INTERNATIONAL STANDARD

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Crude petroleum and petroleum products — Transfer accountability — Assessment of vessel experience factor on loading (VEFL) and vessel experience factor on discharging (VEFD) of ocean-going tanker vessels

Pétrole brut et produits pétroliers — Transfert des cargaisons — Détermination du facteur d'expérience du navire au chargement (VEFL) et du facteur d'expérience du navire au déchargement (VEFD) pour les navires de mer de type pétrolier

Reference number
ISO 13740:1998(E)

Foreword

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International Standard ISO 13740 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants,* Subcommittee SC 6, *Bulk cargo transfer, accountability, inspection and reconciliation.*

Annexes A and B of this International Standard are for information only.

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Introduction

For a particular vessel, an approximately constant ratio can be established between the quantity of oil measured on board the vessel and the corresponding measurement at a shore terminal.

Vessel experience factors are used as a means for monitoring Bills of Lading and/or outturn quantities.

Crude petroleum and petroleum products — Transfer accountability — Assessment of vessel experience factor on loading (VEFL) and vessel experience factor on discharging (VEFD) of ocean-going tanker vessels

1 Scope

This International Standard specifies two methods for establishing the average ratio between the quantity of oil measured on board an ocean-going tanker vessel and the corresponding quantity measured at a terminal. Method 1 is commonly used in the field. Method 2 is more statistically rigorous and is the referee method to be used in cases of dispute. Either method can be used on loading the vessel [vessel experience factor on loading (VEFL)] or on discharging the vessel [vessel experience factor on discharging (VEFD)].

This International Standard applies to shore terminals that determine volumes received or delivered using static tank measurements or dynamic meter measurements carried out according to good accepted industry practice. It also applies to floating storage or off-shore facilities that load ocean-going vessels using dynamic meter measurements carried out according to good accepted industry practice.

This International Standard is not applicable to the assessment of the vessel experience factors of barges.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 8697:—[1)], *Crude petroleum and petroleum products — Transfer accountability — Assessment of on board quantity (OBQ) and quantity remaining on board (ROB).*

3 Method 1

3.1 Procedure for collection of data

3.1.1 General

All the data shall be collected in, or converted to, the same unit of quantity. Conversions from observed data shall be made using the same petroleum measurement tables.

Data shall not be collected for

a) the first voyage after the vessel has been constructed;

1) To be published.

b) voyages for which the terminal measurements are not available;

c) voyages prior to structural modifications which affect the cargo capacity of the vessel.

Data collected for VEFL shall not be used for the calculation of VEFD.

Data collected for VEFD shall not be used for the calculation of VEFL.

3.1.2 Data for the calculation of VEFL

Obtain from ship's records, for the maximum number of voyages which conform to 3.1.1, the total quantity measured on board the vessel after loading and the corresponding on board quantity (OBQ), measured in accordance with ISO 8697.

For these voyages, obtain from available records the total quantity measured as being delivered by the shore terminal.

As some sets of data may be rejected in the calculation procedure, it is advisable to obtain data from more than 5 voyages to ensure that a valid result is obtained.

NOTE For practical reasons, data from no more than the 20 most recent voyages should be collected.

3.1.3 Data for the calculation of VEFD

Obtain from ship's records, for the maximum number of voyages which conform to 3.1.1, the total quantity measured on board the vessel prior to discharge and the corresponding quantity remaining on board (ROB), measured in accordance with ISO 8697.

For these voyages, obtain from available records the total quantity measured as received by the shore terminal.

As some sets of data may be rejected in the calculation procedure, it is advisable to obtain data from more than 5 voyages to ensure that a valid result is obtained.

NOTE For practical reasons, data from no more than the 20 most recent voyages should be collected.

3.2 Calculations

NOTE An example of the use of this calculation procedure is given in annex A.

3.2.1 The VEFL and/or the VEFD shall be calculated in accordance with 3.2.2 to 3.2.9 using the data collected in 3.1.2 and/or 3.1.3.

3.2.2 For each set of data, calculate the total quantity of cargo measured on board the vessel (t_V) using the equation

t_V = Quantity of cargo measured on board the vessel minus OBQ or ROB.

3.2.3 For each voyage, calculate the ratio, r, of the quantities t_V and t_S to five places of decimals using the equation

$$r = \frac{t_V}{t_S}$$

where t_S is the quantity of cargo measured at the terminal.

3.2.4 Sum all the vessel cargo quantities (t_V) to obtain T_V.

3.2.5 Sum all the terminal quantities (t_S) to obtain T_S.

3.2.6 Calculate the average ratio, R, of the total quantities to five places of decimals, using the equation.

$$R = \frac{T_V}{T_S}$$

3.2.7 Compare the individual ratios from 3.2.3 with the ratio of the total. Reject the data from any voyages in which the individual ratios differ from the total by more than ± 0,3 %.

3.2.8 For the data from a minimum of 5 remaining voyages, separately sum the ship quantities and the shore quantities. Calculate the ratio of these total quantities to five places of decimals, round to four places and record it.

3.2.9 If data from less than 5 voyages remain, the VEFL/VEFD shall not be calculated.

4 Method 2

4.1 Principle

A statistical rejection procedure is applied to the collected data to eliminate any outliers. The remaining data is used to calculate the VEFL/VEFD.

4.2 Procedure for collection of data

4.2.1 General

All data shall be collected in, or converted to, the same unit of quantity. Conversions from observed data shall be made using the same petroleum measurement tables.

Data shall only be collected if terminal measurements are also available.

4.2.2 Data for the calculation of VEFL

Obtain from ship's records, for the maximum number of voyages which conform to 3.1.1, the total quantity measured on board the vessel after loading and the corresponding on board quantity (OBQ) measured in accordance with ISO 8697.

For these voyages, obtain from available records the total quantity measured as delivered by the shore terminal.

As some sets of data may be rejected in the calculation procedure, it is advisable to obtain data from more than 8 voyages to ensure that a valid result is obtained.

NOTE For practical reasons, data from no more than the 20 most recent voyages should be collected.

4.2.3 Data for the calculation of VEFD

Obtain from ship's records, for the maximum number of voyages which conform to 3.1.1, the total quantity measured on board the vessel prior to discharge and the corresponding quantity remaining on board (ROB), measured in accordance with ISO 8697.

For these voyages, obtain from available records the total quantity measured as received by the shore terminal.

As some sets of data may be rejected in the calculation procedure, it is advisable to obtain data from more than 8 voyages to ensure that a valid result is obtained.

NOTE For practical reasons, data from no more than the 20 most recent voyages should be collected.

4.3 Calculations

NOTE An example of the use of this calculation procedure is given in annex B.

4.3.1 The VEFL and/or the VEFD shall be calculated in accordance with 4.3.2 to 4.3.9 using the data collected in 4.2.2 and/or 4.2.3.

4.3.2 For each set of data, calculate the total quantity of cargo measured on board the vessel (t_V) using the equation

t_V = Quantity of cargo measured on board the vessel minus OBQ or ROB

4.3.3 For each voyage, calculate the ratio, r, of the quantities t_V and t_S to five places of decimals using the equation

$$r = \frac{t_V}{t_S}$$

where t_S is the quantity of cargo measured at the terminal.

List the ratios in ascending order and label them r_1 to r_n.

4.3.4 If the number of ratios listed is from 8 to 10, calculate R_L (low) and R_H (high) using the equations

$$R_L = \frac{r_2 - r_1}{r_{n-1} - r_1} \qquad R_H = \frac{r_n - r_{n-1}}{r_n - r_2}$$

where n is the number of voyages for which data is being considered.

4.3.5 If the number of ratios listed is from 11 to 13, calculate R_L and R_H using the equations

$$R_L = \frac{r_3 - r_1}{r_{n-1} - r_1} \qquad R_H = \frac{r_n - r_{n-2}}{r_n - r_2}$$

4.3.6 If the number of ratios listed is from 14 to 25, calculate R_L and R_H using the equations

$$R_L = \frac{r_3 - r_1}{r_{n-2} - r_1} \qquad R_H = \frac{r_n - r_{n-2}}{r_n - r_3}$$

4.3.7 Compare R_L and R_H with the critical value given in table 1.

Reject from the list (see 4.3.3) any ratios for which the R_L and R_H values are greater than the critical value given in table 1.

If any ratios are rejected, relabel the remaining ratios in ascending order as r_1 to r_n.

4.3.8 Repeat 4.3.5 to 4.3.7 until no more ratios are rejected. If the number of ratios falls to 8, 9 or 10, calculate R_L and R_H using the equations in 4.3.4:

$$R_L = \frac{r_2 - r_1}{r_{n-1} - r_1} \qquad R_H = \frac{r_n - r_{n-1}}{r_n - r_2}$$

Record the number of ratios, N, left in the list.

If the number of ratios falls below 8, discontinue Method 2 since the quality of the data cannot support this statistical list.

Table 1 — Critical values at the 95 % probability level

n	Critical value	n	Critical value
3	0,941	14	0,546
4	0,765	15	0,525
5	0,642	16	0,507
6	0,560	17	0,490
7	0,507	18	0,475
8	0,554	19	0,462
9	0,512	20	0,450
10	0,477	21	0,440
11	0,576	22	0,430
12	0,546	23	0,421
13	0,521	24	0,413
		25	0,406

4.3.9 Calculate the statistical mean, r, to five places of decimals using the sum of the ratios divided by the number of ratios used:

$$r = \frac{\sum_{n=1}^{N} r_n}{N}$$

Round the mean, r, to four places of decimals and record it.

5 Expression of results

Report the VEFL and/or the VEFD of the vessel calculated in 3.2.8 or 4.3.9 to four decimal places.

6 Assessment report

The assessment report shall contain at least the following information:

a) a reference to this International Standard;

b) all data used to establish the vessel experience factor;

c) all details necessary to identify the vessel assessed;

d) the method used for the assessment (i.e. Method 1 or Method 2);

e) the result of the assessment in accordance with clause 5;

f) the date of the assessment.

Annex A
(informative)

Example of the calculation procedure using method 1

For the purposes of this example, the data according to 3.1, expressed in cubic metres, is given in table A.1.

Table A.1 — Data for examples of calculations by Methods 1 and 2

Voyage number	Total calculated volume (vessel) m^3	OBQ or ROB m^3	t_v m^3	t_s m^3	r (t_v/t_s)
1	25 188	4	25 184	25 085	1,003 95
2	24 355	10	24 345	24 393	0,998 03
3	27 998	9	27 989	28 006	0,999 39
4	28 398	4	28 394	28 412	0,999 37
5	23 530	10	23 520	23 460	1,002 56
6	24 247	12	24 235	24 255	0,999 18
7	27 490	5	27 485	27 447	1,001 38
8	20 108	3	20 105	19 850	1,012 85
9	22 564	8	22 556	22 563	0,999 69
10	26 938	7	26 931	26 895	1,001 34

Calculate the quantity of cargo measured on board the vessel minus the OBQ or ROB (t_v).

Calculate the voyage ratios, r, by dividing t_v by t_s.

Sum the values (t_v) and record the result:

T_v = 250 744 m^3

Sum the values (t_s) and record the result:

T_s = 250 366 m^3

Calculate the ratio, R, of the total quantities by dividing T_v by T_s:

R = 1,001 51

Calculate 0,3 % of R

= 0,003 00

Delete ratios (r) lying outside the range 1,001 51 $\pm$ 0,003, i.e.1,004 51 to 0,998 51. Thus ratios (r) for voyages 2 and 8 are deleted.

Recalculate the ratio, R, to four decimal places, for the remaining 8 voyages:

R = 1,000 9

and report it as the vessel experience factor (loading or discharging).

Annex B
(informative)

Example of the calculation procedure using method 2

For the purposes of this example, the data according to 4.2, expressed in cubic metres cubed is given in table A.1.

B.1 List the ratios in ascending order and label them r_1 to r_{10}:

Voyage number	Vessel load ratio	Label
2	0,998 03	r_1
6	0,999 18	r_2
4	0,999 37	r_3
3	0,999 39	r_4
9	0,999 69	r_5
10	1,001 34	r_6
7	1,001 38	r_7
5	1,002 56	r_8
1	1,003 95	r_9
8	1,012 85	r_{10}

B.2 Calculate R_L and R_H for n = 10:

$$R_L = \frac{r_2 - r_1}{r_9 - r_1} = \frac{0{,}999\,18 - 0{,}998\,03}{1{,}003\,95 - 0{,}998\,03} = \frac{0{,}001\,15}{0{,}005\,92} = 0{,}194$$

$$R_H = \frac{r_{10} - r_9}{r_{10} - r_2} = \frac{1{,}012\,85 - 1{,}003\,95}{1{,}012\,85 - 0{,}999\,18} = \frac{0{,}008\,90}{0{,}013\,67} = 0{,}651$$

B.3 Compare R_L = 0,194 and R_H = 0,651 with the critical value at the 95 % probability level corresponding to n = 10, shown in table 1, i.e. 0,477.

B.4 As R_L = 0,194 is less than the critical value of 0,477, do not delete r_1.

As R_H = 0,651 is greater than the critical value of 0,477, delete r_{10}.

B.5 Relabel the remaining ratios r_1 to r_9.

B.6 Repeat B.1 to B.5 and confirm that, in this example, no more ratios have to be deleted.

B.7 The number of remaining ratios in the list, N, equals 9.

B.8 Calculate the mean, r, of the 9 ratios to four decimal places, using the equation

$$r = \frac{\sum_{n=1}^{9} r_n}{9} = 1{,}000\ 5$$

and report it as the vessel experience factor (loading or discharging).

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