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Manual of Petroleum Measurement Standards
Chapter 17.1

Guidelines for Marine Cargo Inspection

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Introduction

These guidelines are intended to encourage uniform inspection practices for marine petroleum and chemical cargo quantity and quality control. Use of these guidelines will simplify the making of agreements for transferring petroleum and chemical cargoes and help ensure that the agreements can be clearly interpreted and executed between parties. The recommendations provided here are not intended to interfere in any way with provisions contrary to these guidelines that may exist in any contract or applicable recommended practices of other regulatory or standards bodies, nor are they intended to interfere with safety and environmental considerations or local conditions. These guidelines are not promulgated as 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.

Measurement and sampling activities to be performed on board a vessel shall be accomplished in the presence of, or with the express permission of, the vessel's master or other appropriate authority. Activities to be performed at the loading and discharge shore facilities shall be accomplished in the presence of, or with the express permission of, the appropriate shore supervisory personnel.

For reasons of safety, only appropriate and approved equipment should be used. Local jurisdictional regulations regarding loading and unloading also shall be followed.

Guidelines for Marine Cargo Inspection

1 Scope

These guidelines specify the policy and minimum recommended practices for the manual and automatic measurement, sampling, and accounting for bulk quantities of crude oil (including spiked, blended, and reconstituted crude oil), petroleum products, and chemicals 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, customs authorities, 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.

Cargo calculations should be performed independently by the responsible parties or by their authorized representatives, or both. The results of the quality determinations and quantity calculations should be compared, and any differences resolved without delay. Each party involved in a custody transfer is responsible within their domain for contributing to a reconciliation of vessel and shore quantities and for seeking explanations for any discrepancies.

Any discrepancies relating to quality determination or calculated quantities, or both, should be recorded and reported to all interested parties. This procedure may be accomplished by issuance of a Letter of Protest (LOP) or Notice of Apparent Discrepancy. Every effort should be made to resolve discrepancies before the vessel departs.

The independent inspection report for the cargo custody transfer should be issued and distributed promptly.

These procedures 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 4 (All sections), *Proving Systems*

API. *MPMS* Chapter 5 (All sections), *Metering*

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

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

API. *MPMS* Chapter 8.2, *Standard Practice for Automatic Sampling of Petroleum and Petroleum Products*

API. *MPMS* Chapter 8.3, *Standard Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products*

API. *MPMS* Chapter 8.4, *Standard Practice for Sampling and Handling of Fuels for Volatility Measurement*

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 12.2.4, *Calculation of Petroleum Quantities Using Dynamic Measurement Methods and Volumetric Correction Factors, Part 4—Calculation of Base Prover Volumes by Waterdraw Method*

API. *MPMS* Chapter 12.2.5, *Calculation of Petroleum Quantities Using Dynamic Measurement Methods and Volumetric Correction Factors, Part 5—Calculation of Base Prover Volumes by Master Meter Method*

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

API. *MPMS* Chapter 17.11/EI HM 52,[1] *Measurement and Sampling of Cargoes On Board Tank Vessels Using Closed and Restricted Equipment*

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

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) is as follows:

$$\text{API Gravity at 60 °F} = 141.5/(\text{Relative Density 60 °F/60 °F}) - 131.5$$

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
Water taken onboard when a vessel is empty or partly loaded/discharged 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 liquid film that adheres to the inside surface of a container after it has been emptied.

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

3.6
crude oil washing
COW
See **tank washing**.

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
FW
Water that exists as a separate phase.

3.9
gross observed volume
GOV
The total observed volume (TOV) of all petroleum or chemical liquids and sediment and water (S&W), excluding free water (FW), at observed temperature and pressure.

3.10
gross standard volume
GSV
The gross volume (GV) or gross observed volume (GOV) corrected to base temperature and pressure conditions.

3.11
gross standard weight
GSW
The weight of the Gross Standard Volume (GSV).

3.12
indicated volume
The transferred quantity, in indicated (uncorrected) volume units, at operating conditions, that occurs between opening and closing gauges on a tank, during a meter proving with each run, or that occurs from start to stop of a receipt or delivery being measured by a flow meter.

3.13
inerting
The process of purging or displacing air or product vapor with inert gas.

3.14
innage gauge
The depth of liquid in a tank measured from the datum plate or tank bottom up to the surface of the liquid.

3.15
Letter of Protest (LOP) or Notice of Apparent Discrepancy (NOAD)
A letter issued by any participant in a custody transfer citing any condition with which issue is taken. This serves as a written record that a particular action or finding was observed or questioned at the time of occurrence.

3.16
line fullness verification
The activity of verifying the fill condition of the shore and vessel cargo transfer lines before and after a cargo transfer.

3.17
list
a) The leaning or inclination of a vessel, expressed in degrees port or degrees starboard; or

b) The transverse deviation of a vessel from the upright position, expressed in degrees.

3.18
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.

3.19
load on top
Defined both as a procedure and a practice as follows:

Practice—The act of commingling onboard quantity with cargo being loaded.

Procedure—The shipboard procedure of collecting and settling water and oil mixtures, resulting from ballasting and tank cleaning operations (usually in a special slop tank or tanks). and subsequently loading cargo on top of and pumping the mixture ashore at the discharge port.

3.20
net standard volume
NSV
The gross standard volume (GSV) corrected to exclude non-merchantable components such as sediment and water (S&W).

3.21
net standard weight
NSW
The weight of the Net Standard Volume (NSV).

3.22
observed reference height
The distance actually measured from the tank bottom or datum plate to the established reference point at the time of gauging a tank.

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 vertical distance, noted on the tank capacity table and stenciled on the tank near the hatch, between the reference gauge point on the gauge hatch and the datum strike point on the tank floor or the gauge datum plate.

3.25
reference 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.

3.26
remaining on board
ROB
Refers to material remaining in a vessel's cargo tanks, void spaces, and/or pipelines after the cargo is discharged. ROB includes any combination of water, oil, slops, oil residue, oil/water emulsions, and sediment.

3.27
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 and entrained water and sediment.

3.28
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.

3.29
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.

3.30
tank washing
Divided into the following two types of activities:

1) 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.

2) Crude oil washing (COW) 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 inerted during this tank cleaning method.

3.31
total calculated volume
TCV
The gross standard volume (GSV) plus the free water (FW).

3.32
total observed volume
TOV
The total measured volume of all petroleum liquids, S&W, and FW at observed temperature and pressure.

3.33
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.

3.34
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.

3.35
ullage (outage) gauge
The vertical distance from the reference gauge point downward to the liquid surface in a tank.

3.36
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.

3.37
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.

3.38
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.

3.39
wedge formula
A mathematical formula, for approximating the small quantities of liquid and solid cargo and free water on board before a vessel is loaded and after its cargo is discharged, that is based on cargo compartment dimensions and vessel trim, and that is applicable only when a wedge exists and when the liquid does not touch all bulkheads of the vessel's tank.

3.40
wedge table
Pre-calculated vessel tables based on the wedge formula and displayed in much the same way as the vessel innage/outage tables. Wedge tables are used for small quantities such as onboard (OBQ) quantities and remaining onboard (ROB) quantities when the liquid does not touch all of the bulkheads of a vessel's tank.

3.41
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

Personnel involved with the gauging and sampling of petroleum and petroleum-related substances 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

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, and/or sampling on board a vessel shall at all times be accompanied by a designated ship's representative.

4.2 Static Electricity Hazards

If the tank is in a non-inert condition, specific precautions will be required regarding safe measurement and sampling procedures when handling static accumulator oils. 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 include manual steel gauging tapes, portable gauging devices mounted on deck standpipes, metal sampling apparatus, and metal sounding rods.

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. 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.

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

Petroleum vapor displaces oxygen in the air and creates an oxygen-deficient atmosphere. Hydrogen sulfide (H_2S) vapors are particularly hazardous. Petroleum 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, and

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 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.

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 17.10.1 [13], Chapter 17.10.2 [14], Chapter 17.11, and Chapter 17.12).

All responsible parties should be informed if any of the gauging equipment, tanks, or meter facilities have a known bias. Documentation of these deviations should be available for inspection by all responsible parties and should be used in preparing volume reconciliation. Possibilities for known bias error include, but are not limited to, water, snow, ice, or debris on floating-roof tanks.

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 should 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 will not be contaminated (see API *MPMS* Chapter 17.8 [11]). If there are any questions concerning compatibility or contamination, all interested parties should be notified immediately and the questions resolved prior to commencement of loading.

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)

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.

6.5 Chapter 17.5/EI HM 64—Guidelines for Cargo 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 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—Guidelines for Pre-loading Inspection of Marine Vessel Cargo Tanks

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 a VEF, guidance for data collection, and instructions for more complex VEF calculations. The standard contains an example 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 on Board Tank Vessels 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

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.

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.

7.2 Key Meeting

The following items should be discussed at the key meeting.

Loadport:

— 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 (see Cargo Quantity Options Certificate, Annex A).

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

— 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 loading.

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

— Determine which vessel tanks will be loaded, 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 [11]).

— Agreement should be reached on the method to be used to determine line fullness and the agreed tolerance (see API *MPMS* Chapter 17.6 [10]).

— If "first-foot" samples are required, a decision on the tanks to be used for such samples and the quantity of cargo to be loaded for the sampling should be made.

— Issue LOP to any party failing to comply with recommended procedures.

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

On multi-grade vessels, it may be necessary to load the vessel's tanks in a cargo to avoid contamination and to comply with vessel operational requirements. This should be discussed and the order by grade or product, or both, should be agreed upon before loading operations begin.

Caution — Product contamination may result in an unsafe condition for the terminal, vessel, and/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 shorelines is to be loaded as part of the blend, a line sample should be taken and tested.

To aid blending, the heaviest component may be loaded first, followed by the lighter components. The volume may be gauged 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. Blends may require adjustment to maintain the mutually agreed upon blend specifications.

NOTE 1 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.

NOTE 2 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 [6] for further details.

Disport:

— 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.

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

— 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 might have occurred during the sea passage or at the previous port that may require special vigilance during discharge.

— Check with shore personnel to ensure that no special conditions exist on shore that may adversely affect the discharge activity or measurements.

— Determine which shore tanks will receive cargo, the capacity of the shore tanks, and the condition of the shorelines.

— Agreement should be reached on the method to be used to determine line fullness and the agreed tolerance, if applicable (see API *MPMS* Chapter 17.6 [10]).

— Issue LOP to any party failing to comply with recommended procedures.

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

8 Vessel/Shore Communication and Operations

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 should promptly notify all key personnel so that timely action can be taken. Record these events in the inspection report.

When more than one product or grade of product is to be transferred, close communication shall be maintained between personnel on shore and on the vessel to avoid contamination and off-specification material. This is of special importance when switching from one product or grade to another.

If any event occurs that could affect subsequent procedures at any stage of the cargo transfer operation, all key personnel involved should be notified promptly so that necessary timely action can be taken. Any action or refusal to act that is not in accordance with API procedures or specific contractual agreements will be reported to the parties concerned and may be documented by the issuance of an LOP.

9 Vessel Inspection and Sampling

9.1 Vessel Inspection

9.1.1 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 [1] and API *MPMS* Chapter 12.1.1.

9.1.2 Vessel Measurements

Record cargo measurements, water measurements, and temperatures on all cargo compartments at the reference point indicated on the vessel's capacity tables. Vessel capacity tables should be certified by the shipbuilder, classification society, independent inspection company, or other approved competent 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 manual (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 petroleum in cargo compartments (see API *MPMS* Chapter 17.2) and notify all concerned parties.

Observed gauge heights should 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 if it differs from the tank table information.

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 when 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.

In the case of heavy viscous materials, before a tank is gauged, time should be allowed to permit the oil to free itself of entrained air, gas, and water. (See API *MPMS* Chapter 17.2.)

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

Vessel cargo measurements should not be taken during bunkering operations.

9.1.3 Load on Top

If a load-on-top procedure is followed, a Load-on-Top Monitoring Record (see Annex A) should be filled out (see API *MPMS* Chapter 17.2).

9.1.4 Vessel Lines and Tanks

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

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 should 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 should be cleaned thoroughly and drained. Note on the inspection report how cleaning and draining was accomplished.

When the vessel is inspected for tank acceptability prior to loading, tank inspection should be performed in accordance with API *MPMS* Chapter 17.8 [11].

9.1.5 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 nature of 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]). Describe and report the OBQ and FW (see 9.1.16 for slop tanks).

9.1.6 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 nature of 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). Describe material found in the bottom of tanks as liquid material, nonliquid material, or FW. 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 should be issued if applicable.

9.1.7 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].

NOTE All non-load-on-top compartments from the load port should be measured to determine whether any volumes have changed. These measurements should be reported and should not be included in the ROB determination. If there is a change in these volumes, ascertain the reason and, if necessary, notify all interested parties immediately.

9.1.8 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.

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

9.1.9 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 8.1, Chapter 8.2, Chapter 8.3, and Chapter 8.4.

9.1.10 Free Water Measurement

Measure the FW during the course of gauging each compartment. 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 [7], 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 should be given an LOP on that account and all interested parties should be notified immediately.

9.1.11 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. 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.

9.1.12 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 supplied density. Do not use an average temperature for the entire vessel. (See API *MPMS* Chapter 17.2 and Chapter 12.1.1.)

9.1.13 Vessel Experience Factor (VEF)

Data on 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 that are not provided by the vessel or independent inspection companies may only be used if agreed to by the commercial parties.

9.1.14 Remaining Ballast (Loading Operation)

For most cargos, there should be no ballast remaining in the cargo tanks, lines, or pumps. Any ballast on board should be totally segregated. Measure and record the quantity of any ballast left on board prior to loading. Record the presence of and sample any measurable petroleum in ballast tanks. The vessel should not be gauged during deballasting. If simultaneous deballasting is performed during loading operations, determine the reason from the vessel's representative and record it on the inspection report. Indicate single/double valve separations, if any, between clean/dirty ballast and cargo systems.

9.1.15 Ballast Tanks (Discharge Operation)

Inspect ballast tanks and record the quantity of ballast aboard before and after discharge. Report the presence of any measurable cargo in any ballast tanks and obtain samples if possible. Notify all interested parties and issue an LOP as appropriate. A Vessel Ullage/Sounding and Capacity Report (see Annex A) should be used to record these measurements. The vessel should not be gauged during ballasting. If simultaneous ballasting is performed during discharge operations, determine the reason from the vessel's representative and record it in the inspection report. Indicate single/double valve separations, if any, between the clean/dirty ballast and the cargo system.

9.1.16 Slop Tanks

Obtain gauges and temperatures of the contents of slop tanks to determine the interface and the separate quantities of FW and slop oil. Take a separate sample of the water layer, if possible. Calculate the quantities; if any slops are to be commingled with the cargo, they are to be treated as OBQ and recorded appropriately. Keep slops samples separate from cargo samples.

9.1.17 Sea Valves

Confirm in the presence of the vessel's personnel that sea valves and overboard discharge valves are in the closed position and sealed before and after cargo transfer. Seal valves to the extent possible, so as to be able to determine whether they were used during the cargo operation. Record the seal numbers.

If previously sealed valves are not intact, attempt to ascertain why the seals were broken and, if appropriate, notify all interested parties. Record the findings in the inspection report. Seal numbers should 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, ascertain the reason for the discrepancy and notify all concerned parties.

9.1.18 Bunker Inspection

A bunker inspection should, when necessary, 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). Each grade of Bunker Fuel should have its own report, they should not be combined on one report.

Vessel cargo gauging should not be performed during bunkering operations.

9.1.19 Crude Oil Washing (COW)

During the discharge operation, record on a Time Log (see Annex A) when the vessel started and stopped the COW procedure. Indicate in the inspection report which tanks were washed with crude oil, the material used as an agent, and the extent of the washing.

9.1.20 Line Pressure (During Transfer)

The line pressure and flow rate information should be obtained and reported on a Vessel Discharge Record (see Annex A). Indicate the place where the vessel's line discharge pressure was measured.

9.2 Vessel Sampling

9.2.1 General

Samples should be taken from each vessel cargo compartment in such a manner that a volumetric composite sample, intended to represent the total of each grade of cargo, may be prepared for testing (see API *MPMS* Chapter 8.1). This composite will be made by combining the vessel's individual tank samples in proportion to the

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

When the material is known or suspected to be stratified, spot samples may 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 should be 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 should be obtained to meet the requirements of interested parties and regulatory agencies. 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) should 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 the circumstances, experience, and the policies of the parties involved in the custody transfer.

9.3 During Transfer

9.3.1 Line Sample

Line samples are normally taken for quality control purposes. For some products, it is necessary to draw a line sample at the commencement of loading. Line samples can be inspected visually or by laboratory testing.

9.3.2 First-foot Sample

During loading, if a first-foot sample is required, it should be taken when ~1 ft (0.3 m) of cargo has been loaded into the tank. A sample is then drawn from 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 shall be promptly notified before resuming operations.

10 Shore Inspection and Sampling

10.1 Shore Lines

Determine the nature of the material in the shorelines up to the vessel's flange. When line contents are questionable or when the possibility of cargo contamination exists, line samples should be taken and tested to verify compatibility with the cargo that will be transferred. Alternatively, shoreline contents may 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.

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 and the line condition. Additionally, record and report the total capacity of the shorelines used. 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 will be displaced and/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 if possible.

10.2 Shore Tank Gauges

10.2.1 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 and water cuts 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 should be noted and investigated.

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 $^1/_8$ in. if customary tapes are used. When three readings are taken, all three readings shall be within the 3 mm ($^1/_8$ in.) range and readings averaged 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 a slotted or unslotted standpipe (still pipe or guiding pole). 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 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, ullage measurement may be required. Products with densities heavier than water may need to be water cut on top of the product.

Any incrustation that forms on top of the product may produce inaccuracies in measurement. If this condition exists, all parties should be notified, and the condition shall be recorded.

10.2.2 Automatic Gauges

Automatic gauging systems with accuracy tolerances, measurement tolerances, and calibration records consistent with API *MPMS* Chapter 3.1B may be used for custody transfer by mutual agreement among 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.

10.3 Shore Tank Temperatures

10.3.1 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 this situation is determined, extra temperature measurements should be taken.

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

10.3.2 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).

10.3.3 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 necessitate the use of a PET.

10.3.4 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).

10.3.5 Automatic Temperature Systems

Automatic temperature systems with accuracy or measurement tolerances, or both, 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 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.

10.4 Sampling

10.4.1 General

Samples should be labeled immediately with the appropriate date, time, tank number, and other pertinent data. If required, seal the container, and record the seal numbers.

10.4.2 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, in the case of petroleum products, should 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 will only be 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.

Specify in the inspection report the tank locations and methods used to obtain samples. The inspection report should also state whether the tank was equipped with mixers, a circulating system, or aerators.

10.4.3 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. The sampler shall be properly set up and cleaned in preparation for taking a sample, and a visual inspection of the primary sample container shall be made. Ensure that the grab rate is correct to collect a sufficient sample to meet requirements without overfilling the container. Indicate whether the automatic sampler used was flow proportional or time proportional. Any deficiencies should 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. Witness the mixing and withdrawal of the contents of the primary sample receptacle. Gather data necessary to calculate automatic sampler performance report. Report any difficulties that occur with relation to the in-line sampling procedures.

10.5 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.

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

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.

11 Voyage Analysis and Reconciliation

11.1 Shore and Vessel Transferred Volume Calculations

After the shore tank or vessel tank is gauged, the quantities of petroleum 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.

11.2 Load Port Voyage Analysis

Compare the shore's TCV delivered with the vessel's TCV received, corrected by a valid VEF when available. If the difference exceeds contractual limits or company policies, recheck all measurements and calculations to identify the cause of the discrepancy. If the differences cannot be reconciled, the inspector should notify the interested parties and issue an LOP 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, net standard volume (NSV), density, temperatures, or any other specification should be investigated and brought to the attention of the appropriate interested parties.

11.3 In-transit Difference

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

11.4 Discharge Port Voyage Analysis

Complete the Voyage Analysis and Reconciliation Reports. All relevant data from loadport(s) through discharge port(s) should be assembled and an analysis should be made to provide an overall view of the voyage performance. Include on the Voyage Analysis and Reconciliation Report any relevant comments that may help to explain any discrepancies. Compare the shore TCV received (by shore tank or meter) with the vessel's TCV delivered. If the difference on the same comparison basis is greater than the difference specified by parties to the contract or by stated policies of those companies after application of the VEF, recheck all measurements and calculations to identify the discrepancy. If the differences cannot be reconciled, the inspector should notify the interested parties and issue an LOP or a Notice of Apparent Discrepancy to vessel and terminal representatives (see API *MPMS* Chapter 17.5 [9]).

11.5 Qualitative Testing

The interested parties should specify testing and test methods used for analysis. Responsibility for testing rests primarily with the nominated laboratory. Interested parties or their representatives should be allowed to conduct the same tests on a duplicate sample or to witness the testing performed by the nominated laboratory. Any witnessed deviations from the specified testing procedures shall be included in the inspection report.

11.6 LOP or Notice of Apparent Discrepancy

In the event of any dispute, an LOP or a Notice of Apparent Discrepancy shall be issued. This serves as a written record that the particular action or finding was questioned at the time of occurrence.

11.7 Time Log

Report the time and date of the main operational events on the time log. Include the time and description of any unusual occurrences in the appropriate column of the time log.

11.8 Distribution of Documents

All pertinent documents relating to the transfer shall be distributed among all commercial parties and their representatives.

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.

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.

Cross-cuts are provided on all suggested forms to accommodate the various systems of measurement.

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.

[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*.

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)		INNAGE/ ULLAGE (FT/M)	INDICATED VOLUME (_____)	TOTAL OBSERVED VOLUME (_____)	FREE WATER		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
	DATE	TIME				INNAGE/ULLAGE (FT/M)	VOLUME (______)							
TOTALS THIS TANK														
TOTALS THIS TANK														
TOTALS THIS TANK														
TOTALS THIS TANK														
TOTALS THIS TANK														

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

SIGNATURES

____
MEASUREMENT REPRESENTATIVE

____
TERMINAL REPRESENTATIVE

(_____) Units of Measurements

Figure A.1—Report of Shore Quantity

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 (m^3/L)		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

Figure A.2—Vessel Ullage/Sounding and Capacity 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	V C F	GROSS STANDARD VOLUME (____)
		UNCORRECTED	CORRECTED (W IF WEDGED)	LIQUID	NON-LIQUID		INNAGE/ULLAGE UNCORRECTED	INNAGE/ULLAGE CORRECTED (W IF WEDGED)	VOLUME (____)		(°F/°C)	(T.____)	

( ) 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
		OTHER (Explain)

	STRIPPED YES	STRIPPED NO	DROPPED YES	DROPPED NO	TANK NO.	
TOP LINES						SAMPLES TAKEN YES NO
BOTTOM LINES						SEE VALVE SEAL NUMBERS PORT ____
HOSES/ARM						STARBOARD ____
						OVERBOARD ____

SIGNATURES
VESSEL REPRESENTATIVE
TERMINAL REPRESENTATIVE
MEASUREMENT REPRESENTATIVE

Figure A.3a—OBQ/ROB Report

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			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.

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

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

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

Figure A.4—Time Log

VESSEL EXPERIENCE FACTOR

Vessel Experience Factor—Calculation

Vessel: _____ Load or Discharge

Date:

1	2	3	4	5	6	7	8	9	11	10	12	13	14
	List all voyages				BBLS / M^3 / MT (Use same units for all entries)					Step 1	Step 2	Qualifying Voyages	
Cargo	Voyage Number	Cargo Description	Terminal - Port	Date	Vessel Sailing/ Arrival TCV	OBQ ROB	Load/ Discharge TCV	B/L or Outturn TCV	Vessel Load/ Discharge Ratio	Gross Error > 2 %?	Qual. Voy. (>0.30 %) Y/N?	Load or Discharge TCV	B/L or Outturn TCV
Last													
2nd													
3rd													
4th													
5th													
6th													
7th													
8th													
9th													
10th													
11th													
12th													
13th													
14th													
15th													
16th													
17th													
18th													
19th													
20th													
						Totals:					Totals:		
Notes:	List last voyage first Do not include load and discharge information on the same form					Average TCV Ratio:			:		TCV VESSEL TCV SHORE		
	Cross out either "load" or "discharge" and other inapplicable title information The average TCV ratio is the total vessel loaded TCV divided by total shore TCV												
						Qualifying Range (excluding Gross Errors)							
						L:		H:			Vessel Experience Factor:		

Figure A.5—Vessel Experience Factor

☐ 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)		

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

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

Figure A.7—Sample Receipt

LABORATORY REPORT OF QUALITY

VOYAGE NO.

One form per sample tested

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

THE ABOVE SAMPLE WAS EXAMINED AND THE FOLLOWING RESULTS OBTAINED IN UR LABORATORY.

TEST	METHOD	RESULTS

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

LABORATORY CERTIFICATION

SIGNATURE

DATE OF TEST

WITNESS

Figure A.8—Laboratory Report of Quality

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 (____)					
16	SEDIMENT AND WATER, PERCENT					
17	SEDIMENT AND WATER, VOLUME (____)					
18	NET STANDARD VOLUME (BBL/GAL)					
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.

Figure A.9—Metered Quantity Report

METER PROVER REPORT

FORM XXX.XX

Location:		DATE	AMBIENT TEMP.	REPORT NO.

PROVER DATA			PREVIOUS REPORT		
BASE VOLUME AT 60°F AND "0" PSI (BPV)	SIZE (OD)	WALL (WT)	FLOW RATE (bph)	FACTOR	DATE

METER DATA						
SERIAL NO.	METER NO.	PULSES/BBL (KF)	TEMP. COMP.	MANUFACTURER	SIZE	MODEL

FLOW RATE		NON-RESET TOTALIZER
	bbl/hr	

RUN DATA

TEMPERATURE		PRESSURE		TOTAL PULSES	RUN NO.
PROVER AVG.	METER	PROVER	METER		
					1
					2
					3
					4
					5
					6
					7
					8
					9
					10
					AVG.

CTS =	CORRECTION FOR TEMPERATURE ON STEEL
CPS =	CORRECTION FOR PRESSURE ON STEEL
CTL =	CORRECTION FOR THE TEMPERATURE OF THE LIQUID
CPL =	CORRECTION FOR PRESSURE ON LIQUID

LIQUID DATA

TYPE	OBSERVED API GRAVITY (APIobs)			CORRECTED GRAVITY (APIb)		BATCH/TENDER NO.
		AT	° F		AT 60° F / 0 PSIG	

PROVER FIELD CALCULATIONS	COMBINED CORRECTION FACTOR For PROVER (CCFp)				CORRECTED (GSVp) PROVER VOLUME
BASE PROVER VOLUME (BPV) X	[CTSp X	CPSp X	CTLp X	CPLp] =	

METER FIELD CALCULATIONS			COMB. CORR. FACT. For METER (CCFm)		
INDICATED VOLUME OF METER (IVm)			X [CTLm (NON TEMP. COMP. METER ONLY)	x CPLm] =	INDICATED STANDARD METER VOLUME (ISVm)
AVERAGE PULSES [N(avg)] ÷	PULSES PER Bbl (NKF) =	INDICATED METER VOLUME (IVm)			

CORRECTED PROVER VOLUME (GSVp) ÷	INDICATED STANDARD METER VOLUME (ISVm)	METER FACTOR (MF)	X	CPLm LIQUID CORR. FOR PRESS. AT METERING COND.	=	COMPOSITE FACTOR (CMF) FOR CONSTANT PRESS. APPL.
☐ METER FACTOR IS WITHIN 0.25% OF THE PREVIOUS FACTOR.						

REMARKS, REPAIRS, ADJUSTMENTS, ETC.

SIGNATURE	DATE	COMPANY REPRESENTED

Figure A.10—Meter Prover Report

SLOPS RECORD

☐ LOADING ☐ DISCHARGE

INSTRUCTIONS: This record is for tanks in the recovery of oily residues from load-on-top operations (prior to loading) and for tanks used in retaining liquid slops not to be pumped ashore at the discharge port. The **Slops Record is not** used for recording on-board quantities.

VOYAGE NO.

VESSEL	PORT/TERMINAL	DATE/TIME

	Tank No. _____	Tank No. _____	Tank No. _____
ULLAGE/INNAGE (FT/M)			
TRIM (FT/M)			
CORRECTED ULLAGE/INNAGE (FT/M)			
TOTAL OVSERVED VOLUME (___)			
WATER GAUGE (FT/M)			
CORRECTED WATER GAUGE (FT/M)			
FREE WATER VOLUME (____)			
GROSS OBSERVE VOLUME (____)			
API GRAVITY/DENSITY OBSERVED			
TEMPERATURE (F/C)			
API GRAVITY 60 F/DENSITY 15 C			
VOLUME CORRECTION FACTOR TABLE (____)			
GROSS STANDARD VOLUME (_____)			
WEIGHT CONVERSION FACTOR (____)			
GROSS WEIGHT (____) TONS			
PREVIOUS CARGO			
PORT LOADED			
API GRAVITY 60 F/DENSITY 15 C			

SIGNATURES		
VESSEL REPRESENTATIVE	TERMINAL REPRESENTATIVES	MEASUREMENT REPRESENTATIVE

(_____) UNITS

Figure A.11—Slops 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

Figure A.12—Vessel Discharge Record

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/ DENSITY	FLASH POINT	LOWER EXPLOSIVE 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/ DENSITY	FLASH POINT	LOWER EXPLOSIVE 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.	

Figure A.13—Bunker Inspection Report

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 shorelines checked and shore tanks gauged?		
3	Were temperatures taken from all shore tanks?		
4	Was the temperature device checked prior to use?		
5	Were all automatic tank gauging and temperature readings recorded?		
6	Were all shore tanks sampled?		
7	Was an automatic sampler used?		
8	Were meters used for the transfer?		
9	Were vessel experience factors available on board?		
10	Were draft, trim, and list recorded?		
11	Was vessel completely deballasted?(Loading)		
12	Were all ballast tanks checked?		
13	Were vessel lines drained into the cargo compartments?		
14	Were on-board quantity gauges taken?		
15	Were wedge, trim or list corrections made?		
16	Were on-board quantity samples taken? (Loading)		
17	Were vessel samples taken from each compartment? (Discharging)		
18	Were load port samples collected from the vessel and a receipt issued?		
19	Were slops tanks measured?		
20	Were on-board quantity temperatures taken?		
21	Were sea valves sealed in the closed position?		
22	Was load-on-top procedure followed? (Loading)		
23	Were bunker quantities verified?		
24	Were sea valves found to be intact and seal numbers recorded?		
25	Were volume calculations completed before transfer began?		
26	Was the intransit difference determined?		
	DURING TRANSFER		
27	Were any difficulties/unusual problems encountered?		
28	Were line samples drawn?		
29	Were meters proved?		
30	Was a Vessel Discharge Record prepared? (Discharging)		
	AFTER TRANSFER		
31	Were draft, trim, and list recorded?		
32	Were vessel lines drained to compartments prior to ullaging?		
33	Were all vessel ullages, temperatures, and water measurements recorded?		
34	Were temperatures taken in all vessel compartments?		
35	Were ballast tanks inspected?		

Figure A.14a—Inspection Checklist

36	Were samples taken from each vessel compartment?							
37	Were vessel sea valves inspected and confirmed closed?							
38	Were bunker quantities verified?							
39	Were vessel volumes recorded and calculated?							
40	Were all shorelines surveyed and quantities determined?							
41	Were all closing tank gauges taken?							
42	Were tank samples taken?							
43	Were proper automatic sampling and sample mixing performed?							
44	Were copies of meter tickets and proving reports obtained?							
45	Was a reconciliation made between vessel and shore?							
46	Was a voyage analysis prepared?							
47	Does the Bill of Lading agree with the vessel measurements?							
48	Was qualitative testing performed according to directions furnished by interested parties?							
49	Was a Time Log maintained?							
50	Were any Letters of Protest or Notices of Apparent Discrepancy Issued?							
51	Was the following information recorded from the shore tank(s) volume (strapping) tables:							
	S/T #	Type of Strapping Table: Inn. or Ull.	Volume: Gals., Bbls. or Cm's	Strapping Date	Standpipe: Slotted or Non-Slotted	Type of Measurement Taken: Manual, Closed or Automatic		
Comments:								

Figure A.14b—Inspection Checklist (Continued)

INSPECTOR'S WORKSHEET

VESSEL: _____ DATE:___ _____ LOCATION:_____

Cargo: Gravity: API_____ Last Cargo:_____

Type of Strapping: Innage/Ullage Gallons/Bbls Strapping Date: _____
Quality of available strapping tables: Easily Readable / Difficult / Impossible

Type of Measurement:
Closed/Automatic Yes / No Manual: Yes / No

Standpipes: Yes / No Slotted/Unslotted

Type of gauging: Straight Innage/Straight Ullage/Ullage by Innage/Innage by ullage

Was Electronic Method Used: Yes / No Gauge Point Position: _____

Was Pressure equalized prior to gauging: Yes / No

Was the temperature device checked prior to use: Yes / No

Was a Key Meeting held with vessel & shore terminal representative: Yes / No

Were all automatic tank gauging and temperature devices checked: Yes / No

Were draft, trim and list recorded before and after loading/discharging: Yes / No

Trim Corrections Available: Yes / No Applied: Yes / No

Were samples taken from each vessel compartment? Yes / No

How samples, if taken, were bottled per compartment? Composite/Individual/Not taken

Were temperatures taken in all vessel compartments? Yes / No

Were any difficulties encountered: if yes, what? Yes / No
_____ _____ _____ _____

Were all volumes calculated and recorded before leaving the terminal? Yes / No

Was a reconciliation made between vessel and shore: Yes /No/NA

Was a voyage analysis prepared using vessel VEF: Yes / No

For Disport Only
In Transit Difference: _____ Bbls _____ %
Was comparison made between loadport and disport volumes & temperatures Yes / No

Was RECHECK on gauges/temps done to confirm discrepancy, in case discrepancy was observed Yes / No

Additional Comments by inspector: _____
_____

_____ _____ _____
Inspector's Name Signature Inspection Company

Figure A.15—Inspector's Worksheet

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

Figure A.16—Cargo Quantity Options Certificate

LOAD-ON-TOP MONITORING RECORD

DATE COMPLETED	TIME COMPLETED

PORT		LOADING TERMINAL	
VESSEL NAME		FLAG	
SUMMER DEADWEIGHT TONS ►		TOTAL CAPACITY OF CARGO TANKS ( ) ►	

1. LOAD ON TOP

WAS A LOAD-ON-TOP PROCEDURE FOLLOWED THIS VOYAGE? ☐ YES ☐ NO

IF NO, STATE REASON

TANKS WASHED THIS VOYAGE ►	NUMBERS	TOTAL CAPACITY OF TANKS WASHED ( )	

2. SLOP TANK MEASUREMENTS

		SLOP TANKS				TOTAL OBSERVED VOLUME ( )
		ULLAGE(S)		VOLUME		
		TANK A	TANK B	TANK A	TANK B	A + B
1	TOTAL CONTENTS					
2	FREE WATER CONTENT					
					OIL (LINE 1 - LINE 2)	

3. VOLUMES

WILL EITHER SLOPS TANK BE LOADED WITH CARGO? TANK A ☐ YES ☐ NO TANK B ☐ YES ☐ NO

SIGNATURE ►	MEASUREMENT REPRESENTATIVE

MASTER'S EVALUATION AND COMMENTS

SIGNATURE ►	MASTER

( ) UNITS

Figure A.17—Load-on-Top Monitoring Record

GAUGE HEIGHT REPORT

TANK NUMBER	TABLE GAUGE HEIGHT	OBSERVED GAUGE HEIGHT			
		OPEN	DIFFERENCE	CLOSE	DIFFERENCE

Figure A.18—Gauge Height Report

TRIM/LIST REPORT

	Drafts		
Draft Location	Port	Starboard	Average
Forward			
Midships			
Aft			
Average			

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

$$\text{Apparent List}\left(\tan^{-1}\left[\frac{Average\ Port\ Draft - Average\ Starboard\ Draft}{Vessel's\ Beam}\right]\right): \_\_\_\_\_$$

Figure A.19—Trim/List Report

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 _____ day of _____,

at ____ (a.m. or p.m.), 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)

Figure A.20—Letter of Protest

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 ____ (a.m. or p.m.), 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)

Figure A.21—Notice of Apparent Discrepancy Letter

Bibliography

[1] API *MPMS* Chapter 2.8A, *Calibration of Tanks on Ships and Oceangoing Barges*

[2] API. *MPMS* Chapter 3.4, *Standard Practice for Level Measurement of Liquid Hydrocarbons on Marine Vessels by Automatic Tank Gauging*

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