.2.1 Manual Gauges

Manual shore tank gauges shall be taken in accordance with API *MPMS* Chapter 3.1A.

Record the reference height from the shore tank capacity tables before gauges are taken. Take gauges, temperatures, samples, and water measurements of each shore tank to be used in the transfer. Any difference between the observed reference height and the reference height shown on the shore tank capacity tables shall be noted and investigated (see API *MPMS* Ch. 3.1A).

Manual gauging shall require obtaining either two consecutive gauge readings that are identical or three consecutive readings within an absolute range of 3 mm ($^1/_8$in.). If the first two readings are identical, this reading shall be reported to the nearest 1 mm if metric tapes are used or to the nearest $^1/_8$inif customary tapes are used. When three readings are taken, all three readings shall be within the 3 mm ($^1/_8$in) range and readings average to the nearest 1 mm for metric tapes and $^1/_8$in. for customary tapes. If the shore tank contents are determined to be in motion and waiting for equilibrium is not possible, the shore tank measurements should be recorded, and all parties advised. If the situation cannot be resolved, an LOP should be issued. If available, record the automatic shore tank gauges for purposes of comparison.

Document whether the shore tank has slotted or unslotted Standpipes. In the case that the shore tank standpipe is unslotted, measurements from the shore tank shall not be used for custody transfer. In the case of shore tanks with floating roofs, gauging should be avoided while the roof is in the critical zone. The placement of roof legs in

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high or low position and the critical zone shall be recorded.

The heavy nature of some products may require that an ullage measurement be taken. When obstructions, debris, or solid bottoms are observed, the condition shall be recorded, and ullage measurement is usually chosen. Products with densities heavier than water may need to be water cut on top of the product.

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Any incrustation that forms on top of the product may produce inaccuracies in measurement. If this condition exists, it shall be recorded.

9.2.2 Automatic Gauges

Automatic gauging systems with accuracy tolerances, measurement tolerances, and calibration records consistent with API *MPMS* Chapter 3.1B shall be used for custody transfer if mutually agreed to by the parties involved.

Automatic shore tank gauging systems used for custody transfer shall be verified in accordance with API *MPMS* Chapter 3.1B. If an automatic shore tank gauging system is used and the readings are not verified by manual measurements, record in the inspection report the last two times that the automatic system and the manual measurements were compared. Record on the inspection report that automatic gauges were used.

9.3 Shore Tank Temperatures

9.3.1 General

Temperature measurements shall be taken in accordance with API *MPMS* Chapter 7. Heavy cargoes, heated cargoes, blended cargoes, and cargoes in unheated tanks in very cold weather are more susceptible to temperature stratification. When stratification is determined, extra temperature measurements shall be taken.

NOTE Temperatures taken at or near heating elements may distort temperature profiles.

9.3.2 Portable Electronic Thermometer (PET)

The PET is the preferred equipment for obtaining temperatures.

The PET shall have a calibrated range of accuracy that meets the desired temperature range of the material from which a temperature is to be taken (see API *MPMS* Chapter 7).

9.3.3 Liquid-in-Glass Thermometer

Thermometers shall remain in the liquid long enough to reach equilibrium with the temperature of the liquid that is being measured (see API *MPMS* Chapter 7). Regarding liquids in which temperature stratification may occur, the time constraints involved in using a liquid-in-glass thermometer to profile a tank may require the use of a PET.

9.3.4 Dynamic Temperature Measurement

If a temperature probe in the shoreline is used to determine the temperature for the correction of metered quantity transferred, verify and record in the inspection report the last two times that the probe was checked for accuracy (see API *MPMS* Chapter 7).

9.3.5 Automatic Temperature Systems

Automatic temperature systems, consistent with API *MPMS*
Chapter 7.3 [4] may be used for custody transfer by mutual agreement among the parties involved.

Automatic temperature systems should be verified in accordance with API *MPMS* Chapter 7.3 [4]. If an automatic

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temperature system is used and the readings are not verified by manual measurements, record in the inspection report the last two times that the automatic system and the manual measurements were compared and if any differences were noted. Record on the inspection report that automatic temperature systems were used.

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9.4 Sampling

9.4.1 General

Inspector or measurement representative shall label each sample with the appropriate date, time, tank number, and other pertinent data. If required, seal the container, and record the seal numbers.

9.4.2 Manual Tank Sampling

Manual tank samples shall be taken in accordance with API *MPMS* Chapter 8.1.

The objective of manual sampling is to obtain a small portion (spot sample) of material from a selected area within a container that is representative of the material in that area, or in the case of running or all-levels samples, a sample whose composition is representative of the total material in the container. A series of spot samples may be combined to create a representative sample.

Each shore tank to be used in the transfer should be sampled to meet the requirements of interested parties and regulatory agencies. Sample containers shall be clean and shall be flushed with product prior to drawing the sample. Containers that are used for transport and storage of samples shall meet appropriate regulatory requirements.

When nonhomogeneous products are sampled, upper, middle, and lower spot samples are usually obtained. If stratification is suspected, it is strongly recommended that spot samples from additional levels are taken. If product is only transferred from part of a tank, then the spot samples representative of the levels transferred may be used for quality purposes; however, the entire tank's contents should still be sampled and retained in case they are needed. In the case that the tank standpipe (still pipe or guiding pole) is unslotted, samples shall not be used for custody transfer purposes.

The inspector or measurement representative shall specify in the inspection report the tank locations and methods used to obtain samples. The inspection report shall also state whether the tank was equipped with mixers, a circulating system, aerators, or if the tank was in motion.

9.4.3 Automatic Sampling

Automatic samples shall be taken in accordance with API *MPMS* Chapter 8.2.

Automatic sampling is the preferred method of sampling a marine cargo transfer. If an automatic sampling system is installed, it should be proved and operated in conformance with API *MPMS* Chapter 8.2. Any deficiencies shall be reported. Record the last time that the automatic sampler was proved.

If an automatic sampler is used, ascertain that the correct sample volume was obtained. The inspector or measurement representative shall witness the mixing and withdrawal of the contents of the primary sample receptacle. Gather data necessary to calculate automatic sampler performance report. Report any anomalies that occur in relation to the in-line sampling procedures.

9.5 Meters

Terminal operators are responsible for the operation of their meters and meter provers. If meters are to be used for custody transfer, meters shall be proved in accordance with API *MPMS* Chapters 4, 5, 12.2.4, and 12.2.5. Proving data shall be provided to the inspector and reported.

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Prior to transfer, record the opening meter readings. Meter measurement tickets shall be provided for each custody transfer and shall include the information required in API *MPMS* Chapter 12.2. Terminal operators, inspectors, or measurement representatives who are aware of factors that could affect the accuracy shall report the problem to all parties involved in the custody transfer. The incident and any resolution shall be recorded in the inspection report.

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If manual or automatic shore tank measurements are taken, report a comparison with metered volumes. If volumes cannot be reconciled, recheck meter data, shore tank measurements, and calculations. Report all results in the inspection report.

10 Voyage Analysis and Reconciliation

10.1 Shore and Vessel Transferred Volume Calculations

After the shore tank or vessel tank is gauged, the quantities of the bulk liquid hydrocarbon cargos (e.g. crude oil, petroleum products, liquid chemicals, bio-feeds, biofuels, and liquid petroleum gases) in each tank shall be calculated according to the guidelines in API *MPMS* Chapter 12.1.1 and Chapter 12.2. If meters are used, the calculation methods shall be followed, and meter factors shall be calculated according to the guidelines in API *MPMS* Chapter 12.2.

10.2 Load & Discharge Port Voyage Analysis

For both load and discharge port, the inspector or measurement representative should compare the shore's TCV delivered/received with the vessel's TCV received/delivered, corrected by a valid VEF when available. If the difference exceeds contractual limits or company policies, the inspector should re-check all measurements and calculations to identify the cause of the discrepancy. If the differences cannot be reconciled, the inspector or measurement representative shall notify the interested parties and issue a Letter of Protest or a Notice of Apparent Discrepancy (see Annex A) to vessel and terminal representatives.

When the Bill of Lading and vessel volumes are compared, any discrepancies among the GSV, NSV, density, temperatures, or any other specification shall be brought to the attention of the appropriate interested parties.

Upon completion of the final discharge, the inspector or measurement representative should complete the Voyage Analysis and Reconciliation Reports. Unless contractually confidential, all relevant data from load port(s) through discharge port(s) should be assembled and an analysis should be made to provide an overall view of the voyage performance. Include in the Voyage Analysis and Reconciliation Report any relevant comments that may help to explain any discrepancies.

10.3 In-transit Difference

The inspector or measurement representative should compare the TCV, GSV, and FW at the load port prior to sailing with the TCV, GSV, and FW at discharge port prior to offload. If the total volume of cargo quantity varies more than the amount specified by the interested parties, the inspector or measurement representative should notify the vessel's representative and recheck the vessel prior to discharge. If the discrepancy remains after the vessel is rechecked, the inspector or measurement representative shall issue an LOP to the vessel's representative and notify all interested parties (see API *MPMS* Chapter 17.5 [9]).

10.4 Discharge Port Voyage Analysis

10.5 Qualitative Testing

The nominating parties should specify the test methods used for analysis. Responsibility for testing rests primarily with the nominated laboratory. The nominating parties or their representatives should be allowed to conduct the same tests on a

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duplicate sample or to witness the testing performed by the nominated laboratory. The inspector shall include in the inspection report any witnessed deviations from the specified testing procedures.

10.6 Letter of Protest (LOP) or Notice of Apparent Discrepancy (NOAD)

An LOP or NOAD shall be issued by the inspector in the event of a protest, witnessed concern, or discrepancy related to custody transfer. An LOP should be issued individually for each event, this may result in multiple LOPs for a single movement. This serves as a written record that the particular action or finding was questioned at the time of occurrence.

Any action or refusal to act that is not in accordance with API procedures or specific prior contractual agreements shall be reported by the inspector or measurement representative to the parties concerned and should be documented by the issuance of an LOP.

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10.7 Time Log

The inspector or measurement representative shall report the time and date of all operational events on the time log. Include the time and description of any delays or unusual occurrences.10.8 Distribution of Documents. The inspector shall distribute the final report and supporting documents of the transfer amongst nominating parties or their representative(s). Field documents shall be made available to vessel personnel and shore facilities.

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Annex A
(Informative)

Sample Forms

The following sample forms [1] are designed to provide a guideline for recording and reporting essential data obtained during the marine cargo inspection procedure. Users of these forms should not rely exclusively on the information contained in this document. Sound business, scientific, engineering, and safety judgment should be used in employing the information contained herein and where applicable, authorities having jurisdiction should be consulted.

These forms (Figure A.1 through Figure A.21) were designed for a simple voyage and as such may not be suitable for all contingencies. Measurement personnel may use other forms and explanations where required to fully document the transfer operation.

The following forms, except form 6 (Figure A.6) (available with the purchase of API *MPMS* Chapter 17.5 [9]), are freely offered to all companies to use, with or without company identification logos.

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[1] These examples are for illustrative purposes only. [Each company should develop its own approach.] They are not to be considered exclusive or exhaustive in nature. API makes no warranties, express or implied for reliance on or any omissions from the information contained in this document. Where applicable, authorities having jurisdiction should be consulted. Work sites and equipment operations may differ. Users are solely responsible for assessing their specific equipment and premises in determining the appropriateness of applying the examples. At all times users should employ sound business, scientific, engineering, and judgment safety when using this *MPMS*.

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Figure A.1—Report of Shore Quantity

REPORT OF SHORE QUANTITY INDICATE ► ☐ LOAD PORT ☐ DISCHARGE PORT

PORT/TERMINAL	CARGO	VESSEL			VOYAGE NO.	DATE PREPARED

TANK NUMBER	LOAD PORT (OPENING 1ST) DISCHARGE PORT (CLOSING 1ST) DATE	TIME	INNAGE/ ULLAGE (FT/M)	INDICATED VOLUME (_____)	TOTAL OBSERVED VOLUME (_____)	FREE WATER INNAGE/ULLAGE (FT/M)	FREE WATER VOLUME (_____)	CTSH CORRECTION	ROOF CORRECTION	GROSS OBSERVED VOLUME (_____)	TEMP (°F/°C)	°API 60 °F OR DENSITY 15 °C	VOLUME CORRECTION FACTOR TABLE ___	GROSS STANDARD VOLUME (_____) @60°F/15°C
TOTALS THIS TANK														
TOTALS THIS TANK														
TOTALS THIS TANK														
TOTALS THIS TANK														
TOTALS THIS TANK														

GROSS STANDARD VOLUME (_____)		NET STANDARD VOLUME (M^3/L)		**SIGNATURES**
FREE WATER (_____)		NET STANDARD VOLUME (____)		
TOTAL CALCULATED VOLUME (_____)		COMPOSITE SHORE/VESSEL API GRAVITY 60°F/DENSITY 15°C		MEASUREMENT REPRESENTATIVE
SEDIMENT AND WATER, PERCENT		WEIGHT CONVERSION FACTOR (TABLE_____)		TERMINAL REPRESENTATIVE
SEDIMENT AND (_____) VESSEL/SHORE		WEIGHT (_____)		
COMMENTS:				

(_____) Units of Measurements

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Figure A.2—Vessel Ullage/Sounding and Capacity Report

VESSEL ULLAGE/SOUNDING AND CAPACITY REPORT

BEFORE AFTER
LOAD ☐ ☐
DISCHARGE ☐ ☐
LIGHTER ☐ ☐ ☐ TO ☐ FROM VESSEL: _____

VESSEL	PORT/TERMINAL	CARGO	VOYAGE NO.	DATE/TIME GAUGED

TANK NUMBER	ULLAGE (FT/M)	TRIM/LIST CORRECTED ULLAGE (FT/M)	TOTAL OBSERVED VOLUME (BBLS)	FREE WATER		GROSS OBSERVED VOLUME (BBLS)	TEMPERATURE (°F/°C)	°API@60°F OR DENSITY@ 15°C	VCF (TABLE_____)	GROSS STANDARD VOLUME ( )
				INNAGE/ULLAGE (FT/M)	VOLUME ( )					

Gauge Point Used (Circle One): Fore Mid Aft Comments:

INSPECTION EQUIPMENT USED: (MAKE, MODEL, SERIAL #):

CAPACITY OF VESSEL LINES ( ) WHEN THIS FORM IS USED FOR ON-BOARD QUANTITY/REMAINING ON BOARD, TRANSFER THIS NUMBER TO OBQ/ROB REPORT

GROSS STANDARD VOLUME (bbls)		DRAFT FORWARD (FT/M)	
GROSS STANDARD VOLUME (_)		DRAFT AFT (FT/M)	
PLUS FREE WATER ( )		LIST (DEGREES) P/S	
TOTAL CALCULATED VOLUME ( )		SEA VALVE SEAL NUMBERS	
API GRAVITY 60°F/DENSITY 15°C		PORT	
SEDIMENT AND WATER, PERCENT		STARBOARD	
WEIGHT CONVERSION FACTOR (TABLE____)		OVERBOARD PORT	
TCW ( ) TONS		OVERBOARD STARBOARD	
( ) IDENTIFY UNIT OF VOLUME AND/OR MEASUREMENT			

SIGNATURES

VESSEL REPRESENTATIVE

TERMINAL REPRESENTATIVE

MEASUREMENT REPRESENTATIVE

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Figure A.3a—OBQ/ROB Report

ONBOARD QUANTITY/REMAINING ON BOARD REPORT INDICATE► ☐ ROB ☐ OBQ

VESSEL	PORT/TERMINAL	CARGO	DATE/TIME MEASUREMENTS TAKEN	API/DENSITY

TANK NUMBER	GAUGE HT. LOCATION (NOTE 3) F C A O	INNAGE/ULLAGE (NOTE 3)		MATERIAL DESCRIP.		TOTAL OBSERVED VOLUME (_____)	FREE WATER			GROSS OBSERVED VOLUME (_____)	TEMP (°F/°C)	V C F (T._____)	GROSS STANDARD VOLUME (_____)
							INNAGE/ULLAGE		VOLUME (_____)				
		UNCORRECTED	CORRECTED (W IF WEDGED)	LIQUID	NON-LIQUID		UNCORRECTED	CORRECTED (W IF WEDGED)					

( ) IDENTIFY UNIT OF VOLUME AND/OR MEASUREMENT. INSPECTION EQUIPMENT USED: (MAKE, MODEL, SERIAL #):

NOTES:

1. Liquid indicated is free flowing (in the opinion of the measurement representative).
2. If wedged, attached wedge calculation
3. F - Foreward
   C - Center
   A - Aft
   O - Other

GSV ( )						PRIOR CARGO(S):	
FREE WATER ( )						FORWARD DRAFT (_____)	
TCV ( )						AFT DRAFT (_____)	
LIQUID ( ) (NOTE 1)					(L)	LIST (DEGREES) P/S	
NONLIQUID ( ) (NOTE 1+2)					(S)	BALLAST TANKS USED THIS VOYAGE	
	STRIPPED		DROPPED		TANK NO.	OTHER (Explain)	
	YES	NO	YES	NO			
TOP LINES						SAMPLES TAKEN YES NO	
BOTTOM LINES						SEE VALVE SEAL NUMBERS	
HOSES/ARM						PORT _____	
						STARBOARD _____	
						OVERBOARD _____	

SIGNATURES
VESSEL REPRESENTATIVE
TERMINAL REPRESENTATIVE
MEASUREMENT REPRESENTATIVE

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Figure A.3b—OBQ/ROB Report (Continued)

ONBOARD QUANTITY REMAINING ON BOARD REPORT

TANK NUMBER	GAUGE HT. LOCATION (NOTE 3) F C A O	INNAGE/ULLAGE (NOTE 3)		MATERIAL DESCRIP.		TOTAL OBSERVED VOLUME (_____)	FREE WATER INNAGE/ULLAGE		VOLUME (_____)	GROSS OBSERVED VOLUME (_____)	TEMP (F/C)	V C F (T._____)	GROSS STANDARD VOLUME (_____)
		UNCORRECTED	CORRECTED (W IF WEDGED)	LIQUID	NON-LIQUID		UNCORRECTED	CORRECTED (W IF WEDGED)					

( ) IDENTIFY UNIT OF VOLUME AND/OR MEASUREMENT.

NOTES:

1. Liquid indicated is free flowing (in the opinion of measurement representative).

2. If wedged, attatched wedge calculation

3. F - Foreward
   C - Center
   A - AFT
   O - Other

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Figure A.4—Time Log

TIME LOG

☐ DISCHARGE / ☐ LOADING

DATE	REFERENCE NO.

VESSEL	PORT/TERMINAL	PRODUCT/CARGO

	MONTH	DAY	HOUR
1. END OF SEA PASSAGE			
2. VESSEL ARRIVED -- _____			
3.			
4. DOCKED (GANGWAY IN PLACE)			
5. NOTICE OF READINESS TENDERED			
6. NOTICE OF READINESS ACCEPTED			
7. VESSEL CLEARED BY GOVERNMENTAL OFFICIAL			
8. SURVEYOR ON BOARD			
9. KEY MEETING HELD			
10. VESSEL SURVEY COMPLETED/BEGINNING OF TRANSFER			
11. HOSES CONNECTED (__ X __)			
12. COMMENCED DISCHARGE/TAKING BALLAST			
13. FINISHED DISCHARGE/TAKING BALLAST			
14. STARTED LOADING/UNLOADING			
15. COMPLETED LOADING/UNLOADING			
16. HOSES DISCONNECTED			
17. ESTIMATED SAILING TIME			
18. SURVEY COMPLETE/END OF TRANSFER			
19.			
20.			
21.			
22.			

AMBIENT TEMPERATURE	SEA WATER TEMPERATURE	GENERAL WEATHER CONDITIONS

REMARKS:

MEASUREMENT REPRESENTATIVE

VESSEL REPRESENTATIVE

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Figure A.5a—Vessel Experience

Example of Primary VEF Method
M/T Popsicle - Load Port VEF Worksheet

Unit of Measurement shall be consistent on the entire form (shore-vessel and all rows in data set)

Sequential Voy #	Date	Voyage Number	Port	Cargo	Quantities in [Unit of Measurement] Vessel Sailing TCV	OBQ	Vessel Loaded TCV	Vessel CTPL Basis	Shore TCV (B/L)	Shore CTPL Basis	Load B/L Basis	Ship / Shore Ratio	* Rejected Voyage	Qualifying Voyage	Comments
1	27/02-05/03/18	18-04A&B	Equitorial Guinea & Nigeria	Forcados; Aseng	684,436	124	684,312	54A	684,300	54A	Shore	1.00002	No	Yes	
2	2/14/18	18-03	Libya	Crude Oil	603,640	0	603,640	54A	602,180	54A	Shore	1.00242	No	No	
3	2/2/18	18-02	Russia	Crude Oil							Shore		Yes		Gross Error
4	1/16/18	18-01	Algeria	Crude Oil	666,623	101	666,522	54A	668,232	54A	Shore	0.99744	No	Yes	
5	10/27/17	17-17	Venezuela	Morichal 16	600,150	20	600,130	5A	600,501	5A	Shore	0.99938	No	Yes	
6	10/1/17	17-16A&B	Gabon	Crude Oil	714,083	65	714,018	54A	715,061	54A	Shore	0.99854	No	Yes	
7	9/2-9/8/17	17-15A&B	Saudi Arabia & UAE	Arab Light, LSC	670,893	64	670,829	54A	673,712	54A	Shore	0.99572	No	Yes	
8	8/10/17	17-14	Italy	Fuel Oil							Ship		Yes		Vsl figures with VEF applied
9	7/22/17	17-13	Russia	Crude Oil	673,499	256	673,243	54A	673,945	54A	Shore	0.99896	No	Yes	
10	7/10/17	17-12	Ukraine	VGO	586,302	27	586,275	6B	586,654	6B	Shore	0.99935	No	Yes	
11	6/14/17	17-11	Saudi Arabia, Kuwait	Arab Med; Kuwait	597,876	152	597,724	54A	598,473	54A	Shore	0.99875	No	Yes	
12	6/2/17	17-10	UAE	Fuel Oil							Ship		Yes		Ship to ship transfer
13	5/5/17	17-09	Indonesia	Crude Oil	679,994	65	679,929	5A	680,845	5A	Shore	0.99865	No	Yes	
14	4/3-4/6/17	17-08A,B&C	Estonia	Fuel Oil	650,112	75	650,037	6B	650,953	6B	Shore	0.99859	No	Yes	
15	3/3/17	17-07	Trinidad	Crude Oil	627,714	82	627,632	5A	627,944	5A	Shore	0.99950	No	Yes	
16	2/24/17	17-06	Bahamas	Naphtha	550,042	36	550,006	6B	550,335	6B	Shore	0.99940	No	Yes	
17	2/8/17	17-04	Bahamas	Naphtha							Ship		Yes		Lightering
18	2/1/17	17-03	St. Lucia	Crude Oil	645,973	0	645,973	5A	648,815	5A	Shore	0.99562	No	No	
19	1/15/17	17-02	Mexico	Maya Crude Oil	457,716	15	457,701	5A	458,477	5A	Shore	0.99831	No	Yes	
20	1/3/17	17-01	Curacao	Crude Oil							Ship		Yes		Lightering
				Sum of all non-rejected quantities			9,407,971		9,420,427						
				Mean Vessel/Shore Ratio			0.99868								
				+/- 0.30% of the Mean Vessel/Shore Ratio			0.99568		1.00168						
				Sum of all qualifying quantities			8,158,358		8,169,432						
				Vessel Experience Factor			**0.9986**								

Calculated as **(Mean Vessel/Shore Ratio * 0.997)** and **(Mean Vessel/Shore Ratio * 1.003)** with each value rounded to 5 Decimal places

*** Rejected Voyages**
As defined by Section 5.2
Reason(s) for voyage rejection should be listed under Comments

Example of Primary VEF Method
M/T Popsicle - Discharge Port VEF Worksheet

Unit of Measurement shall be consistent on the entire form (shore-vessel and all rows in data set)

Sequential Voy #	Date	Voyage Number	Port	Cargo	Quantities in [Unit of Measurement] Vessel Arrival TCV	ROB	Vessel Discharged TCV	Vessel CTPL Basis	Shore TCV (Outturn)	Shore CTPL Basis	Discharge Outturn Basis	Ship / Shore Ratio	* Rejected Voyage	Qualifying Voyage	Comments
1	27/02-05/03/18	18-04A&B	Wilmington, Ca	Forcados; Aseng	684,436	124	684,312	54A	684,300	54A	Shore	1.00002	No	Yes	
2	2/14/18	18-03	Torrance, Ca	Crude Oil	603,640	0	603,640	54A	602,180	54A	Shore	1.00242	No	No	
3	2/2/18	18-02	Baytown Refinery, Tx	Crude Oil							Shore		Yes		Gross Error
4	1/16/18	18-01	Loop Terminal, La	Crude Oil	666,623	101	666,522	54A	668,232	54A	Shore	0.99744	No	Yes	
5	10/27/17	17-17	Altona Refinery, Australia	Morichal 16	600,150	20	600,130	5A	600,501	5A	Shore	0.99938	No	Yes	
6	10/1/17	17-16A&B	Antwerp, Belgium	Crude Oil	714,083	65	714,018	54A	715,061	54A	Shore	0.99854	No	Yes	
7	9/2-9/8/17	17-15A&B	Mossel Bay, South Africa	Arab Light, LSC	670,893	64	670,829	54A	673,712	54A	Shore	0.99572	No	Yes	
8	8/10/17	17-14	Cherry Point, Wa	Fuel Oil							Ship		Yes		Vsl figures with VEF applied
9	7/22/17	17-13	Nederland, Tx	Crude Oil	673,499	256	673,243	54A	673,945	54A	Shore	0.99896	No	Yes	
10	7/10/17	17-12	Fawley Refinery, England	VGO	586,302	27	586,275	6B	586,654	6B	Shore	0.99935	No	Yes	
11	6/14/17	17-11	Whiffen Head Terminal, NL	Arab Med; Kuwait	597,876	152	597,724	54A	598,473	54A	Shore	0.99875	No	Yes	
12	6/2/17	17-10	Long Beach, Ca	Fuel Oil							Ship		Yes		Ship to ship transfer
13	5/5/17	17-09	Texas City, Tx	Crude Oil	679,994	65	679,929	5A	680,845	5A	Shore	0.99865	No	Yes	
14	4/3-4/6/17	17-08A,B&C	Richmond, Ca	Fuel Oil	650,112	75	650,037	6B	650,953	6B	Shore	0.99859	No	Yes	
15	3/3/17	17-07	Chalmette, La	Crude Oil	627,714	82	627,632	5A	627,944	5A	Shore	0.99950	No	Yes	
16	2/24/17	17-06	Omisalj, Croatia	Naphtha	550,042	36	550,006	6B	550,335	6B	Shore	0.99940	No	Yes	
17	2/8/17	17-04	Whangarei Refinery, NZ	Naphtha							Ship		Yes		Lightering
18	2/1/17	17-03	Beaumont, Tx	Crude Oil	645,973	0	645,973	5A	648,815	5A	Shore	0.99562	No	No	
19	1/15/17	17-02	Tranmere, England	Maya Crude Oil	457,716	15	457,701	5A	458,477	5A	Shore	0.99831	No	Yes	
20	1/3/17	17-01	Sault Ste. Marie, ON	Crude Oil							Ship		Yes		Lightering
				Sum of all non-rejected quantities			9,407,971		9,420,427						
				Mean Vessel/Shore Ratio			0.99868								
				+/- 0.30% of the Mean Vessel/Shore Ratio			0.99568		1.00168						
				Sum of all qualifying quantities			8,158,358		8,169,432						
				Vessel Experience Factor			**0.9986**								

Calculated as **(Mean Vessel/Shore Ratio * 0.997)** and **(Mean Vessel/Shore Ratio * 1.003)** with each value rounded to 5 Decimal places

*** Rejected Voyages**
As defined by Section 5.2
Reason(s) for voyage rejection should be listed under Comments

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Figure A.5b—Example of Alternate Calculation Method

Example of Calculation for Load Data

Step (a) List VLRs in ascending order and label r_1 to r_{10}:

Voyage Number	VLR	Label
9	0.99755	r_1
10	0.99858	r_2
8	0.99906	r_3
1	0.99986	r_4
7	1.00086	r_5
3	1.00105	r_6
5	1.00225	r_7
4	1.00278	r_8
6	1.00548	r_9
2	1.01207	r_{10}

Step (b)

(i) Since the number of VLRs is 10, calculate R_L and R_H for n = 10.

$$R_L = \frac{r_2 - r_1}{r_9 - r_1} = \frac{0.99858 - 0.99755}{1.00548 - 0.99755} = \frac{0.00103}{0.00793} = 0.130$$

$$R_H = \frac{r_{10} - r_9}{r_{10} - r_2} = \frac{1.01207 - 1.00548}{1.01207 - 0.99858} = \frac{0.00659}{0.01349} = 0.489$$

(ii) Compare R_L = 0.130 and R_H = 0.489 with the critical value at the 95 % probability level corresponding to n = 10 shown in Table D.1, i.e., 0.477.

(iii) As R_L = 0.130 is less than the critical value of 0.477, do not delete r_1.

(iv) As R_H = 0.489 is greater than the critical value of 0.477, delete r_{10}.

Step (c) Re-label the remaining ratios r_1 to r_9. Repeat Step (b) and confirm that in this example, no more VLRs have been deleted.

Step (d) Calculate the mean, r, of the 9 remaining ratios to four decimal places, and report as the vessel experience factor: r = 1.0008

DRAFT FOR CONTRIBUTE

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Figure A.6—Voyage Analysis Report (see API *MPMS* Chapter 17.5 [9])

☐ Loading ☐ Discharge ☐ V-V Transfer ☐ Summary				Reference No.	Voyage/Trip No.	C/P Date (M/D/Y)	Page No. ____ Of ____
Vessel				Cargo		Type of Voyage	
Loading Port/Terminal/Berth		Arrived (M/D/Y)	Sailed (M/D/Y)	Discharge Port/Terminal/Berth		Arrived (M/D/Y)	Sailed (M/D/Y)
Quantity Unit ☐ Bbls ☐ Gals ☐ M3 ☐ L		Supplier	Receiver	VCF Table Used			
				Shore Load	Shore Disc	Vessel Load	Vessel Disc
Description	API/ Density	TCV	FW	GSV	S&W	NSV	Calculation Reference
I. Comparison of Shore Quantities in Custody Transfer							
Bill of Lading 1.							-1
Outturn 2.							-2
Diff. 3.							(3) = (2) – (1)
Diff. % 4.		%		%		%	(4) = (3) / (1) × 100
Recalc. B/L 5.	(a)		Recalculate if B/L and O/T use different tables				(5) (a) Vol.Diff.
II. Vessel/Shore Quantaties at ( ) Load Port(s)							
Vessel Sailing A.					LIQUID	NON-LIQUID	(A)
OBQ (All) B.							(B)
Loaded C.							(C)=(A) – (B)
Difference D.							(D)=(C)–[(1) or (5)]
Difference % E.		%		%			(E)=(D)/[(1)or(5)]×100
Load Vessel Ratio F.							(F)=(C)/[(1) or (5)]
Load VEF G.							(G)
Theoretical Shore H.							(H)=(C) / (G)
Theoretical Shore Diff. I.							(I)=(H) – [(1) or (5)]
Theoretical Shore Diff. % J.		%					(J)=(I)/[(1) or (5)]×100
III. Vessel/Shore Quantities at ( ) Discharge Port(s)							
Vessel Arrival K.					LIQUID	NON-LIQUID	(K)
ROB (All) L.							(L)
Discharged M.							(M) = (K) – (L)
Difference N.							(N) = (M) – (2)
Difference % O.		%		%			(O) = (N) / (2) × 100
Discharge Vessel Ratio P.							(P) = (M) / (2)
Discharge VEF Q.							(Q)
Theoretical Shore R.							(R) = (M) / (Q)
Theoretical Shore Diff. S.							(S) = (2) – (R)
Theoretical Shore Diff. % T.		%					(T) = (S) / (2) × 100
IV. Vessel's Comparison of Loading and Discharge Port(s) VCF Table Must Be Consistent							
Transit Difference U.							(U) = (K) - (A)
Difference V.		%			LIQUID	NON-LIQUID	(V) = (U) / (A) x 100
OBQ/ROB Difference W.							(W) = (B) - (L)
TCV Diference (3) - OBQ (B) + ROB (L)				[S&W(1) / GSV(1)] x 100		[S&W(2) / GSV (2)] x 100	
ADJ TCV DIFF _____(Quantity)/ _____%				S&W at Load Port _____%		S&W at Discharge Port _____%	
Comments:							
Prepared by		Title		Company		Date Completed (M/D/Y)	

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Figure A.7—Sample Receipt

SAMPLE RECEIPT

VESSEL	PRODUCT/CARGO	PORT/TERMINAL	DATE PREPARED

SIZE OF SAMPLE	SEAL NUMBER	DESCRIPTION
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		

COMMENTS:

RECEIVED BY	RECEIVED FROM
SIGNATURE	SIGNATURE
PRINT NAME	PRINT NAME
COMPANY/VESSEL	COMPANY/VESSEL
DATE SIGNED	DATE SIGNED

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Figure A.8—Test Witness Report

TEST WITNESS REPORT

One form per sample tested

VOYAGE NO.

VESSEL	PORT/TERMINAL	DATE SAMPLE TAKEN
CARGO	SAMPLE DRAWN FROM	LAB REFERENCE NO.
SAMPLED BY	TESTED BY	

THE ABOVE SAMPLE WAS WITNESSED AND THE FOLLOWING RESULTS OBTAINED IN LABORATORY.

TEST	METHOD	RESULTS	UNITS

TYPE OF SAMPLE: I.E., SPOT-RUNNING-AVERAGE

LABORATORY CERTIFICATION

SIGNATURE

DATE OF TEST

WITNESS

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Figure A.9—Metered Quantity Report

METERED QUANTITY REPORT ☐ LOAD PORT ☐ DISCHARGE PORT

DATE	TIME

PORT/TERMINAL	OPERATOR	VESSEL	CARGO	VOYAGE NO.

1	METER NUMBER					
2	METER TYPE					
3	CLOSING METER READING (_____)					
4	OPENING METER READING (_____)					
5	INDICATED VOLUME (LINE 3 - LINE 4)					
6	METER FACTOR (NOTE 1)					
7	AVERAGE STREAM TEMPERATURE, (_____) IF NON TEMPERATURE COMPENSATED (NOTE 2)					
8	API GRAVITY 60° F/DENSITY 15° C (_____)					
9	VOLUME CORRECTION FACTOR (C_{tl}) (SEE NOTE 2) TABLE _____					
10	AVERAGE METER PRESSURE, (_____) (VOLUMETRIC WEIGHTED AVERAGE)					
11	PRESSURE CORRECTOR FACTOR (Cpl)					
12	COMPOSITE CORRECTION FACTOR — FOR NON TEMPERATURE COMPENSATED METERS ONLY (LINE 6 X LINE 9 X LINE 11)					
	COMPOSITE CORRECTION FACTOR — FOR TEMPERATURE COMPENSATED METERS ONLY (LINE 6 X LINE 11)					
13	TOTAL CALCULATED VOLUME (LINE 5 X LINE 12)					
14	FREE WATER (SEE NOTE 3)					
15	GROSS STANDARD VOLUME (____) (LINE 13 - LINE 14)					
16	SEDIMENT AND WATER, PERCENT					
17	SEDIMENT AND WATER, VOLUME (____) (LINE 15 * (1 - LINE 16))					
18	NET STANDARD VOLUME (BBL/GAL) (LINE 15 - LINE 17)					
19	NET STANDARD VOLUME (M^3/L)					

SUMMARY (AS DETAILED BY METER FACILITY SAMPLING)	
TOTAL CALCULATED VOLUME (_____)	
FREE WATER VOLUME (_____)	
GROSS STANDARD VOLUME (_____)	
SEDIMENT AND WATER, VOLUME PERCENT	
COMPOSITE GRAVITY 60° F (TABLE _____)	
WEIGHT CONVERSION FACTOR	
TOTAL CALCULATED WEIGHT (_____)	
NET STANDARD VOLUME (BBL/GAL) **TOTAL**	
NET STANDARD VOLUME (M^3/L) **TOTAL**	

SIGNATURES

_____
TERMINAL REPRESENTATIVE

_____
MEASUREMENT REPRESENTATIVE

NOTES: 1. ATTACH TO THIS FORM COPIES OF METER PROVING REPORTS SHOWING DETERMINATION. REFERENCE MPMS CHAPTER 12.2
2. NON-TEMPERATURE COMPENSATED METERS ONLY.
3. ONLY TO BE USED WITH NON-INLINE SAMPLER MOVEMENT.
(_____) UNITS OF MEASUREMENT.

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Figure A.10—Meter Volumetric Prover Report
(additional proving examples can be found in API MPMS Ch4.8)

PROVER INFORMATION

CERTIFICATION DATE: _____ (YY/MM/DD) PROVER COMPANY _____

BASE PROVER VOLUME _____ (BARRELS) PROVER UNIT SERIAL NO. _____

METER INFORMATION

SERIAL NO. _____ MANUFACTURER _____

METER ID _____ MODEL _____

LOCATION _____

K-FACTOR _____ (PULSES/BBL)

PROCESS CONDITIONS

FLOW RATE _____ (BBL/HR) _____

Product Table _____ (DEVICE/LOCATION) DENSITY _____ (kg/m³ @ or °F) FLUID TYPE _____

PROVE INFORMATION

PREVIOUS METER FACTOR _____ (DATE OF PROVE YY/MM/DD) _____ (FACTOR)

RUN NUMBER	1	2	3	4	5
TOTAL METER PULSES					
PROVER TEMPERATURE (°F)					
CTS_p					
CTL_p					
PROVER PRESSURE (psig)					
CPS_p					
CPL_p					
METER TEMPERATURE (°F)					
CTL_m					
METER PRESSURE (psig)					
CPL_m					
PROVER VOLUME (bbl)= [(BaseVol * CTS_p * CPS_p) * CTL_p * CPL_p]					
METER VOLUME (bbl)= [(Pulses/Vol. K-Factor) * CTLm * CPLm]					
METER FACTOR= (Prover Volume/Meter Volume)					

AVERAGE METER FACTOR _____

PERCENT REPEATABILITY _____ [(MAX – MIN)/MIN] * 100 PERCENT UNCERTAINTY _____

PROVER _____ (SIGN) _____ (DATE) WITNESS _____ (SIGN) _____ (DATE)

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Figure A.11—Slops Record

SLOP RECORD ☐ LOADING ☐ DISCHARGE

INSTRUCTIONS: This record shall be used only for cargo tanks designated to collect oily residues generated during load-on-top operations prior to loading, and for cargo tanks used to retain liquid slops that are not intended to be discharged ashore at the discharge port. It shall not be used to record general onboard cargo quantities or cargo remaining on board (ROB).

VOYAGE NO.

VESSEL	PORT/TERMINAL	DATE/TIME

	Tank No. _____	Tank No. _____	Tank No. _____
ULLAGE/INNAGE (FT/M)			
CORRECTED ULLAGE/INNAGE (FT/M)			
TOTAL OBSERVED VOLUME (____)			
WATER GAUGE (FT/M)			
CORRECTED WATER GAUGE (FT/M)			
FREE WATER VOLUME (____)			
GROSS OBSERVED VOLUME (____)			
API GRAVITY/DENSITY OBSERVED			
TEMPERATURE (°F/°C)			
API GRAVITY 60°F/DENSITY 15°C			
VOLUME CORRECTION FACTOR (TABLE_____)			
GROSS STANDARD VOLUME (____)			
WEIGHT CORRECTION FACTOR (TABLE_____)			
GROSS WEIGHT (____) TONS			
PREVIOUS CARGO			
PORT LOADED			
DRAFT FORWARD (FT/M)			
DRAFT AFT (FT/M)			
LIST (DEGREES) P/S			
SIGNATURES			

VESSEL REPRESENTATIVE	TERMINAL REPRESENTATIVE	MEASUREMENT REPRESENTATIVE

(_____) UNITS

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Figure A.12—Vessel Discharge Record

VESSEL DISCHARGE RECORD

DATE PREPARED

VOYAGE NO.

VESSEL	PORT/TERMINAL	BERTH

GAUGE LOCATION	SHORE	VESSEL

TIME	VESSEL PRESSURE	SHORE PRESSURE	RATE (____ /HR)	VOLUME DISCHARGE (____)	COMMENTS

NOTE: Pressure are expressed in applicable gauge units.

(_____) UNITS

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Figure A.13—Bunker Inspection Report

BUNKER INSPECTION REPORT NOTE: ONE FORM PER GRADE OF BUNKERS

VESSEL	PORT/TERMINAL	DATE PREPARED	GRADE

■ 1. VESSEL HISTORY FROM CHIEF ENGINEER

AVERAGE BUNKER CONSUMPTION/DAY (TONS) ( ) AT SEA IN PORT AT ANCHOR

■ 2. BUNKERS LAST PORT OF CALL ►

SAILING DATE	SAILING TIME	BUNKERS ON SAILING ►	( ) TONS	API GRAVITY 60° F / DENSITY 15° C ►	

■ 3. INSPECTION UPON ARRIVAL **DATE:** **TIME:**

BUNKER TANKS	ULLAGES ( )	GROSS OBSERVED VOLUME ( )	API/ DEN-SITY	FLASH POINT	LOWER EX-PLOSIVE LIMIT LEL %	TEMP. ( )	VCF TABLE (_____)	GROSS STANDARD VOLUME ( )
				TOTAL GROSS STANDARD VOLUME ( )				
				WEIGHT CONVERSION FACTOR ( )				
				GROSS WEIGHT ( )				

■ 4. INSPECTION PRIOR TO SAILING **DATE:** **TIME:**

BUNKER TANKS	ULLAGES ( )	GROSS OBSERVED VOLUME ( )	API/ DEN-SITY	FLASH POINT	LOWER EX-PLOSIVE LIMIT LEL %	TEMP. ( )	VCF TABLE (_____)	GROSS STANDARD VOLUME ( )
DID VESSEL BUNKER AT THIS PORT? ☐ YES ☐ NO				**TOTAL GROSS STANDARD VOLUME ( )**				
DID VESSEL BUNKER IN TRANSIT? ☐ YES ☐ NO				**WEIGHT CONVERSION FACTOR ( )**				
QUANTITY LOADED ( ) TONS GROSS STANDARD WEIGHT:				**GROSS STANDARD WEIGHT ( )**				

■ 5. BUNKER CONSUMPTION

	IN PORT		TIME PERIOD
OPENING +		DATE/TIME	
CLOSING -		DATE/TIME	
BUNKERING +		ELAPSED DAYS/HOURS	
CONSUMPTION +		CONSUMPTION PER 24 HRS.	

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Figure A.14a—Inspection Checklist

INSPECTION CHECKLIST						VESSEL NAME:		
						PORT/TERMINAL:		
						CARGO(ES):		
						DATE:		

If an item listed below is completed in accordance with the procedures, check “yes”; if not, check "no" and explain under the comments section. If an item is not applicable, write “NA” (not applicable) next to it.

A completed copy of this checklist should be included with the measurement report.

ITEM	ACTION	YES	NO
	BEFORE TRANSFER		
1	Was a key meeting held with vessel representative and shore representative?		
2	Were all gauge tapes inspected prior to use?		
3	Were shoreline conditions checked?		
4	Were all shore tanks gauged?		
5	Were shore tanks active or tank mixers on during gauging?		
6	Was a Line Fullness Verification performed? (comment type)		
7	Were temperatures taken from all shore tanks?		
8	Was the temperature device checked prior to use?		
9	Were all automatic tank gauging and temperature readings recorded?		
10	Were all shore tanks sampled? (comment type of sample: comp., zone, etc.)		
11	Was an automatic sampler used?		
12	Were meters used for the transfer?		
13	Were vessel experience factors available on board?		
14	Were draft, trim, list, and sea conditions recorded?		
15	Was vessel completely deballasted?(Loading)		
16	Were all ballast tanks checked?		
17	Were vessel lines drained into the cargo compartments?		
18	Where all vessel compartment ullages and water measurements taken?		
19	Were terperatures taken in all vessel compartments?		
20	Were wedge, trim or list corrections made?		
21	Were on-board quanity samples taken? (Loading)		
22	Were vessel samples taken from each compartment? (Discharging)		
23	Were load port samples collected from the vessel and a receipt issued?		
24	Were slops tanks measured?		
25	Were sea valves sealed in the closed position?		
26	Were bunker quantities verified?		
27	Were sea valves found to be intact and seal numbers recorded?		
28	Were volume calculations completed before transfer began?		
29	Was the intransit difference calculated & reported?		
	DURING TRANSFER		
30	Were any difficulties/unusual problems encountered?		
31	Were line samples drawn?		
32	Were meters proved?		
33	Was a Vessel Discharge Record prepared? (Discharging)		

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Figure A.14b—Inspection Checklist (Continued)

AFTER TRANSFER			
34	Were draft, trim, and list recorded?		
35	Were vessel lines drained to compartments prior to ullaging?		
36	Were all vessel compartment ullages, and water measurements recorded?		
37	Were temperatures taken in all vessel compartments?		
38	Were ballast tanks inspected?		
39	Were samples taken from each vessel compartment? (Loading)		
40	Were rest on-board samples taken? (Discharge)		
41	Were vessel sea valves inspected and confirmed closed?		
42	Were bunker quantities verified?		
43	Were vessel volumes recorded and calculated?		
44	Were all shorelines surveyed and quantities determined?		
45	Were all closing tank gauges taken?		
46	Were shore tank samples taken?		
47	Were proper automatic sampling and sample mixing performed?		
48	Were copies of meter tickets and proving reports obtained?		
49	Was a reconciliation caclulated & reported between vessel and shore?		
50	Was as a recheck performed on gauges, temperatures, and calculations?		
51	Was a voyage analysis prepared using VEF?		
52	Does the Bill of Lading agree with the Discharge measurements?		
53	Was qualitative testing performed according to directions furnished by interested parties?		
54	Was a Time Log maintained?		
55	Were any Letters of Protest or Notices of Apparent Discrepancy Issued?		
56	Was the following information recorded from each shore tank?		
	Type of Gauging (Straight Innage, Straight Ullage, Innage by Ullage, etc.)		
	Strapping Table and Date of Strapping		
	Standpipe Condition (slotted, unslotted, etc.)		
	Type of measurement taken (Manual, Closed, Automatic)		

Comments:

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Figure A.15—Cargo Quantity Option Report

CARGO QUANTITY OPTION REPORT

VESSEL	PORT	DATE
TERMINAL ►		

CARGO QUANTITY			
PRODUCT	SHORE ORDER	VESSEL REQUIRED	OPTIONS/COMMENTS
1)			
2)			
3)			
4)			
5)			

VESSEL REQUIREMENT ESTABLISHED BY VESSEL'S OFFICER

INSPECTOR
VESSEL'S OFFICER

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Figure A.16—Key Meeting Summary Report

Key Meeting Summary

Vessel | Port | Terminal

Before operations begin, a key meeting should be held among cargo inspectors, vessel representatives, and shore operational personnel who are involved in the cargo transfer operation.

Key Meeting Date	From (HH:MM)	To (HH:MM)

Key Personnel Present	Position	Name
Vessel Representative		
Terminal Representative		
Inspector Representative		

Cargo Quantity

Grade: xxxx	Principal	Terminal	Vessel
Nominated Quantity			
Unit of Measurement			
Comment (min/max, etc)			
Max Rate			
Ship or Shore Stop			

Line Fullness Verification

	Line Displacement		Internal Circulation		Line Press		Line Clearing		High Point Bleed Valve

Sequence	Product	Line Volume	Agreed Tolerance
1			
2			
3			

Shore Facility

Sequence	Tank Number(s)	Product	Jetty Line	Shore Arm / Hose	Approx API/Dens	Approx Temp
1						
2						
3						

Vessel / Barge

Sequence	Tank Number(s)	Product	Jetty Line	Shore Arm / Hose	Approx API/Dens	Approx Temp
1						
2						
3						

Inspection Representative _____ Terminal Representative _____ Vessel Representative _____

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Figure A.16—Vessel Gauge Height Report

Vessel Gauge Height Report					
Method of Gauging:			Location of Gauge:		
Tank Number	Table Gauge Height	Observed Gauge Height			
	UOM:	Open	Difference	Close	Difference

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Figure A.17—Vessel Trim/List Report

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Draft Position	Port	Starbord	Mean
Forward:			
Midships:			
Aft:			

Apparent Trim (Average Aft Draft - Average Forward Draft): _____

Apparent List ($\tan^{-1}[\frac{Average\ Port\ Draft\ -\ Average\ Starbord\ Draft}{Vessel's\ Beam}]$): _____

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Figure A.18—Letter of Protest

LETTER OF PROTEST
(Duplicate to be signed and returned)

Date: _____

Address
To the Representative of _____(*vessel or port name)*

In the Port of: _____
(or designate the agents, owner's representative, owner, or operator)

Dear Sir or Madam:

On behalf of _____, we hereby notify you that on the _____ day of _____, at _____, the above-named port caused (describe nature of the occurrence)

_____

_____

_____

at _____

in the city (or town) of _____

Accordingly, we are holding your port/vessel, the owners, charterers, operators, and other interested parties responsible for the loss and damage thereby sustained, as well as any consequential loss and damage arising therefrom.

Kindly acknowledge receipt on the copy thereof and return it to us. *The signatures thus obtained are for receipt only and in no way acknowledge responsibility for the incident.*

Please direct any written correspondence on this matter to:

_____

_____

_____

Very truly yours,

By_____

Title_____

Receipt acknowledged:

_____

(owner, agent, other)

cc: Port agent, owner, representative,
or operator (if different from owner)

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Figure A.19-Notice of Apparent Discrepancy Letter

NOTICE OF APPARENT DISCREPANCY
(Duplicate to be signed and returned)

Date: _____

Address
To _____ _____

In the Port of _____

Dear Sir or Madam:

On behalf of _____, we hereby notify you that on _____ day of _____, at ____, the above named port caused (describe nature of the occurrence)

_____

_____

_____

at _____

in the city (or town) of _____

Accordingly, you are hereby notified that further investigation is intended to resolve this discrepancy.

Kindly acknowledge receipt on the copy thereof and return it to us. *The signatures thus obtained are for receipt only and in no way acknowledge responsibility for the incident.*

Very truly yours,

By _____ Receipt acknowledged:

Title _____ _____

(shore representative)

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[1] International Organization for Standardization, 1, Chapter de la Voie-Creuse, Case postale 56, CH-1211 Geneva 20,

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Switzerland, www.iso.org

[2] Oil Companies International Marine Forum, 29 Queen Anne's Gate, London, SW1H 9BU, England, www.ocimf.com

[3] International Maritime Organization, 4, Albert Embankment, London SE1 7SR, United Kingdom, www.imo.org

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