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Guidelines for Voyage Analysis and Reconciliation of Cargo Quantities

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Introduction

The shipment of petroleum or petroleum products by marine vessels may result in a difference between the load port and discharge port quantities. This difference, gain or loss, will be caused by one or more of the following:

a) **Physical Loss/Gain** is an actual loss or gain of cargo (sometimes referred to as “Real Loss or Gain”).

Physical losses can be the result of evaporation, unmeasured ROB, line fill, cargo diversion, spillage or theft.

Evaporative loss may occur during load/discharge operations and during transit. Daily temperature variations and movement of the cargo during the voyage (sloshing) will increase evaporative losses. Cargos with higher vapor pressure are likely to suffer greater evaporative losses.

The ROB (quantity remaining on board) is the liquid and non liquid cargo left on board the vessel after discharge. The ROB measurement can only include cargo which remains on the tank floor and can be measured from available gauge points. Unmeasured ROB can occur when a vessel is out of trim and it is not possible to measure the cargo from the tank available gauge points. That cargo which remains as clingage on the tank sides or other internal structure is not included in the ROB measurement and will result in a real loss when the outturn is considered. The amount of clingage will be dependent upon cargo viscosity and temperature.

Line fill losses result from transfer lines which contain more cargo after the movement than before, leading to reduced quantities being measured in the receiving tanks. This can occur during loading or discharge.

Cargo diversion can occur inadvertently as a result of incorrectly set or leaking valves, operator error, or intentionally as theft.

While physical gains are not common, some cargos with the ability to absorb water or to blend with other components or additives may show physical gain. In addition, gains may be caused by physical operations and equipment errors or failures such as cargo diversion, Crude Oil Washing (COW) recovering clingage from previous cargo, etc.

b) **Apparent Loss/Gain** is a difference in quantity which is not related to a physical loss. Apparent losses include errors which can possibly be corrected and also differences due to uncertainties in the measurement systems which generally cannot be removed. The majority of individual losses and gains are apparent rather than real and fall into the following categories.

Measurement error includes all the errors associated with measurement procedures, equipment and operator performance. These errors can be in liquid level or meter measurements, determining temperature, sampling, tank calibration, and laboratory testing methods.

Procedural error occurs when operations deviate from the industry measurement standards and good practice. An example would be the failure to ensure pipeline fullness at the start of the cargo transfer.

Calibration error relates to accuracy (calibration) of the measurement equipment. Only the base international standards are deemed to be exact. The possibility of introducing a fixed error or bias increases with every step in the calibration chain, moving from the base standard to the field device. Random error or uncertainty increases with each step.

Further, all measurement equipment is affected by use and handling, so regular field checks and calibrations are necessary to ensure that equipment continues to provide accurate measurements.

Paper Loss/Gain is a term frequently used to include all Apparent Losses/Gains. It is the result of calculation errors which may occur when converting basic measurement data into cargo quantities. Computer programmes and calculators have reduced the risk of mathematical errors but the cargo calculations should always be checked when a large discrepancy occurs.

Guidelines for Voyage Analysis and Reconciliation of Cargo Quantities

1 Scope

This standard covers guidelines for the reconciliation of marine cargo quantities. These guidelines are intended to provide a basis for analyzing and reconciling the quantity differences (gains/losses) resulting from marine custody transfer movement(s) of petroleum and petroleum product cargoes. As such, the guidelines are complementary to, but do not replace, normal inspection procedures.

2 Normative References

2.1 General

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.

The following documents may be referenced to supplement the information presented in this chapter:

2.2 API/EI Joint Documents

API *MPMS* Chapter 17.6/EI HM66, *Guidelines for Determining the Fullness of Pipelines between Vessels and Shore Tanks*

API *MPMS* Chapter 17.9/EI HM49, *Vessel Experience Factor*

API *MPMS* Chapter 17.11/EI HM52, *Measurement and Sampling of Cargoes On Board Tank Vessels Using Closed/Restricted Equipment*

2.3 API Documents

API *MPMS* Chapter 17.1, *Guidelines for Marine Cargo Inspection*

API MPMS Chapter 17.3, *Guidelines for Identification of the Source of Free Waters Associated with Marine Petroleum Cargo Movements*

2.4 EI Documents

EI HM40 [1], *Guidelines for the crude oil washing of ships' tanks and the heating of crude oil being transported by sea*

EI HM28, *Procedures for crude oil cargo inspections*

EI HM29, *Procedures for petroleum product cargo inspections*

EI HM30, *Procedures for Liquified Petroleum Gas (LPG) cargo inspections*

EI HM 51, *Procedures for bulk liquid chemical cargo inspections*

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[1] Energy Institute, formerly the Institute of Petroleum, 61 New Cavendish Street, London W1G 7AR, UK, www.energyinst.org.