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BSI Standards Publication

Tanks for transport of dangerous goods — Sealed parcel delivery systems — Working principles and interface specifications

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National foreword

This British Standard is the UK implementation of EN 15208:2014. It supersedes BS EN 15208:2007 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AUE/18, Tanks for the transport of dangerous goods.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Foreword

This document (EN 15208:2014) has been prepared by Technical Committee CEN/TC 296 “Tanks for transport of dangerous goods”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2014 and conflicting national standards shall be withdrawn at the latest by November 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 15208:2007.

According to edition EN 15208:2007 the following fundamental changes are given:

— Annex B revised;

— Annex D deleted;

— referred standards updated.

This document forms part of a coherent standards programme comprising the following standards:

— EN 13616, *Overfill prevention devices for static tanks for liquid petroleum fuels*

— EN 13922, *Tanks for transport of dangerous goods — Service equipment for tanks — Overfill prevention systems for liquid fuels*

— EN 14116, *Tanks for transport of dangerous goods — Digital interface for product recognition devices for liquid fuels*

— EN 15207, *Tanks for transport of dangerous goods — Plug/socket connection and supply characteristics for service equipment in hazardous areas with 24 V nominal supply voltage*

— EN 15969-1, *Tanks for transport of dangerous goods — Digital interface for the data transfer between tank vehicle and with stationary facilities — Part 1: Protocol specification — Control, measurement and event data*

— EN 15969-2, *Tanks for transport of dangerous goods — Digital interface for the data transfer between tank vehicle and with stationary facilities — Part 2: Commercial and logistic data*

This document is applicable for tanks according to ADR [1].

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Sealed parcel delivery systems, the subject of this European Standard, provide information concerning the content and the status of each compartment, used to transfer liquid fuels from loading gantries to delivery points, and optionally, the delivered quantities.

SPDS may be suitable for other application, e.g. sealed transfer of products subject to duties.

Sealed parcel delivery systems may be classified according to:

— the combination of functions implemented by the system;

— the way the functions are implemented (“type of function”).

Sealed parcel delivery systems are not measuring instruments but they may be ancillary devices as defined in OIML R 117 [2].

1 Scope

This European Standard is applicable to sealed parcel delivery systems used with transport tanks and specifies the performance requirements, critical safety aspects, data transfer methods between loading gantries and transport tank, transport tank and delivery points, other optional communications and tests to provide functional and compatible systems.

Sealed parcel delivery systems covered by this European Standard is for bottom loaded transport tanks.

The systems specified by this European Standard are suitable for use with liquid petroleum products and other dangerous substances of Class 3 of ADR which have a vapour pressure not exceeding 110 kPa at 50 °C and petrol, and which have no sub-classification as toxic or corrosive.

2 Normative references

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

EN 12266-1:2012, *Industrial valves - Testing of metallic valves - Part 1: Pressure tests, test procedures and acceptance criteria - Mandatory requirements*

EN 12266-2, *Industrial valves - Testing of metallic valves - Part 2: Tests, test procedures and acceptance criteria - Supplementary requirements*

EN 13082, *Tanks for transport of dangerous goods - Service equipment for tanks - Vapour transfer valve*

EN 13083, *Tanks for transport of dangerous goods - Service equipment for tanks - Adaptor for bottom loading and unloading*

EN 13094, *Tanks for the transport of dangerous goods - Metallic tanks with a working pressure not exceeding 0,5 bar - Design and construction*

EN 13308, *Tanks for transport of dangerous goods - Service equipment for tanks - Non pressure balanced footvalve*

EN 13314, *Tanks for transport of dangerous goods - Service equipment for tanks - Fill hole cover*

EN 13316, *Tanks for transport of dangerous goods - Service equipment for tanks - Pressure balanced footvalve*

EN 13317, *Tanks for transport of dangerous goods - Service equipment for tanks - Manhole cover assembly*

EN 13616, *Overfill prevention devices for static tanks for liquid petroleum fuels*

EN 13922, *Tanks for transport of dangerous goods - Service equipment for tanks - Overfill prevention systems for liquid fuels*

EN 14025, *Tanks for the transport of dangerous goods - Metallic pressure tanks - Design and construction*

EN 14116, *Tanks for transport of dangerous goods - Digital interface for product recognition devices for liquid fuels*

EN 14564, *Tanks for transport of dangerous goods - Terminology*

EN 14595, *Tanks for transport of dangerous goods - Service equipment for tanks - Pressure and Vacuum Breather Vent*

EN 14596, *Tanks for transport of dangerous goods - Service equipment for tanks - Emergency pressure relief valve*

EN ISO 3166-1, *Codes for the representation of names of countries and their subdivisions - Part 1: Country codes (ISO 3166-1)*

ISO/IEC 7816-1, *Identification cards - Integrated circuit cards - Part 1: Cards with contacts - Physical characteristics*

ISO/IEC 7816-2, *Identification cards - Integrated circuit cards - Part 2: Cards with contacts - Dimensions and location of the contacts*

ISO/IEC 7816-3:2006, *Identification cards - Integrated circuit cards - Part 3: Cards with contacts - Electrical interface and transmission protocols*

ISO/IEC 7816-4:2013, *Identification cards - Integrated circuit cards - Part 4: Organization, security and commands for interchange*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
access port
port through which it is possible to access to cargo and/or to change the physical characteristics of the parcel

3.2
bottom loading
according to EN 14564

3.3
cargo
product contained within a parcel

3.4
clingage
quantity of product that remains adhering to the parcel's internal surfaces after a complete delivery

3.5
compartment
<tanks for transport of dangerous goods> vessel closed by a foot valve, vapour transfer valve and a manhole cover assembly

3.6
delivery
complete operation performed at a station to discharge products from one or more compartments into one or more tanks including a start and a finish phase

3.7
depot
terminal
site of the products to be loaded onto the tank vehicles and the location of the loading facilities

3.8
depot session
time period covering the complete loading of the tank vehicle, starting at the beginning of the loading procedure and ending with the final loading or transfer operation

3.9
device for the transfer of measured quantities
DTMQ
all the equipment contained within a system that permits the secure transfer of metrological data between the loading rack, the tank vehicle and the delivery or transfer station

3.10
empty parcel
parcel in which no product is present except clingage

3.11
equipment port
port through which only access to cargo is possible

3.12
frustrated delivery
delivery of a parcel which does not result in an empty parcel

3.13
guaranteed cargo
sum of measured quantities transferred into a sealed parcel under guaranteed routing where parcel emptiness has been previously automatically identified

Note 1 to entry: In this case, the cargo within a parcel is equal to the guaranteed cargo.

3.14
guaranteed delivered volume
volume of product passing a port of a parcel enabling the parcel to be empty (transferring point)

3.15
guaranteed routing
routing that is satisfactorily completed under routing control

3.16
guaranteed transport
transportation of a guaranteed cargo or a minimum guaranteed cargo or an automatically detected empty parcel

3.17
maximum guaranteed volume
fill capacity of a compartment which corresponds to 97 % of the compartment's total capacity

3.18
maximum sealable quantity
maximum volume of product which can be guaranteed by the parcel

3.19
measured quantity routed
product quantity as routed into a parcel which has been measured by an approved metering system

3.20
measurement cycle
time period between the connection and the disconnection of a loading arm onto a parcel

3.21
measurement number
non-repeating sequence number (incrementing from 1) assigned to each measurement cycle when a measured quantity routed is available

3.22
metrological data
data that includes product quantities and is used for metrological purposes

3.23
minimum guaranteed cargo
sum of measured quantities transferred into a sealed parcel under guaranteed routing

Note 1 to entry: The cargo within a parcel may be greater than its minimum guaranteed cargo.

3.24
monitored port
port whose closed position is checked automatically

3.25
non-guaranteed cargo
condition of a guaranteed cargo or a minimum guaranteed cargo once the parcel has been unsealed

3.26
operational port
port which permits cargo transfer to or from the parcel in normal operation and through which it is not possible to change the physical characteristics of the parcel

3.27
parcel
compartment(s) and all associated pipes and equipment, including its ports

Note 1 to entry: This here defined term “parcel” should not be confused with the term in the packaging practice.

3.28
permanently closed port
port which can only be opened by destroying it

3.29
port
<tanks for transport of dangerous goods> any inlet or outlet connection or hole in a parcel

3.30
return facility
facility dedicated to the handling of product returns

Note 1 to entry: This facility may include means to measure the returned volume.

3.31
returns
undelivered product left in the parcel

3.32
routing
transfer of a measured product quantity into a parcel

3.33
routing control
control method used to ensure that the total measured quantity is transferred into the parcel

3.34
sealed parcel
one whose ports are monitored closed by either mechanical or electronic devices or are permanently closed

3.35
sealed parcel delivery
SPD
process where a measured quantity of product is loaded into a parcel which is then sealed, controlled during transportation and discharged without the need for further measurement

3.36
sealed parcel delivery system
SPDS
instrumentation system that controls the seal status of a parcel

3.37
sealed port
port which cannot be opened without the destruction of its mechanical seal

3.38
secured port
port through which no product can be transferred even when it is open

3.39
station
<tanks for transport of dangerous goods> any discharge site, delivery point but particularly petrol filling stations

3.40
tank vehicle
according to EN 14564

3.41
top-up loading
adding of additional product to a parcel that, although containing product, is not full

3.42
transaction
<tanks for transport of dangerous goods> successful loading or delivery of a minimum guaranteed cargo or a guaranteed cargo

3.43
transfer station
set of measurement, pumping, and associated hoses and/or loading arms installed to enable the transfer of measured product between parcels of a tank vehicle(s)

3.44
unknown cargo
contents of a parcel which is not defined by either a minimum guaranteed cargo, a guaranteed cargo or a non-guaranteed cargo

3.45
wet leg sensor
liquid sensor(s) which detect the emptiness of the pipe(s)

3.46
compartment's total capacity
maximum volume capable of being loaded into the compartment without any product release or escape

4 Aims (functions) of SPDS

4.1 Minimum aim for delivery

— Check status of each parcel before loading;

— secure the transfer of product from the measuring set to each relevant parcel;

— acquire and transmit to receiver the product grades and quantities loaded per parcel;

— control the sealed status of each parcel during transport;

— confirm emptiness of each parcel after delivery or follow procedure of frustrated delivery.

4.2 Minimum aim for frustrated delivery

The aim of 4.1 plus:

— secure the return of non-delivered product to return facility;

— acquire and transmit to receiver the quantities of non-delivered product per parcel, if required.

4.3 Minimum aim for unattended delivery (optional)

The aim of 4.1 plus:

— give suitable insurance that the quantity is fairly delivered (e.g. location of petrol station or tank within the petrol station, product grade);

— minimise the risk of accidental or fraudulent withdrawal of liquid;

— allow the retrieval of measuring data until the settlement of the transaction.

4.4 Minimum aim for unattended frustrated delivery (optional)

The aim of 4.2 and 4.3 plus:

— automatic recognition of the end of delivery.

5 Functionality

5.1 General

The functions of the systems shall be according to Table 1.

Table 1 — Functions

Functions	Annex A DTMQ 4.1 to 4.4 and Welmec [3]	Annex B PID/PRD 4.1 to 4.4 Welmec optional [3]	Annex C Paper 4.1 and 4.2 no Welmec [3]
Measuring results indication	yes	option	no
Seal breakage	yes	yes	yes
Loading arm identification	yes	yes	no
Receiver tank identification	option	yes	no
Location device	option	option	no
Product grade at loading	yes	yes	no
Product grade at discharge	option	yes	no
Guaranteed volume	option	option	no
Receiver loading data	yes	option	no
Data transfer receiver	option	option	no
Transaction recording	yes	option	no
Non transaction event recording	yes	yes	yes
Volume change detection	option	option	no

This clause describes the requirements of the different functions that can be provided by a SPDS.

5.2 Data

5.2.1 Recording

5.2.1.1 Transaction recording

The SPDS shall be provided with a means of keeping track of all transactions. This recording shall be available until the settlement of the transaction has been completed, but for a minimum time period of 15 days.

As a minimum, the following transaction data per parcel shall be recorded:

— date and time of the transaction;

— product quantity;

— product grade;

— special conditions e.g. empty, not empty;

— guaranteed or non-guaranteed cargo.

It is not required that the loaded quantity be recorded in the SPDS at the moment of sealing.

5.2.1.2 Non transaction event recording

Events, such as sealing, re-sealing, breaking of a seal or changing the status of a parcel, shall be recorded in an electronic memory.

The record shall include the time and date of the event.

These events may be recorded in a summary if the transaction has been completed.

If an automatic empty detection is available any change of the status shall be considered as an event.

5.2.2 Display

The secured status of each compartment shall be clearly visible and unambiguous.

— Measuring results indication

The volume and status of the cargo as presented to the receiver shall be displayed, printed or otherwise securely transferred to the interested parties.

— Guaranteed volume

The volume of the cargo delivered to a station shall be displayed, printed or otherwise securely transferred to the interested parties.

5.2.3 Data transfer methods

Data transfer methods to be used at the loading rack and on the station are described in Annex A, Annex B or Annex C.

5.2.4 Integrity of the data

The data transfer and recording shall be safe against interference and manipulation. Errors shall be detected.

5.2.5 System identification

Systems using data communication shall have permanently installed identification devices to determine the proper method of communication.

5.3 Loading

5.3.1 Empty status

The status of the parcel shall be available prior to loading.

If the parcel is not empty the top-up procedures in the applicable annexes shall be followed.

5.3.2 Routing

Secured transfer of product shall be achieved by:

— ensuring that no product is diverted between the transfer point of the metering set and the routing port of the parcel;

— ensuring that no product is lost from the parcel during loading;

— the complete sealing of the loaded parcel shall be activated within a time scale that makes fraud or withdrawal of product impossible without detection.

The SPDS shall be able to detect or identify which loading arm either is or was connected to which parcel. Identification may be done directly or indirectly.

The SPDS shall be able to identify which product grade is about to be loaded or has been loaded into a parcel. Acquisition of product grade may be done directly or indirectly.

The SPDS shall be able to exchange data with the depot. Loading data shall contain at least volume and product grade. Data exchange may be done directly or indirectly.

5.4 Delivery

5.4.1 Attended delivery

The status of all parcels shall be presented to the receiver along with the allocated cargoes.

If the sealed status is not given an individual procedure should be defined.

All delivered parcels shall be presented empty after delivery. Otherwise see 5.5.

No product shall be diverted between the parcel and the receiving tank.

5.4.2 Unattended delivery

The minimum requirements are:

— automatic station identification;

— automatic empty detection;

— a method to transmit securely to the station product grade and volume.

Additional requirements may be:

— verification of volume which shall be delivered against the available ullage in the tank;

— automatic tank identification;

— confirmation that volume was delivered into the correct receivers tank.

5.5 Frustrated delivery

5.5.1 Station

The return of non-delivered product shall be secured by recording

— date and time of last resealing of the relevant parcels before transfer of return;

— date and time of end of last delivery at the station, either confirmed by the receiver signature or automatically generated.

The return discharge shall be carried out in accordance with 5.5.2.

5.5.2 Returns

5.5.2.1 General

The safe transportation between the station and the return facility shall be controlled by comparing the time and date of the last resealing before the presentation at the return facility with the time and date of end of last delivery from the tank vehicle at the station.

Measuring of returned quantities may not be necessary if the returned product can be delivered in another place to the same receiver, e.g. where a cargo is split between delivery locations. The parcel shall be controlled to be empty at the final delivery location.

5.5.2.2 Non-measured returns

The return shall be unloaded in the return facility (which may be a second station). It may not be necessary to control emptiness because no measurement has taken place.

5.5.2.3 Measured returns

The unloaded volume shall be measured to conclude the frustrated delivery, volume delivered being the difference between guaranteed cargo and returned volume. The parcel shall be controlled to be empty.

The bill of return product with the date and time of last resealing of the relevant parcels as well as their identification shall be issued. Reconciliation of loaded and returned product shall be performed and the results shall be transferred to the receiver of the frustrated delivery.

When the returned product is transferred into another parcel of the same tank, the requirements of 5.5.2.1 shall be fulfilled.

5.6 Integrity

Any unauthorised, accidental or fraudulent addition to or withdrawal of cargo from a parcel, shall be impossible or shall be detected, this shall also include equipment failure.

6 Design characteristics

6.1 Empty detection

If between two transactions the tanker runs with a guaranteed cargo, any change of state of the wet leg sensor shall initiate a seal break.

Types of empty detection according to Table 2.

Table 2 — Types of empty detection

Type	Type code					Explanation/example	Application limits
	Wet leg empty detection	Parcel internal detection	Compart-ment empty detection	Pitch detection	Roll detection		
1	M	M	O	O	O	Empty detection shall be controlled by the receiver.	Unsuitable for unattended delivery Unsuitable for non-horizontal stations Not suitable for unattended measurement of returns
2	M	A	O	O	O	Empty detection shall be controlled by the receiver.	Unsuitable for unattended delivery Unsuitable for non-horizontal stations
3	M	M	O	M	O	Empty detection shall be controlled by the receiver.	Unsuitable for unattended delivery Not suitable for unattended measurement of returns
4	M	M	O	M	M	Empty detection shall be controlled by the receiver	Unsuitable for unattended delivery Not suitable for unattended measurement of returns
5	A	A	O	O	O	Automatic empty detection by the system.	Suitable for unattended delivery Unsuitable for non-horizontal stations
6	A	O	A	O	O	Automatic empty detection by the system.	Suitable for unattended delivery May be suitable for non-horizontal stations
7	A	O	A	M	O	Automatic empty detection by the system.	Suitable for unattended delivery May be suitable for non-horizontal stations
8	A	A	O	M	M	Automatic empty detection by the system.	Suitable for unattended delivery May be suitable for non-horizontal stations
9	A	O	A	M	M	Automatic empty detection by the system.	Suitable for unattended delivery May be suitable for non-horizontal stations
10	A	A	A	A	O	Automatic empty detection	Suitable for

						by the system.	unattended delivery May be suitable for non-horizontal stations
11	A	A	O	A	A	Automatic empty detection by the system.	Suitable for unattended delivery May be suitable for non-horizontal stations
12	A	A	A	A	A	Automatic empty detection by the system.	Suitable for unattended delivery May be suitable for non-horizontal stations
M – manual (e.g. visual) A – automatic (e.g. electronic) O – not fitted							

6.2 Types of ports

6.2.1 General

As defined, ports are those valves or openings which permit the cargo to enter or leave the parcel. They are not those devices which only enable cargo transfer within the parcel.

Valves or openings which, when opened during normal operation, connect between parcels or parcels to common collectors, shall also be classed as ports.

Ports immersed in product which could lead to product leakage shall be monitored.

6.2.2 Examples

As an example, for a bottom loaded tank with vapour recovery system, the following devices shall be classed as ports:

— API adaptor and discharge valve or manifold valve (operational port);

— fill hole cover (access port);

— manhole cover (access port);

— emergency pressure relief valve (equipment port);

— vapour transfer valve (equipment port);

— pressure vacuum breather vent (equipment port);

— overfill sensor (equipment port);

— dip tubes (equipment port).

Valve that is not to be classed as port is:

— foot valve.

6.3 Checking of ports

Ports shall be either monitored, sealed, secured or permanently closed. The level of security required shall be dependent upon the performance of the SPDS according to Table 3.

— Monitored port

Any attempt to open such a port shall be recorded. The port sensor shall be set such that any leakage of more than 10 l/h shall result in the initiation of seal break.

In the event of the monitoring system identifying the opening of an access or equipment port, the SPDS shall treat the parcel as unsecured until reset by an authorised person. In case of unsecured equipment port proper condition of equipment port shall be restored. In case of unsecured access port the proper condition of the whole parcel shall be verified.

— Sealed port

The completeness of any mechanical sealing device shall be easily verified. The tanker shall carry identification showing the location of all such devices. Examples of mechanical sealing devices include a lead seal.

— Secured port

If a guaranteed cargo is present in the parcel, a secured port shall not be immersed in product in normal operation. Secured ports may include barriers, e.g. flame arresters or filters.

— Permanently closed port

It is not necessary to check during normal operation the status of permanently closed ports. Examples of permanently closed ports include those which are kept closed by direct or indirect welding.

Table 3 — Methods of checking of ports

Ports	Monitored	Sealed	Secured	Permanently closed
operational	Yes, at least if cargo is present	Yes, at least if cargo is present	no	no
equipment	Yes, at least if cargo is present	Yes, at least if cargo is present	yes	yes
access	Yes, continuously	Yes, continuously	yes	yes

6.4 Quantity monitoring

6.4.1 General

Quantity monitoring based on level gauging, differential pressure measurement or other techniques may be integrated in an SPDS along with any combination of other monitoring methods.

Quantity measurements may be carried out at any time, but as a minimum after each loading and before each unloading.

Quantity monitoring systems shall be classified by the manufacturer according to their sensitivity threshold according to Table 4.

In addition, quantity monitoring systems are characterised by the measuring range, i.e. the minimum and maximum measurable product quantity.

The measuring range shall cover the maximum sealable cargo.

The minimum measurable product quantity shall be specified by the manufacturer.

6.4.2 Quantity monitoring above foot valve

6.4.2.1 Long term quantity monitoring

Any quantity variation during the monitoring period which is greater than the value specified in Table 4 for the type of system shall initiate a seal break.

6.4.2.2 Short-term quantity monitoring

The quantity variation shall be checked continuously. A seal break shall be initiated as soon as the quantity variation exceeds the larger of:

— 0,05 of the value specified in Table 4 for the type of system, per hour;

— 0,1 of the value specified in Table 4 for the type of system.

6.4.3 Quantity monitoring below foot valve

Quantity variation before and after opening of the foot valves shall be checked immediately before unloading.

Any quantity change of more than 0,1 per hour of the value specified in Table 4 for the type of system shall be detected as a seal break.

Table 4 — Types of level monitoring

Type	Min. detectable loss or gain of min. transportable quantity l	Min. detectable loss or gain of min. transportable quantity %
1	< 500	5
2	< 250	2,5
3	< 100	1
4	< 50	0,5
5	< 25	0,25
6	< 10	0,1
The values of this table do not include evaporation.		

6.5 Memory capacity and retention time

The memory capacity and the retention time shall be a minimum of 15 days. The use of removable storage devices to provide the memory capacity may be acceptable.

6.6 Data transfer methods

The data transfer methods shall be in accordance with at least one of the methods described in Annex A, Annex B or Annex C.

6.7 Crossover prevention at service station

Where crossover prevention is provided, it shall comply with the requirements of EN 14116.

6.8 Overfill prevention at service station

Where overfill prevention is provided, it shall comply with the requirements of EN 13616.

6.9 Tank top equipment

6.9.1 General characteristics

If sealed ports are utilised on tank top equipment, then the tank vehicle shall be equipped with means (e.g. ladders, walkways, safety rails) allowing checking of the status of the seals by the receiver. Sealing points shall be clearly visible.

6.9.2 Manhole cover assembly

Manhole cover assemblies shall comply with EN 13317.

6.9.3 Fill hole cover

Fill hole covers shall comply with EN 13314.

6.9.4 Overfill prevention sensor

Overfill prevention sensors shall be in accordance with EN 13922.

6.9.5 Pressure and vacuum breather vent

Pressure and vacuum breather vent shall be in accordance with EN 14595.

6.9.6 Emergency pressure relief valve

Emergency pressure relief valves shall be in accordance with EN 14596.

6.9.7 Vapour transfer system

— **Common collector system**

Cargo shall be prevented from transferring from one parcel to another parcel through the common collector system.

— **Vapour transfer valve**

Vapour transfer valves shall be in accordance with EN 13082.

6.10 Product transfer equipment

6.10.1 Foot valve

Foot valves shall be in accordance with EN 13308 or EN 13316.

6.10.2 Manifold valve

Manifold valves and their operating system shall be designed to prevent the transfer of cargo from one parcel to another parcel through the manifold.

6.10.3 API Adaptor

API adaptors shall be in accordance with EN 13083.

6.10.4 Delivery valve

If separate delivery valves used, these valves shall meet the requirements of EN 12266-1 and EN 12266-2.

6.11 Temperature range

Unless otherwise specified, the system shall be designed for an operating temperature range of −20 °C to +50 °C and a product temperature range of −10 °C to +50 °C.

Where the SPDS is used in severe conditions, the operating temperature range shall be extended to −40 °C or +70 °C as applicable.

6.12 Power supply

A power supply failure shall not cause a state where SPDS functions can be overridden or manipulated. If this is not possible, then the status of parcels shall be indicated as unsealed when the power supply returns.

If the integrity of the parcel is not guaranteed by the system in case of power failure the seal shall be broken. Under power supply failure conditions at truck/trailer either the system is fully functional or the integrity of the parcel shall be retained or any delivery in progress shall be stopped until the supply power returns.

The power supply shall be sized to provide sufficient power to satisfy the SPDS and maintain any seal, for a minimum period of 3 days.

7 Tests

7.1 General

Two classes of tests are required, type tests and production tests.

Test methods and procedures shall comply with the requirements of EN 12266-1 and EN 12266-2 except as specified or amended within this European Standard.

7.2 Equipment type tests

7.2.1 General

A minimum of 2 production samples of each model type shall be type tested to demonstrate the performance and mechanical strength of the design.

Devices having one design, size and set pressure are considered to be of one model type.

NOTE Devices can mean complete SPDS.

These tests shall be performed at ambient temperature.

Type tests shall comprise:

— port leakage test;

— monitored routing port mechanical endurance test.

7.2.2 Port leakage test

7.2.2.1 Application

This test shall be applied to all port types, not only monitored, but also those defined as sealed, secured or permanently closed.

7.2.2.2 Test procedure

Valve types shall be classified for the choice of the test method.

Gate/ball/plug valve according to Table A.3 of EN 12266-1:2012

7.2.2.3 Test pressures

— 12 kPa and

— 20 kPa.

7.2.2.4 Test duration

According to Table A.4 of EN 12266-1:2012.

7.2.2.5 Acceptance criteria

Leakage in either direction shall not exceed the permitted leakage rate according to Table A.5 of EN 12266-1:2012 at the test pressure.

7.2.3 Monitored Routing Port mechanical endurance test

7.2.3.1 Application

This test is performed to demonstrate that a monitored routing port shall maintain permissible leakage rates over an extended operating time period of some 4 000 opening and closing operations, equivalent to 12 months operation.

This test shall be applied to all monitored ports that are used as routing ports.

7.2.3.2 Test apparatus

The test apparatus shall comprise a small vessel having a flanged opening onto which the port under test is mounted, a header tank to enable complete filling of the port, a sight glass to confirm the fill level, a device to open and close the port and the means to pressurise the complete assembly.

The port under test shall be fitted to the test apparatus in its normal operating attitude using the method used to attach the port to the parcel. All bolts and seals intended for parcel mounting shall be used and secured in accordance with the manufacturer’s instructions.

A method of recording the number of opening/closing cycles and measuring the leakage rate shall also be provided.

The test fluid shall be water which may contain a corrosion inhibitor.

A typical example for an API adaptor is shown in Annex D.

7.2.3.3 Test procedure

a) Mount the complete port, including any operating device, to the mounting flange of the test apparatus.

b) Operate the port to demonstrate opening/closing function.

c) Close the port, disconnect the operating device to ensure normal closure force is applied and fill the small vessel with the test medium, until the port is full.

d) Wait for 60 s to stabilise.

e) Wipe-off the sealing face(s) and check leakage rates (to be in accordance with the port leakage test criteria).

f) Pressurise the vessel to apply at least 20 kPa hydrostatic pressure to the parcel side of the port during test.

g) Wait for 60 s to stabilise.

h) Wipe-off the sealing face(s) and check leakage rates (to be in accordance with the port leakage test criteria).

i) Slowly crack-open the port and measure the leakage rate at the point when a seal break is initiated. This rate shall not exceed the permitted value.

j) Turn-off the pressure source, fully open the port and drain off the test fluid.

k) Reconnect the operating device.

l) Subject the port to 4 000 opening and closing operations, ensuring that the port is closed on each closure.

m) After completion of these cycles, and with the port closed and the operating device disconnected, refill the vessel with the test medium until full.

n) Wait for 60 s to stabilise.

o) Wipe-off the sealing face(s) and check leakage rates (to be in accordance with the port leakage test criteria).

p) Pressurise the vessel to apply at least 20 kPa hydrostatic pressure to the parcel side of the port during test.

q) Wait for 60 s to stabilise.

r) Wipe-off the sealing face(s) and check leakage rates (to be in accordance with the port leakage test criteria).

s) Slowly crack-open the port and measure the leakage rate at the point when a seal break is initiated. This rate shall not exceed the permitted value.

t) Turn-off the pressure source, fully open the port and drain off the test fluid.

7.2.3.4 Acceptance criteria

To be met before and after completion of the endurance cycling.

When closed, seat leakage shall be in accordance with 7.3.2.

When being opened, a seal break shall have been initiated before the port leakage rate exceeds the permitted value.

7.2.4 Test results

Test results shall be recorded and maintained for a time period which shall not be less than the manufactured life of the product.

7.3 Production tests

7.3.1 General

Production tests shall be carried out by the manufacturer of the tanker. These tests shall be performed at ambient temperature, and shall include as a minimum:

— parcel leakage test;

— SPDS functional test.

These tests may form part of other tests performed on the tank.

7.3.2 Parcel leakage test

7.3.2.1 General

The complete parcel shall be subjected to a maximum sealable quantity leakage test considering the pressure and temperature conditions specified for the tanker.

The test fluid shall be selected by the manufacturer to suit the design and application of the tanker and shall have a viscosity not greater than water.

The maximum working pressure of the tanker as specified in EN 13094 or EN 14025 as appropriate shall not be exceeded during this test.

7.3.2.2 Test procedure

The test fluid shall be routed into the parcel through the normal routing port.

The parcel shall be filled, at a flow rate and pressure commensurate with normal operation, to the maximum sealable quantity to demonstrate that any valves or openings which connect between parcels or parcels to common collectors remain leak tight throughout this process.

Once filled, the filling mechanism shall be removed and the parcel left to stabilise for 15 min.

The parcel shall then be checked for leaks or any sign of fluid transfer, loss or gain.

The parcel shall then be emptied, to confirm the value of the residual product volume, and again checked for leaks or any sign of fluid transfer, loss or gain.

7.3.2.3 Acceptance criteria

Leakage rate (gain, loss or transfer) shall not exceed 50 ml/h for any parcel.

Residual product volume shall not exceed either 0,1 % of the parcel's nominal capacity or 5 l, whichever is the smaller quantity.

7.3.3 Tests for quantity monitoring

7.3.3.1 General

In addition, the ability of the quantity monitoring system to detect small quantity variations shall be tested according to 7.3.3.2.

If the SPDS is capable of checking the pipework status by quantity monitoring, the tests according to 7.3.3.3 shall be performed in addition.

7.3.3.2 Quantity above foot valve

7.3.3.2.1 Short-term quantity variations

A quantity of 0,1 of the value given in column 2 of Table 4 shall be removed with a constant flow within a minimum time period of 2 h.

If the SPDS comprises also monitored ports, the removal shall be carried out in such a way that the port monitoring is not triggered.

The test shall be carried out with the following product quantities:

— parcel loaded with maximum sealable quantity;

— parcel loaded with the minimum measurable quantity.

The SPDS shall initiate a seal break in all three cases.

7.3.3.2.2 Long term quantity variations

The quantity as given in Table 4 shall be removed continuously and with constant flow over a time period of 72 h, under the conditions according to 7.3.3.2.1.

At the latest at the end of the 72 h test period, the SPDS shall initiate a seal break.

7.3.3.3 Quantity in pipework

Removal of a quantity of 0,1 of the value given in column 2 of Table 4 from the pipework shall be detected by the system and initiate a seal break.

7.3.4 SPDS functional test

7.3.4.1 General

The complete SPDS installation, once installed on the tanker, shall be subjected to a functional test to demonstrate the correct functioning of all parts of the SPDS.

The test fluid shall be selected by the manufacturer to suit the design and application of the tanker and shall have a viscosity not greater than water.

The SPDS manufacturer shall provide the tanker builder with a procedure for carrying-out this test. This procedure shall check as a minimum:

— setting of any routing sealed port;

— operation of any other sealed port;

— operation of foot valve indicators;

— demonstration of the permanence of any permanently closed port;

— operation of the system; loading, sealing, discharge, transfer;

— event recording facility;

— effectiveness of empty detectors;

— satisfactory operation of any other optional equipment (e.g. localisation equipment).

7.3.4.2 Acceptance criteria

Satisfactory operation of the devices or system under test.

7.3.5 Test results

Test results shall be recorded and maintained in accordance with the tanker manufacturer's procedures.

8 Marking

The part of the system mounted on the truck, as well as the parts installed at the loading gantry and at the delivery point shall have a permanent identification marking which includes the following:

— reference to this European Standard, i.e. EN 15208 and, if applicable, to the relevant annex;

— manufacturer's name and/or logo;

— manufacturer's type or assembly number;

— serial number and/or date of manufacture;

— applicable metrological approval certificate number;

— temperature range.

A drawing with location of mechanical seals or closed ports (or a list) shall be clearly visible on or close to the identification plate.

9 Installation, operating and maintenance recommendations

Installation, operation and maintenance instructions shall be provided for the equipment.

Annex A
(normative)
DTMQ guide using smart card

A.1 Terms and definitions

For the purposes of this annex, the terms and definitions given in ISO/IEC 7816-4and the following apply.

A.1.1
Adaptor
API adaptor
item of service equipment used for bottom loading and unloading, in accordance with EN 13083

A.1.2
Application Protocol Data Unit
APDU
command set in accordance with ISO/IEC 7816-4

A.1.3
AP sensor
liquid sensor installed in the inlet of a transfer station

A.1.4
bloc 1
data written to the badge by the TC at the beginning of a rack session

A.1.5
bloc 2
loading or transfer data written to the badge by the TD or TR, at the end of the tank session

A.1.6
continuous position monitoring
GPS system providing continuous readings of the current position of the device

A.1.7
correlation
method by which each measured quantity routed to the tank shall be assigned to its parcel

A.1.8
customisation (personalization)
operations carried out on a smart card to convert it from a standard card to a DTMQ badge

A.1.9
discharge zone
area enclosed within the maximum and minimum GPS readings obtained during the discharge period

A.1.10
discrete position monitoring
GPS system providing position readings at the start and finish of the delivery

A.1.11
DTMQ badge
smart card meeting the DTMQ specifications and containing, or able to contain, metrological data

A.1.12
DTMQ tank identifier

fixed device on the vapour recovery adaptor that enables other devices to provide automatic recognition that the tank vehicle shall be equipped with DTMQ

A.1.13
GPS
global positioning system

A.1.14
loading rack terminal
TD
DTMQ module fitted to the loading rack and connected to the loading metering system

A.1.15
loading session – finish
writing of the loading data onto the DTMQ badge by the TD

A.1.16
loading session – start
first loading coupling connection to the tank

A.1.17
rack session
period of time starting at DTMQ badge initialisation and ending when the correlation is proceeded

A.1.18
returns terminal
TR
DTMQ module fitted to the transfer rack and connected to the transfer metering system

A.1.19
sealed compartment
compartment in which all openings are either monitored as being closed, or are opened under the control of the routing

A.1.20
specified data transferred by the DTMQ badge

A.1.20.1
specified data – depot
DND
data transferred between TD and TC

A.1.20.2
specified data – returns
DNR
data transferred between TR and TC

A.1.20.3
specified data – station
DNS
data transferred between TC and TS

A.1.21
station session
period of time starting at DTMQ badge initialisation in TC (see Figure A.2 step 1) and ending when the DTMQ badge is inserted back at the end (see Figure A.2 step 8)

A.1.22
station terminal
TS
DTMQ module fitted to the service station or any discharge facility

A.1.23
tank session
time period in which the badge is removed from the TC whilst the tank is being loaded

A.1.24
tank terminal
TC
DTMQ module fitted to the tank

A.1.25
TD session
time period between the introduction and the withdrawal of the badge in the TD

A.1.26
transfer station
set of measurement, pumping and associated equipment permitting the transfer or measured product between compartments of a tanker

A.1.27
TR session
time period between the introduction and the withdrawal of the badge in the TR

A.2 Equipment

A.2.1 Loading rack equipment

A.2.1.1 For each loading rack

A TD shall provide:

— DTMQ badge read/write facility;

— the recording of the metrological journal - depot (JMD) with a minimum capacity of the previous 90 days;

— permissive to load output.

A.2.1.2 For each loading arm

A coupler fitted with connection/disconnection detection associated with at least a measurement set.

A.2.1.3 Automatic DTMQ Tank identification

If applicable, a sensor fitted to the vapour recovery coupler arm shall recognise the presence of a DTMQ tank identifier (see A.9).

A.2.2 Tank equipment

A.2.2.1 Type A tank

A.2.2.1.1 General

This type of tank is not able of providing an automatic guarantee of cargo delivery and requires the presence of the receiver (i.e. station attendant present and responsible for accepting the receipt of the cargo) for both deliveries and measurement of returned quantities.

A.2.2.1.2 For each tank

a) A TC which shall provide:

— DTMQ badge read/write facility;

— a facility to display the quantity and quality of cargo contained in each parcel;

— the recording of the metrological journal - tank (JMC), with a minimum capacity of the previous 15 days;

— one current and spare DTMQ badges (see details in A.5). A badge shall be assigned to a TC. The TC shall control its assigned badges and shall place each badge into one of three states, being:

— **valid badges**: spare badges available for use by the TC;

— **current badge**: the badge in use at the moment. Only one is permitted for each TC;

— **invalid badge**: a previously valid badge made invalid by the TC after suspicion of fraudulent use;

b) a DTMQ tank identifier (see A.9);

c) access to the top of the tank shall be made difficult with no ladders, walkways or other provisions being provided.

A.2.2.1.3 For each compartment

— Permanent identification of maximum sealable capacity;

— an adaptor fitted with open/close position sensor and a device for identifying the connection of a loading coupling;

— a means to control any removal of product from the parcel greater than 10 lh^{-1}.

— a means to ensure either visually or automatically the empty state of the compartment and run off pipe. E.g. a sight glass fitted to the API adaptor and visual method of identifying the open status of the associated foot valve;

— a means of protecting the contents of the compartment that meets the applicable requirements (e.g. an approved sealing system).

A.2.2.2 Type B tank

Type B tank needs type A equipment with additional following equipment to permit unmanned transfer operation:

— automatic ***sensing*** of the non-closed status of all foot valves.

A.2.2.3 Type C tank

Type C tank needs type B equipment with additional following equipment to permit automatic control of complete discharge of a guaranteed cargo, and unattended deliveries at a service station equipped with a TS:

— automatic sensing of each compartment's empty status.

A.2.2.4 Type D tank

Type D tank needs type C equipment with additional following equipment to permit unattended deliveries:

— secured printer that can provide a guaranteed delivery ticket;

— GPS receiver or similar position recorder.

GPS position coordinates shall be expressed in degrees, minutes and thousandths of a minute, in the format:

Latitude: N DD° MM,mmm '

Longitude: E DDD° MM,mmm '

Where: E (W) signifies that the position is East (West) of the Greenwich Meridian, and

N (S) indicates that the position is North (South) of the equator.

DD/DDD = Degrees; MM = Minutes; mmm = thousandths of minute

A.2.3 Station equipment

Generally no specific equipment is required.

If the service station is equipped with TS the TS shall provide:

— DTMQ badge read/write facility;

— the recording of the metrological journal - station (JMS), with a minimum capacity of the previous 90 days.

A.2.4 Transfer station equipment

A.2.4.1 For each transfer bay

a) A TR providing:

   — DTMQ badge read/write facility;

   — the recording of the metrological journal – returns (JMR), with a minimum capacity of the previous 90 days;

   — the permissive output for TR authorisation;

b) one or more transfer sets;

c) a sealed vapour coupling or similar device, to operate the vapour adaptor interlock to ensure that the vapour transfer valves are open, enabling vapour to be transferred between compartments.

A.2.4.2 For each transfer metering set

— Upstream, an unloading coupling connected to an inlet hose fitted with a AP sensor or equivalent;

— downstream, a delivery hose/loading arm complete with coupler fitted with connection detector.

The design of transfer stations may vary. Typically, they shall be grouped into types according to the manner in which the destination compartment's adaptor shall be opened during transfer. Currently, two types exist, type OH in which the adaptor shall be opened by the coupler of the transfer group and type F which uses the product flow to open the destination compartment's adaptor.

A.2.4.3 Optional equipment

Automatic DTMQ tanks identifier see loading rack.

A.3 Badge: reading/writing and movements

A.3.1 Depot reading/writing DTMQ badge

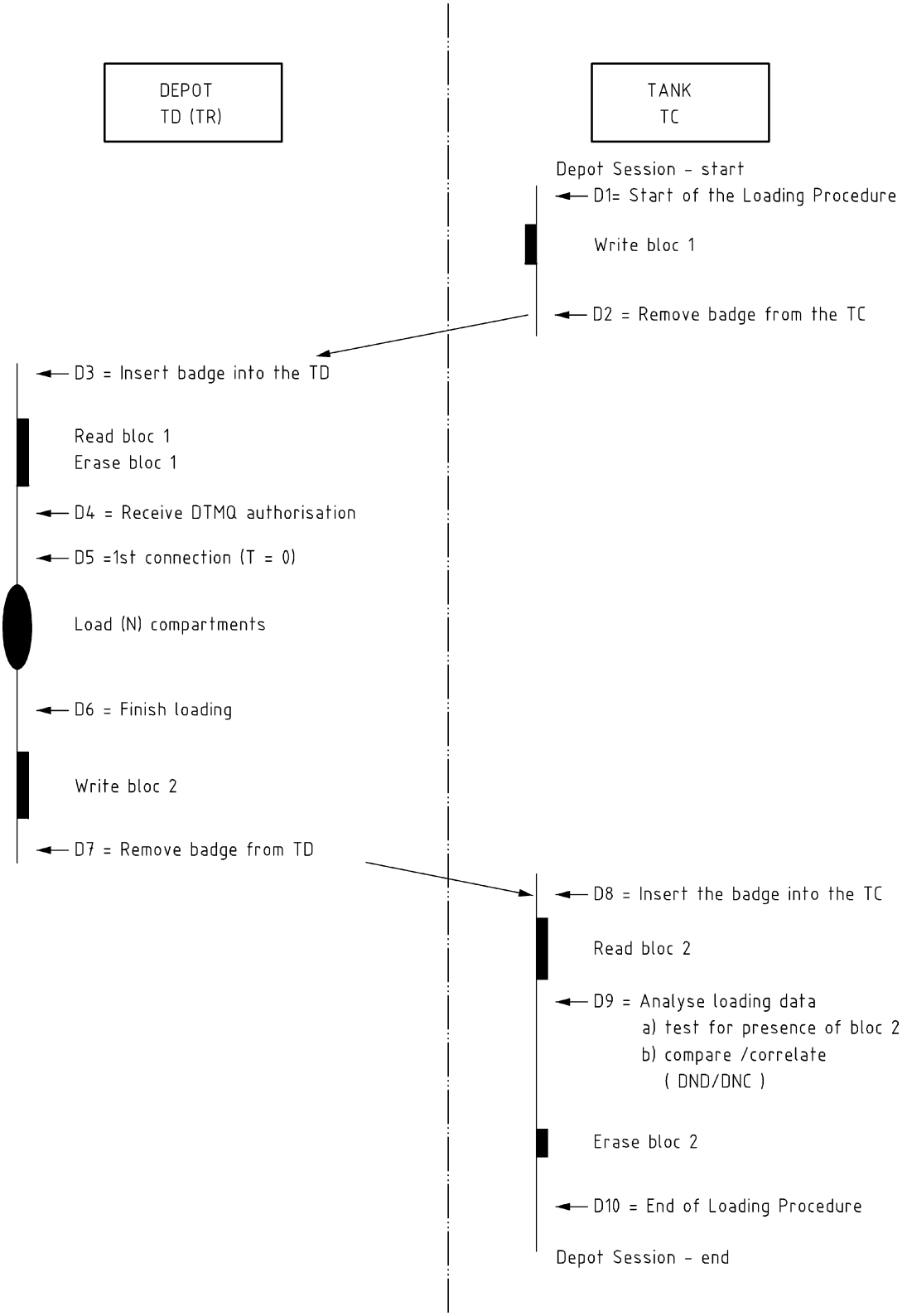


Figure A.1

Table A.1 — Loading sequence

Stage	Name	Remarks
D1	Start of the loading procedure	Rack session – start When the TC writes bloc 1 onto the badge At this stage all the foot valves are shut
D2	Withdrawal of the badge from the TC	Shall be preceded by D1
D3	Insertion of the badge into the TD	TD (TR) session – start TD (TR) identifies presence of bloc 1 and reads it. (If no bloc 1 present, go to D7) TD (TR) shall record random number, and then erases bloc 1
D4	Loading permissive	TD (TR) shall provide loading permissive signal
D5	First connection	Commencement of loading. reference time point T = 0
		Loading continues
D6	Finish loading	Loading ends Bloc 2 written onto badge [a] Start of permitted badge reinsertion window De-activation of loading permissive
D7	Withdrawal of the badge from the TD (TR)	Shall be preceded by D6 TD (TR) session – end De-activation of loading permissive if not achieved in D6
D8	Insertion of badge in TC	Reading of bloc 2
D9	Analysis of loading data	Data received from TD (TR) is correlated with the data existent within the TC: DND/DNC. Bloc 2 erased
D10	End of the loading procedure	Rack session – end TC display's cargo status

[a] It is permitted to transfer the loading data to bloc 2 data during the loading process.

A.3.2 Station reading/writing DTMQ badge

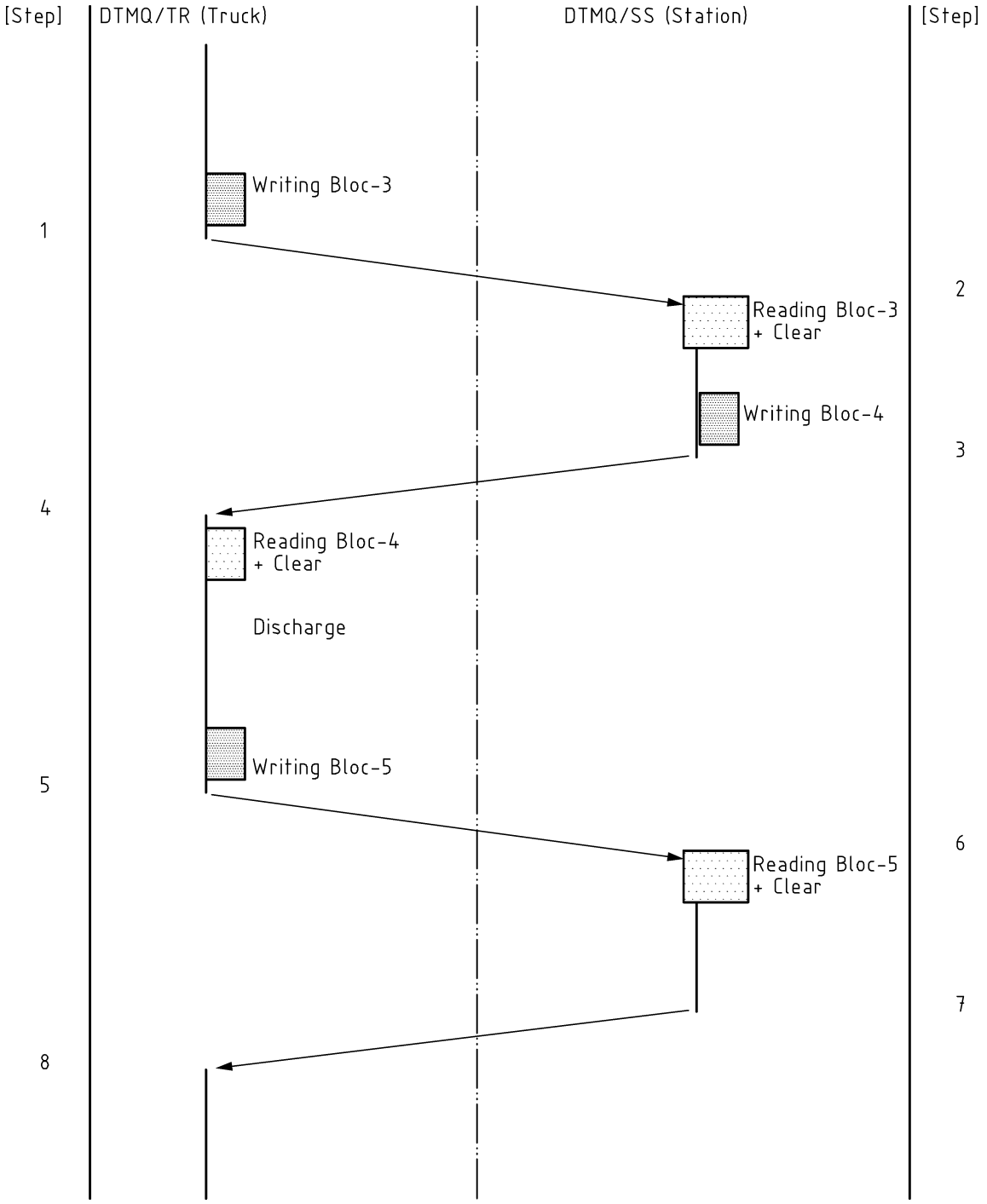


Figure A.2

A.4 Correlation method

A.4.1 General

The TC shall compare the coupling / uncoupling events time:

a) coming from loading rack (or return terminal) through the DTMQ badge;

b) measured locally on the truck;

in order to determine which coupler was connected to which adaptor.

A.4.2 Correlation method at loading time

The reference time (t = 0) start at first loading coupling connection to the tank. This time shall give common synchronisation event for both (TC and TD) equipment.

A.4.3 Correlation method for transfer operations

The reference time (t = 0) shall be defined as:

a) for the TC: the detection of the first opening of an adaptor (normally the source compartment's adaptor);

b) for the TR: the detection of a change of state (from dry to wet) of the AP sensor corrected by the estimated time to fill the inlet hose.

This time shall be recorded in Bloc 2 as the relative time of arm connection [T connection] for the discharge [EM_Bras] = 0.

— The relative time used to record the end of the discharge, shall be the instant when the AP sensor has remained dry for a continuous period of 5 s. This time shall be recorded in Bloc 2 as the relative time of arm disconnection [T disconnection] for the discharge [EM_Bras] = 0.

The relative time of closure of the source compartment's adaptor ((see a) above the use of "adaptor" as defined)) shall occur within a time window with a length of 14 min 45 s starting 15 s after the end of the discharge.

Correlation shall be established if:

a) the changes of state of the AP sensor (dry to wet, then back to dry) occur during the source compartment's API adaptor is open;

b) the opening and closing of the destination compartment's adaptor occurs during the loading hose/arm is connected to the API.

There may be several openings and closings of the destinations compartment's API adaptor during the time window set by the connection/disconnection of the loading hose/arm. The TC shall consider these as only one event, starting with the first opening of the adaptor and ending with the adaptor's final closure.

In the event of multiple destination compartments, allocation of transferred quantities shall be based upon the sequence of use of the destination compartments, as recorded by the connection/disconnection of the loading arm/hose and the opening/closing of the compartments API adaptors.

NOTE See A.5.8.11.2 for the definition of [Mesurage] number of record.

A.5 DTMQ Badge specification

A.5.1 General

A.5.1.1 Minimum characteristics

— Size (capacity):

- the minimum capacity shall be 8 KB (1 kilobyte = 1 024 bytes);

- transmission speed and response time:
  - transmission rate = 9 600 baud (default value at time of power up);
  - maximum response time < 1,5 s;
  - response time = 5 s (global maximum acceptable at terminals).

A.5.1.2 Card type

The cards shall be of the multi-application microprocessor type and shall conform to ISO/IEC 7816-1, ISO/IEC 7816-2, ISO/IEC 7816-3 and ISO/IEC 7816-4.

A.5.1.3 Criteria to be used

A.5.1.3.1 Transmission protocol

t = 0 according to 6.1 of ISO/IEC 7816-3:2006

A.5.1.3.2 CLA according to 5.4.1 of ISO/IEC 7816-4:2013

Values shall be: 00 or 80 or C0 (hex).

A.5.1.3.3 Reset structure

TS = Direct convention according to 8.1 of ISO/IEC 7816-3:2006.

A.5.1.3.4 Operating condition

Class A (see 5.1.3 of ISO/IEC 7816-3:2006).

A.5.1.3.5 Select File command

After the answer to reset, the MF (Master File) shall be implicitly selected through the basic logical channel. (see 11.1.2 of ISO/IEC 7816-4:2013).

A.5.1.3.6 APDU bit 8, commands for: “READ BINARY” and “UPDATE BINARY”

If bit 8 (msb) = 0 in P1, then P1 (Hi) to P2 (Lo) shall be the offset of the first byte to be read in data units from the beginning of the file (see 11.2.3 and 11.2.5 of ISO/IEC 7816-4:2013).

Data unit size shall be 1 byte.

A.5.1.3.7 APDU decoding convention

The parameter “Le” (data length) in the commands “READ BINARY” and “UPDATE BINARY” shall be between 1 (01 hex) and 250 (FA hex).

The card shall respond with a valid answer, with a length of 1 byte to 250 bytes.

A.5.1.3.8 APDU “SELECT FILE” command

As a minimum, the APDU “SELECT FILE” command shall work with a “Le” field value of empty.

A.5.1.4 Smart Card operation

A.5.1.4.1 General

There are two distinct phases in the working of the smart card:

A.5.1.4.2 Customisation phase

The way to customise the card is currently outside the scope of this European Standard.

The customisation of the card shall permit the specification of the DF (Dedicated File) and EF (Elementary File) files as follows:

— the sets of EF used by the DTMQ badge depend on a unique DF, to optimise the access times of file selection.

  The address of this DF shall be fixed at 0200H. (Hex).

  It is recommended that after the first access, this DF address can be directly accessed from the specification application file (EMV process);

— the interoperable EF used by the DTMQ badge shall be allocated to these successive addresses: 0201H, 0202H. 020FH;

  — file types:

  All interoperable files [0201H to 020FH] will be of the TRANSPARENT type (see ISO/IEC 7816-4, definitions);

  — conditions for access to the DTMQ files:

  except for the ” Identification file of the Badge ” 020FH that is read-only, the set of the interoperable files used by the DTMQ badge (0201H.. 020EH) shall possess access attributes that permit reading and the unrestricted writing in normal working, following power sequencing;

— the EF open to every user of the DTMQ badge shall be allocated to these successive addresses: 0210H, 0211H. 023FH;

— the implementation of the procedures to invalidate or revalidate a DTMQ badge is not in the field of this European Standard;

— personalization of a card shall not limit the available file sizes, particularly the common DTMQ DF file.

A.5.1.4.3 Application phase

A.5.1.4.3.1 Interoperable APDU commands

Only the APDU command according to Table A.2 shall be used to ensure interoperability:

Table A.2 — APDU command

APDU command	Hex
SELECT LINE	A4
READ BINARY [a]	B0
UPDATE BINARY	D6
a In standard reading mode.	

A.5.1.4.3.2 Interoperability between terminals

The DTMQ Badge shall be part of the tank equipment supply.

Each TC shall be supplied with smart cards customised such that they can only operate with this TC.

These cards shall be used as the interface between the TC and any TD, TR or TS.

A.5.2 File format

A.5.2.1 Each file shall contain

Table A.3 — File content

Block of data
Empty band

— The block of data shall contain the informative data;

— the empty band shall be used to ensure the correct file length.

The files shall be created during the personalization phase with a length that shall not be less than the corresponding “data block“. The empty band shall be located after the “data block” and can be of any length.

A.5.2.2 A block of data comprises:

A.5.2.2.1 General

Table A.4 — Data block content

Header
Data
CRC

These three parts are defined in the following subclause.

A.5.2.2.2 Header

The header shall be used to provide a summary of the data to be found in the “data block”. The format of the header shall be independent of the type of “data block“.

A header shall comprise the five fields according to Table A.5:

Table A.5 — Fields of the header

FIELD	Function	Bytes	subclauses
[IdF]	Identifying file (APDU)	2	-
[Len]	Useful length data file (field [IdF] to [CRC] included)	2	-
[Ver]	DTMQ version	2	A.5.4
[IdT]	Terminal Identifier: Source of information	8	A.5.5
[Tterm]	Terminal type	1	A.5.6

NOTE In the case of the “identification file of the badge” (in read only), the fields [IdF] and [Term] are the ones of the associated TC.

A.5.2.2.3 Data

The data part shall be broken down into a number of specific fields defined for each “data block“.

See details in A.7.

A.5.2.2.4 CRC

2 bytes length:

a) from, and including, the first byte of the header;

b) to, and including, the last byte of the data.

The calculation of the CRC shall be based on the initial value FFFF (hex).

The polygon of iteration of the CRC-16 shall be equal to A001 (hex).

A.5.2.3 Block Erasure

The “Header” shall be maintained with a [Len] = 17, comprising a header of 15 bytes and a CRC of 2 bytes.

The CRC shall be positioned directly after the header.

An erased data block shall have the value 0 binary.

The CRC shall be recalculated.

A.5.3 Data format

A.5.3.1 Notes concerning binary coding

A.5.3.1.1 Optimization of length

In an effort to optimize the size of data, the number of bytes shall be determined in accordance with the precision required, without reaching a power of 2 (1, 2, 4, 8 etc.) bytes.

EXAMPLE [VolProd] = 000000…..999999 coded on 3 bytes.

A.5.3.1.2 Order of data

The most significant byte shall be first.

EXAMPLE 34000 decimal will be coded: 00 84 D0 (3 bytes);

00 hexadecimal = most significant byte;

84 hexadecimal;

D0 hexadecimal = least significant byte.

A.5.4 "Software version" [Ver]

A.5.4.1 Number format

The number format used comprises two parts being (Major 256* Version) + (Minor Version).

A.5.4.2 Compatibility

A.5.4.2.1 Case 1: upward compatibility (minor version change)

In this case the terminal ignores those new fields that are unknown, and which do not affect the integrity of the system:

— reading: the terminal only reads data corresponding to its own software version;

— writing: the terminal only writes data corresponding to its own software version.

A.5.4.2.2 Case 2: incompatibility (major version change)

In this case the terminal refuses to accept the data and shall signal an incompatibility in a clear and simple manner.

A.5.4.3 Additional requirements

To ensure compatibility, the following requirements apply globally to all and any DTMQ systems:

a) any new major version shall include the last published minor version;

b) the operational data sets may use their own software versions independent of the metrological data;

c) these requirements are applicable to the DTMQ software version as transmitted in the beginning of every block, and not to the operational software within the terminal.

A.5.5 Terminal Identifier [IdT]

A.5.5.1 General

Each smart card shall carry an identifier to connect the card with its associated TC.

The TC shall only accept cards that contain the correct identifier number. This shall permit the exclusion of faulty and corrupted cards.

This identifier shall comprise 8 bytes (2 + 4 + 2) as follows.

A.5.5.2 Country code [Cpays]

In accordance with EN ISO 3166-1: Format: 3 digits, coded binary 2 bytes.

A.5.5.3 Significant part of the TC's Metrological approval number

The approval number (example: "F-04-C-0061") shall comprise 4 fields as follows:

— country code: not significant in relation with A.5.5.1;

— year: 2 digits: significant;

— equipment category: not significant;

— rank: 3 to 4 digits (unique incremental number): significant.

The 2 fields noted above as being significant shall be used to provide the TC's manufacturer's identifier [IdConstructeur] = Field 2 (year), Field 4 (Rank) = 2 + 4 = 6 [000000 digits….999999] coded binary 32 bits (4 bytes).

A.5.5.4 TC's Manufacturer's number

This number which comprises 4 digits and coded binary 2 bytes shall contain the TC's unique serial number as allocated by the manufacturer.

Manufacturer's Number: [NumConstructeur].

A.5.6 Terminal type: [TTerm]

Four types of terminals are identified and coded in Ascii, as follows:

Table A.6 — Terminal type

Type of terminal:	Coding
Tank terminal (TC)	'C'
Loading rack terminal (TD)	'D'
Returns terminal (TR)	'R'
Station terminal (TS)	'S'

A.5.7 Measurement Set

A.5.7.1 General

Each Measurement Set (EM) shall be uniquely identified by:

A.5.7.2 [EM_Quai] Loading Rack Measurement Set

a) EN ISO 3166-1 Country Code (001.. 999). (3 numeric characters);

b) CPDP Department Zone, (CPDP code pages B/1 to B/29), (3 numeric characters);

c) CPDP coding (pages B/1 to B/29), or equivalent, for:

   — category identifier (1 numeric character);

— company identifier (3 numeric character);

— loading depot identifier (1 numeric character);

d) loading rack identifier (01.. 99).

NOTE The CPDP is the French Committee for Petroleum Professionals who allocate identification numbers to each loading rack and gantry in France. Alternative coding bodies can be used in other countries to provide the unique identification numbers for this equipment.

A.5.7.3 [EM_Bras] – Loading arm identifier for a known loading rack (01.. 99)

A record of arm and rack numbers shall be held at each depot and shall be available for inspection upon request.

A.5.8 Correlation of relative times

A.5.8.1 Unit of time

each time unit = 0,2 s with a resolution of 1 unit.

A.5.8.2 Scale

allocation = 2 bytes (0 to 65535) which is equivalent to [0 to 13107] ss, (0 to 03h 38min 27s).

A.5.8.3 Load/transfers which take longer than 3 h

a) Loading authorisation shall be withdrawn;

b) the connection/disconnection events shall be not transferred to the card.

A.5.8.4 “Rounding” method

Truncated after adding 0,5 unit.

A.5.8.5 Reference start time: [DateHeure]

The event which sets the reference start time (t = 0) shall be the first connection following the introduction of the DTMQ badge in the TD. This reference time shall be recorded in the field [DateHeure] of the block [ChargCommun].

A.5.8.6 Reference end time: [TCloture]

The reference end time shall be the time of the completion of loading, (D6 in A.3).

This time shall be recorded in field [TCloture] of the block [ChargCommun].

If no start time is recorded, then this end time will remain as 0.

A.5.8.7 Time limit between the withdrawal of the badge from the TD (TR) and its reinsertion in the TC

To reduce the possibility of fraud, the time between the removal of the badge from the TD (TR) and its reinsertion into the TC shall be limited to 15 min.

This limitation covers the time period between D6 and D8 (see A.3).

If the time period exceeds that permitted, then the badge becomes void and a duplicate shall be required.

A.5.8.8 Terminal time measurement tolerance

The tolerance covering the variations of reaction times as recorded by the terminals for:

— opening/closing of valves;

— data recorded on the badge;

shall not exceed that specified in A.6.4.

A.5.8.9 Loading rack coupler/adaptor operation (filtering of recordings)

The transfer and allocation of the loading data to the correct compartment requires that each connection/disconnection of a loading arm with a compartment adaptor shall be recorded.

To prevent fraud and to ensure a secure load, each separate opening/closing of a loading coupler or the compartment adaptor shall also be recorded.

However, to avoid the transfer of meaningless data, particularly that caused by misalignment in the coupling procedure, filtering shall be applied to repeat openings/closings within a strict time window.

— TD or TR:

  repeat connections, without measurement, within a 2 s window are to be considered as one connection;

— TC:

  repeat connections within a 3 s window are to be considered as one connection.

The difference in these times allows for the tolerance band as noted in A.5.8.8 above.

A.5.8.10 Bloc-1: Random Numbers

To guarantee that the source of the loading data are an EM and not some other device, a different random number shall be generated by the TC for each transaction. This number shall be noted in both the TC's and the TD's metrological journals and thus provide an identification link between the two, which can be accessed in the event of a dispute.

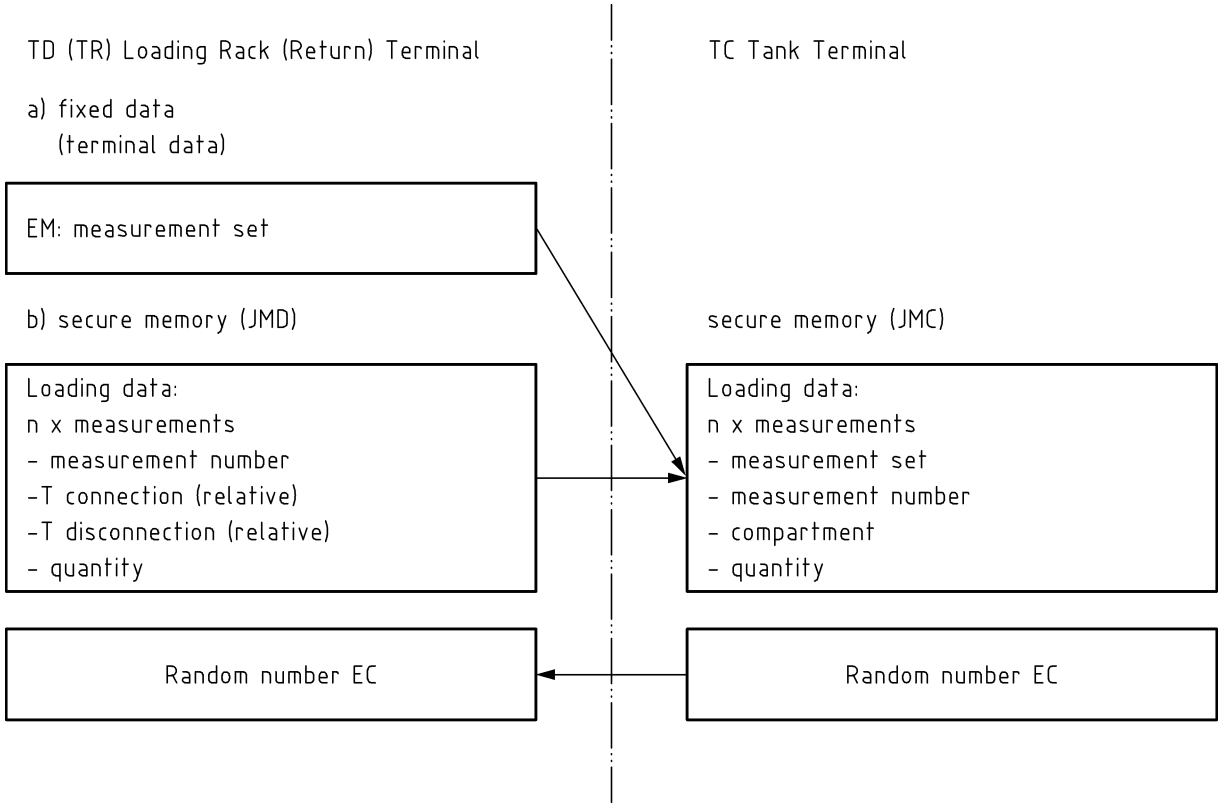


Figure A.3

A.5.8.11 Bloc-2: Format of the [Mesurage] and [SansMesurage] data

A.5.8.11.1 General

The data transferred from the TD (TR) to the TC shall comprise 3 parts:

a) common data [ChargCommun]: Common information relating to the loading session which is independent of the number of loads;

b) measurement data [Mesurage]: Information specific to each measured load;

c) loads without measurement [SansMesurage]: Information specific to product transfer in which no measured data are available or transferred. Possible causes are failed equipment or a fraudulent operation.

The message format shall be:

— the first part [ChargCommun] has a fixed length;

— a message can contain both [Mesurage] and [SansMesurage] fields;

— the fields [Mesurage] and [SansMesurage] have variable length and may be mixed, but always follow on from the [ChargCommun].

The msb of [EmBras] shall be used to distinguish between a [Mesurage] and a [SansMesurage] field.

msb = 0 (positive value) = [Mesurage].

msb = 1 (negative value) = [SansMesurage].

A.5.8.11.2 Capacity of [ChargCommun] records

If the sum of the [Mesurage] and [SansMesurage] files exceed the available capacity of (MaxBloc2), then the TD (TR) shall issue an alarm, withdraw the loading authorisation and shall instruct the driver to disconnect the last connected loading arm.

It should then be possible for the previous loads to be correlated as normal.

Any data received after the issue of the alarm shall not be transferred to the TC.

Bloc 2 shall contain complimentary message blocks within the [ChargCommun] being:

Number of elements recorded by the TD (TR):

— [CptMesurage]: number of measurements recorded by the TD (TR);

— [CptSansMesurage]: number of non-measurements recorded by the TD (TR).

Written record counts on the badge:

— [EnrMesurage]: record count of type [Mesurage] written on the badge;

— [EnrSansMesurage]: record count of type [SansMesurage] written on the badge.

To enable different software versions to read the [Mesurage] and [SansMesurage] information:

— [LenEnrMesurage]: number of bytes by registration of type [Mesurage];

— [LenEnrSansMes]: number of bytes by registration of type [SansMesurage].

The TD (TR) writes the value corresponding in its own last DTMQ software version.

The complete message length shall be calculated from the sum of:

— number of bytes of [ChargCommun] +;

— (number of bytes of [Mesurage] * number of (measured loads)) +;

— (number of bytes of [SansMesurage] * number of (non-measured loads));

— the total length shall not exceed (MaxBloc2).

For Version 3.1 of the exchange format, the following criteria apply:

— number of bytes of [ChargCommun] = 23;

— number of bytes of [Mesurage] = 25;

— number of bytes of [SansMesurage] = 5;

— (MaxBloc2) = 500.

A.5.8.11.3 TR (Return Terminal)

Transfer operations use only one source compartment for any transfer. Therefore the loading report shall contain:

— only one measurement record [Mesurage] shall be present for the source compartment connection, (arm = 0);

— one or more measurement records [Mesurage] shall be present for the destination compartment connections, (arm > 0).

See A.4 for correlation procedures.

A.5.9 Bloc-15: Badge Personalization file

A.5.9.1 General

This file shall be written during the personalization of the badge and shall contain information concerning the maximum lengths of the different data blocks (including Header and CRC) for reach of the interoperable files (0201 to 020F hex).

This file shall be a read-only file.

A.5.9.2 Format

“Hi” then “Low” (2 bytes).

A.5.9.3 Example (Hex)

Table A.7 — Example of personalization file

Offset	Data
00 00	00 28
00 02	01 F4
…	…
00 1E	00 50

A.5.10 DTMQ badge acceptance criteria

Each time a DTMQ badge is introduced into a terminal, the following shall be checked:

a) the ability to read the contents of the “Badge identification” file;

b) to verify that the following elements are within the ‘Badge Identification’ file:

[IdF] = 020FH;

[PaternDTMQ] contains the following 4 ASCII characters: “DTMQ” (or in hexadecimal: 44H 54H 51H 4DH);

[Crc] conforms to the CRC-16 calculation;

The field [Ver] corresponds to the “badge personalization version”.

c) on the “data file block”:

1) [IdF] = read file Number, exists;

2) [Ver] compatible with the terminal DTMQ software version;

3) [Crc] conforms to the CRC-16 calculation;

d) in all cases, it shall be necessary to check that the maximum file lengths read in the table [FileLenTable] are compatible with the Terminal’s software version;

e) when the terminal that reads the Badge is a TC:

1) the badge shall be the current badge. (Unless a replacement badge is being processed);

2) that the fields [IdT] and [TTerm] are those of the associated TC.

A.6 Coupler/adaptor timing

A.6.1 General

To provide interoperability between equipment of different manufacturers, it is necessary to specify the critical criteria used to provide the time references that provide the basis for the correlation of the transferred data.

A.6.2 Reference point

The time reference common to both coupler and adaptor is the point (T0) when the poppet of the adaptor moves from its “closed” rest position.

A.6.3 Speed of operation (opening)

The data below is based upon a linear velocity of poppet movement (V1) of:

V1 = 0,05 m/s

A.6.4 Response times

The distance (D1) moved by the adaptor poppet to trigger a movement sensor shall not be greater than 5 mm.

The change of state of the coupler sensor (closed to open) shall occur between 0,5 s and 1,5 s before mechanical contact between the two valve poppets is made.

The permitted variation in connection and disconnection times shall be in range of: +0 s to +0,5 s.

The value used to establish the correlation between different connection/disconnection events shall be 4,8 s (see Welmec [3] 10.2 guidelines, 2.1).

For the purpose of this specification, dt = 5 s.

A.6.5 API adaptor closed position detection

The API adaptor position sensor shall be installed such that in the signalled closed position, the maximum leakage rate from the adaptor shall not exceed 10 lh^{-1}.

A.7 DTMQ Data exchange format between TD, TC and TS

A.7.1 Format

The data listing is arranged into four categories, being:

A.7.2 File definition

General summary of the interoperable files.

A.7.3 Type

Specification to ensure an agreed basis for the definition of the data.

See Tables A.8 to A.13 for type definition.

Tables A.8 to A.13 use the following abbreviations:

DT	Data type
RQ	Requested
CD	Coding
BY	Byte size
AS	ASCII size
NT	Note

Information associated with each data field:

a) an indice: Bloc and Field (for location);

b) data;

c) type: references previous format definitions;

d) remarks: clarification comments as required;

e) the multiplier factor (number of occurrences): Table A.16:

- by loads;
- by delivery;
- by additive (product composition);
- by loading arm;
- by coupler connection/disconnection (measurements);
- by tank compartment;
- by service station fill point;

f) mandatory data indicator (Y/N);

g) length (bytes);

h) when data are written;

i) when data are erased;

j) notes: see Table A.17.

See Tables A.14 to A.16 for data definition.

Tables A.14 to A.16 use the following abbreviations:

MF	Multipl. factor
RW	Requested Wr
BY	Byte length
WP	Write phase
CP	Clear phase
NT	Note

A.7.4 Codes

Codes define the possible different values for:

— data type;

— coding;

— obligatory requirement;

— terminal types;

— writing/erasing;

— multiplier.

Table A.8 — File definition

Bloc Elementary file: METROLOGICAL		**ID**	**DL**	**BL**	**ML**	**RD**	**WR**
1	Start loading	01	7	24	40	O	O
2	End loading	02	483	500	500	O	O
3	Start unloading (phase 1)	03	25	42	80	O	O
4	Start unloading (phase 2)	04	36	53	80	O	O
5	End unloading (phase 5)	05	447	464	500	O	O
6	(Reserved for future use)	06	0	0	0		
7	(Reserved for future use)	07	0	0	0		
8	(Reserved for future use)	08	0	0	0		
9	(Reserved for future use)	09	0	0	0		
10	(Reserved for future use)	0A	0	0	0		
11	(Reserved for future use)	0B	0	0	0		
12	(Reserved for future use)	0C	0	0	0		
13	(Reserved for future use)	0D	0	0	0		
14	Image of loading	0E	680	697	750	O	O
15	Customize of card	0F	36	53	80	O	N
	CUMUL		**1714**	**1833**	**1990**		

HIDF (Dedicated file)	02	**File Id (high part) hexa**
HIEF (Elementaty file)	02	**File Id (high part) hexa**
Dedicated file: METROLOGICAL	00	**File Id (low part) hexa**

File type (ISO/IEC 7816-4) =	TRANSPARENT	
Token length (ISO/IEC 7816-4) =	1 byte	

Abbreviation:

ID	File Id (lower part) hexa
DL	DATA length
BL	BLOC length
ML	Recommended minimum length
RD	Authorized reading
WR	Authorized writing

Table A.9 — Type-1

TYPE (1..15 char)	DATA	Comment	DT	RQ	CD	BY	AS	NT
[Vacuity]	Presence of vacuity sensor	1 = presence	B		U	1	1	
[Tank]	Tank code (in station)		T		A	10	10	
[Compartment)]	Compartment number		P		U	1	2	
[Country]	Country code	Upon EN ISO 3166-1 specification: numerical case	N	Y	U	2	3	
[ProductCode]	Product code	CPDP codification	N	Y	U	2	4	9
[CargoState]	State of cargo	(Empty, Guaranteed…)	N	Y	U	1	1	22
[Carrier]	Carrier code		T		A	14	14	
[Duplicate]	Boolean indicator	1 = Duplicate	B		U	1	1	
[LicencePlace]	Licence place (Truck, trailor)		T		A	16	16	
[IdTag]	Tag identification	Manufacturer code + Serial number	N		U	4	10	
[IncCard]	Incremental number of card identification	[0000..9999]	N		U	2	4	
[ProdName]	Product name		T		A	8	8	
[Weight]	Weight in kg		N		U	3	5	
[MaxArmCx]	Max number of arm connected simultaneously		N		U	1	2	
[Author]	Autorisation number	Id key of loading	T		A	8	8	
[Arm]	Arm number	[0..10]	N		U	1	2	
[Measurindex]	Measurement number (+1 each loading)	99999+1 = 00000	N		U	3	5	17
[PaternDTMQ]	Patern “DTMQ”	“D” = 44 “T” = 54H “Q” = 51H “M” = 4DH	T		A	4	4	
[RandomN]	Random number (EC ou ED1 ou ED2)	(00000.99999)	N	Y	U	3	5	19
[Temperature]	Temperature		N		U	3	5	4
[TripNumber]	Trip number		N		U	1	2	
[RelativeTime]	Relative time (connect/disconnect)	(Unit = 0,2 s)	N	Y	U	2	5	
[TerminalType]	Type of terminal	('D' = depot, 'C' = truck”, 'S' = Station, 'R' = Return)	T	Y	A	1	1	
[SoftwareVer]	Software version DTMQ (TD, TR, TC, TS) for compatibility	(256*Major) + (Minor version)	N	Y	U	2	6	2
[TtankCapacity]	Capacity of tank (station)	Volume in liter	N		U	3	6	
[Volume]	Product volume	Volume in liter	N		U	3	6	

Table A.10 — Type-2

TYPE (1..15 char)	DATA	Comment	DT	RQ	CD	BY	AS	NT
[Header]	Common information (located at head)							
	[IdF]	File identifier (APDU)	N	Y	U	2	4	
	Len	File length	N	Y	U	2	6	
	[Ver]	Software version DTMQ	N	Y	U	2	6	2
	[IdT]	Terminal id	N	Y	U	8	15	
	[Tterm]	Terminal type:TD or TR	T	Y	A	1	1	
						15	32	
[Crc]	Common information (located at tail of used data)							
	[Crc16]	File Crc-16	N	Y	U	2	4	
						2	4	
[FrameLen]	Number of bytes to add to DATA part to get up used file length	= [Header length] + [Crc length]				17		

Table A.11 — Type-3

TYPE (1..15 char)	DATA	Comment	DT	RQ	CD	BY	AS	NT
[FileDef]	File length definition (file 0201 to 020F)							
	[FileLen]	Max length	N	Y	U	2	4	
			N		U	2	4	
[IdF]	Smart card DTMQ identifier (TD ou TC ou TS ou TR)							
	[Country]	Country code (001..999)	N	Y	U	2	3	
	Approval number: Year = 2 char. + Type = 3char. +Index = 3 char.	Part 2 and 3 &4	N	Y	U	4	8	
	Manufacturer incremental number	(0000..9999)	N	Y	U	2	4	
			N		U	8	15	
[DateTime]	Date and time format							
	Year (Low part)	(00.99)	N	N	U	1	2	
	Month	(01..12)	N	N	U	1	2	
	Day	(01..31)	N	N	U	1	2	
	Hour	(00..23)	N	N	U	1	2	
	Minute	(00..59)	N	N	U	1	2	
	Second	(00..59)	N	N	U	1	2	
			N		U	6	12	
[CommonLoad]	Loading data: Common part							
	[RandomN]	Depot session: Random number EC	N	Y	U	3	5	
	[EM_Berth]	Berth measuring unit identifier	N	Y	U	6	12	
	[DateTime]	1st connection time	N	N	U	6	12	
	[RelativeTime]	End of loading time	N	Y	U	2		
	[MeasurementCount]	Number of measurement	N	Y	U	1	2	
	[NoMeasurementCount]	Number of no-measurement	N	Y	U	1	2	
	[MeasurementRecord]	Number of measurement record	N	Y	U	1	2	
	[NoMeasurementRecord]	Number of no-measurement record	N	Y	U	1	2	
	[MeasurementRecordLength]	Measurement record length	N	Y	U	1	2	
	[NoMeasurementRecordLength]	No-measurement record length	N	Y	U	1	2	
						23	36	

Table A.12 — Type-4

TYPE (1..15 char)	DATA	Comment	DT	RQ	CD	BY	AS	NT
[Measurement]	Loading data: Measurement case							
	[EM_Arm]	Measuring unit identifier (msb = 0)	N	Y	U	1	2	
	[RelativeTime]	Arm connection time	N	Y	U	2		
	[RelativeTime]	Arm disconnection time	N	Y	U	2		
	[MeasurementIndex]	Measurement number (+1each loading)	N	Y	U	3	5	
	[ProductCode]	Product code	N	Y	U	2	4	
	[ProdName]	Product name	N	Y	U	8	8	
	[Volume]	Loaded Gross volume (liter)	N	Y	U	3	6	
	[Compatibility code]	Product code compatibility	N	Y	U	4		
						25		
[NoMeasurement]	Loading data: No-measurement case							
	[EM_Arm]	Measuring unit identifier (msb = 1)	N	Y	U	1	2	
	[RelativeTime]	Arm connection time	N	Y	U	2		
	[RelativeTime]	Arm disconnection time	N	Y	U	2		
						5		
[EM_Berth]	Measuring unit id: Common part per berth							
	Measuring unit id: Country code	Upon EN ISO 3166-1 specifications:numerical case	N	Y	U	2	3	
	Measuring unit id: Area code		N	Y	U	1	2	
	Measuring unit id: Depot code		N	Y	U	2	5	
	Measuring unit id: Island code	(01..99)	N	Y	U	1	2	
						6	12	
[EM_Arm]	Measuring unit id: Detail per measurement							
	Measuring unit id: Arm code	For a given loading island (01..99)	N	Y	U	1	2	
						1		
[PosGps]	Global Position System (GPS) station: Latitude (angle)	“SDDMM.mmm”	T	N	A	5	5	5
	Global Position System (GPS) station: Longitude (angle)	“SDDDMM.mmm”	T	N	A	4	4	6
						9		

Table A.13 — Type-5

TYPE (1..15 char)	DATA	Comment	DT	RQ	CD	BY	AS	NT
[CommonCarg]	Non metrological loading data: Common part							
	[DateTime]	End of loading time	N	N	U	6	12	
	[MeasurementCount]	Number of measurement	N	Y	U	1	2	
	[MeasurementRecordLength]	Measurement record length	N	Y	U	1	2	
						8	16	
[CargItem]	Non metrological loading data: Measurement item							
	[Compartment]	Compartment number	N	Y	U	1	2	
	[EM_Berth]	Measuring unit identifier	N	Y	U	6	12	
	[EM_Bras]	Identifiant Ensemble Measurage Bras (Bit 7 = 0)	N	Y	U	1	2	
	[MeasurIndex]	Measurement numbe (+ 1 each loading)	N	Y	U	3	5	
	[ProductCode]	Product code	N	Y	U	2	4	
	[ProdName]	Product name	N	Y	U	8	8	
	[Volume]	Loaded Gross volume (liter)	N	Y	U	3	6	
	[Compatibility code]	Product code compatibility	N	Y	U	4	21	
						28		

Table A.14 — Data-1

Bloc	Field	DATA	Type	Comment	MF	RW	BY	WP	CP	NT
	A	**METROLOGICAL**								
1		**Start loading: Block-1**	**0201**	**Truck to depot**						
1.	1	Duplicate flag	[Duplicate]		D	Y	1	D1		
1.	2	PrevRamdomEc	[RandomN]	Previous random EC	D	Y	3	D1		
1.	3	RandomEC	[RandomN]	Current random EC	D	Y	3	D1		19
				Data length =			**7**			
2		**End loading: Block-2**	**0202**	**Depot to truck**						
2.	1	CommonLoad	[CommonLoad]	Loading data: Common part	D	Y	23	D2		
2.	2	Measurement [1)]	[Measurement]	Measurement record	A	Y	25	D2		
2.	3	NoMeasurement [1)]	[NoMeasurement]	No-Measurement record	F	Y	5	D2		
			MaxBloc2	Data length smaller or equal to			**483**			
		[1)] Measurement and NoMeasurement record are added on chronological way, sorted upon relative deconnection time)								
3		**Start unloading: Block-3**	**0203**	**Truck to station**						
3.	1	RandomED1	[RandomN]	Random ED1 (Station) initial	S	Y	3	S1		19
	2	LicencePlate	[LicencePlace]	Licence plate (Truck, trailor)	S	Y	16	S1		
	3	DateTimeInit	[DateTime]	DateTime Initialisation unloading (T1)	S	Y	6	S1		
				Data length =			25			

Table A.15 — Data-2

Bloc	Field	DATA	Type	Comment	MF	RW	BY	WP	CP	NT
4		**Start unloading: Block-4**	**0204**	**Station to truck**						
4.	1	Random ED1	[RandomN]	Random ED1 (Station) initial (copy Bloc-3)	S	Y	3	S3		19
4.	2	Random ED2	[RandomN]	Random ED2: Station session	S	Y	3	S3		19
4.	3	Station name		Free text	S	N	20	S3		
4.	4	Max time 1–4 (second)		Ta-R value	S	N	2	S3		
4.	5	Max time 4(5(< = 3 compartment)		Max value in second	S	N	2	S3		
4.	6	Max time 4(5(< = 3 compartment)		Max value in second	S	N	2	S3		
4.	7	Max time 4(5(< = 3 compartment)		Max value in second	S	N	2	S3		
4.	8	Max time 4(5(< = 3 compartment)		Max value in second	S	N	2	S3		
				Data length =			**36**			
5		End unloading: Block-5	0205	Truck to station						
5.	1	RandomED1	[RandomN]	Random ED1 (Station) initial (copy Bloc-3)	S	Y	3	S5		19
5.	2	RandomED2	[RandomN]	Random ED2: Station session	S	Y	3	S5		19
5.	3	DateTimeEnd	[DateTime]		S	Y	6	S5		
5.	4	Measurement of 4–5 time		In second	S	Y	2	S5		
5.	5	Number of record	0 to	16	S	Y	1	S5		3
5.	6	N x Record		(see detail hereafter)	P	Y	432	S5		
				Data length =			**447**			
5		**Unloading record**	**The record are time sorted on 5c criteria**							
5.	5a	Compart number				Y	1	S5		
5.	5b	Unloading status (alarm)	[UnloadingStatus]	= 0 if Ok		Y	1	S5		
5.	5c	DateTimeRescealing	[DateTime]			Y	6	S5		
5.	5d	Cargo state at	[CargoState]			Y	1	S5		22

		unloading time								
5.	5e	Empty state at end of unloading	[Empty]	0 = not empty 1 = Empty		Y	1	S5		
5.	5f	ProductCode	[ProductCode]			Y	2	S5		9
5.	5g	Product name	[ProdName]			Y	8			
5.	5h	Volume	[Volume]	Loaded Gross volume (liter)		Y	3	S5		
5.	5i	No mix product code	[NoMixCode]	According to EN 14116		N	4			
				Data length =			**27**			
14		**No metrological loading data: B 020E**								
14.	1	CommonCarg	[CommonCarg]	Common part		O	8			
14.	2	CargItem	[CargItem]	Loading item		O	672			
				Data length =			**680**			
15		**Card customization data: Block F020F**								
15.	1	IncCard	[IncCard]	Incremental number of card identification		O	2			
15.	2	PaternDTMQ	[PaternDTMQ]	Patern “DTMQ” 44H 54H 51H 4DH		O	4			
15.	3	FileLenTable	[FileDef]	Max size per file (customization)	T	O	30			
				Data Length =			**36**			
(NB: Phase value are coming from Welmec [3] document)										

Table A.16 — Code 1

Key	Value	Meaning	Max	Number
Data type				
	T	Text		
	N	Numerical		
	B	Boolean (0 = No 1 = Yes		
Coding				
	A	Ascii [A.Z]+ [a..z] + [0..9]+ [,]+[.]+[ ]		
	U	Unsigned Binairy		
	S	Signed Binairy		
Requested information				
	Y	Yes		
	N	No		
Terminal type				
	TD	Depot Terminal		
	TR	Return Terminal		
	TC	Truck Terminal		
	TS	Station Terminal		
Write/Clear				
		Procedure		
	P	Card customization		
	V	Initial agreement (Write only)		
	I	Initial install on truck (Write only)		
Multiplying factor				
	T	Per card file DTMQ (Table):01..0F hexa	MaxFile	15
	D	Per depot session (loading	MaxDep	1
	S	Per station session (unloading)	MaxStat	1
	E	Per additive (Compound Product)	MaxAddit	3
	B	Per loading arm	MaxBras	8
	A	Per measuring (connexion)	MaxCpl	20
	F	Per connexion without measuring	MaxCplVide	20
	P	Per truck compartment	MaxCompart	11
	I	Per cargo record	MaxItemCarg	24
	C	Per tank in station	MaxBouches	16

Table A.17 — Note-1

NOTE	Fonction	Comment
1	Id TD, TR, TC, TS	('D' = depot, 'C = truCk', 'S' = station, 'R' = Return
2	Soft version DTMQ	(256*Major version) + (Minor version)
9	Codification produit base	In france: CPDP (4 digits)
17	Measuring number	Arbitrary number, incremented by 1 before each operation of measuring: Modulo 100000: 99999 + 1 = 00000
18	Relative time	Time (in 0,2 s unit) from the first connexion for a given measuring
19	Random number	Random number in range 00000 to 99999
22	Cargo state	0 = Empty 1 = guaranteed 2 = Minimum guaranteed 3 = not empty/Not guaranteed/unknowed 4 = Frustrated delivery

A.8 Minimum contents of the Metrological Journals

A.8.1 Classification of contents

The contents of each type of metrological journals is split into three classes:

Class	Contents
1	Metrological data (example « VolProd »)
2	Non-metrological data which presence in the journal is recommended to facilitate traceability. (example «LibProd »)
3	Non-metrological data requested by this annex.

A.8.2 Metrological Journal – depot (JMD) and returns (JMR)

A.8.2.1 Measurement (Mesurage)

#	Identifier	Function	Class
1	Date-Time	Date/time stamp of event (audit)	3
2	RandomN	Random number of each session (generated by TC)	1
3	DmdeDuplicata	Demand duplicate flag	1
4	PrevRandomN	Preceding random number (generated by TC)	3
5	EM_Quai	Loading rack identification	1
6	EM_Bras	Loading arm identification	1
7	TConnexion	Time of loading arm connection (relative)	3
8	TDeconnexion	Time of loading arm disconnection (relative)	3
9	NumMes	Measurement number	1
10	Cprod	Simplified product coding (CPDP)	3
11	CodeCompatib	Product compatibility code [a]	3
12	LibProd	Product type label	2
13	VolProd	Volume of product transferred (litres)	1

[a] This data are provided to assist in the clarification of product codes in the event of a dispute.

A.8.2.2 Non-measurement (SansMesurage): Non-metrological

#	Identifier	Function	Class
1	Date-Time	Date/time stamp of event	3
2	RandomN	Random number of each session (generated by TC)	3
3	EM_Quai	Loading rack identification	3
4	EM_Bras	Loading arm identification	3
5	TConnexion	Time of loading arm connection (relative)	3
6	TDeconnexion	Time of loading arm disconnection (relative)	3

A.8.2.3 Insertion/withdrawal of a DTMQ badge, independent of other events: Non-metrological

#	Identifier	Function	Class
1	Date-Time	Date/time stamp of event	3
2	IdT	Terminal identification (message 020F)	3
3	IncBdg	Badge incremental identification number	3

A.8.2.4 Defects

All defects on the TD to be recorded in accordance with R117 and Welmec [3] 10.2.

A.8.3 Metrological Journal – tank (JMC)

A.8.3.1 Measurement (Mesurage) (guaranteed cargo)

#	Identifier	Function	Class
1	Date-Time	Date/time stamp of event	1
2	Compartiment	Compartment number	1
3*	RandomN	Random number of the session (generated by TC)	1
4*	EM_Quai	Loading rack identification	1
5*	EM_Bras	Loading arm identification	1
6*	TConnexion	Time of loading arm connection (relative)	3
7*	TDeconnexion	Time of loading arm disconnection (relative)	3
8*	NumMes	Measurement number (incremental, provided by TD)	1
9*	Cprod	Simplified product coding (CPDP)	3
10*	CodeCompatib	Product compatibility code [a]	3
11*	LibProd	Product type label	2
12*	VolProd	Volume of product transferred (litres)	1
13	TconnexionCamion	Time of API adaptor opening (relative)	3
14	TdeconnexionCamion	Time of API adaptor closing (relative)	3
15	DateHeureRescellement	Date/time stamp of last re-seal (API closure prior to transporting returns)	1
16	DemandeDuplicata	Duplicate request flag status	3
17	PrevRandomN	Previous random number (provided by TC)	1

[a] This data are provided to assist in the clarification of product codes in the event of a dispute.

* Data sourced from the TD (TR).

A.8.3.2 Non-measurement (SansMesurage) (received by the DTMQ badge): Non-metrological

#	Identifier	Function	Class
1	Date-Time	Date/time stamp of event	3
2	RandomN	Random number (generated by TC)	3
3	EM_Quai	Loading rack identification	3
4	EM_Bras	Loading arm identification	3
5	TConnexion	Time of loading arm connection (relative)	3
6	TDeconnexion	Time of loading arm disconnection (relative)	3

A.8.3.3 Connection/disconnection of Adaptors, without correlation: Non-metrological

#	Identifier	Function	Class
1	Date-Time	Date/time stamp of event	3
2	RandomN	Random number of each session (generated by TC)	3
3	EM_Quai	Loading rack identification	3
4	TconnexionCamion	Time of API adaptor opening (relative)	3
5	TdeconnexionCamion	Time of API adaptor closing (relative)	3
6	Compartiment	Compartment number	3

A.8.3.4 Breaks of Seal – guaranteed cargo (Alarm conditions): Metrological

#	Identifier	Function	Class
1	Date-Time	Date/time stamp of event	3
2	RandomN	Random number of the load (generated by TC)	1
3	Compartiment	Compartment number	1

A.8.3.5 Breaks of Seal – non-guaranteed cargo: Non-metrological

#	Identifier	Function	Class
1	Date-Time	Date/time stamp of event	3
2	Compartment	Compartment number	3

A.8.3.6 Compartment going empty (type C and above tanks)

#	Identifier	Function	Class
1	Date-Time	Date/time stamp of event	3
2	RandomN	Random number of the load (generated by TC)	1
3	Compartiment	Compartment number	1

A.8.3.7 Date/Time setting of the TC: Non-metrological

#	Identifier	Function	Class
1	Date-Time-Ref	Date/time before change	3
2	Date- Time-New	Date/time after change	3

A.8.3.8 Unattended deliveries with location recognition by GPS (for each compartment)

#	Identifier	Function	Class
1	Date-Time Start	Date/time stamp of event	1
2	location type	continuous/discrete	1
3	GPS_Position_1	2 cases: a) continuous: minimum of zone; b) discrete: position before discharge.	1
4	GPS_Position_2	2 cases: a) continuous: maximum of zone; b) discrete: position after discharge.	1
5	Compartment	Compartment number	1
6	StateBefore	State of cargo before discharge	1
7	LibProd	Product type label	2
8	IdTag	Identification tag number	3
9	CompatibilityCode	Compatibility Code	3
10	VolProd	Volume of product transferred (litres)	1
11	Emptiness	Emptiness state after discharge	1
12	Date-Time Stop	Date/time stamp of event	1

A.8.3.9 Unattended deliveries with location recognition by TS (for each compartment)

#	Identifier	Function	Class
1	Date-Time Start	Date/time stamp of event	1
2	Compartment	Compartment number	1
3	StateBefore	State of cargo before discharge	1
4	IdTs	Station Terminal Identification	1
5	Random-ED1	Random number discharge: TC	1
6	Random-ED2	Random number discharge: TS	1
7	CProd	Product code	3
8	LibProd	Product type label	2
9	IdTag	Identification tag number	3
10	CompatibilityCode	Compatibility Code	3
11	VolProd	Volume of product transferred (litres)	1
12	Emptiness	Emptiness state after discharge	1
13	Date-Time Stop	Date/time stamp of event	1

A.8.3.10 Defects

All defects on the TC to be recorded in accordance with R117 and Welmec [3]10.2.

A.8.4 Metrological Journal – station (JMS)

A.8.4.1 Unattended deliveries (for each compartment)

#	Identifier	Function	Class
1	Date-Time Start	Date/time stamp of event	1
2	Compartment	Compartment number	1
3	StateBefore	State of cargo before discharge	1
4	IdTc	Truck Terminal Identification	1
5	Random-ED1	Random number discharge: TC	1
6	Random-ED2	Random number discharge: TS	1
7	CProd	Product code	3
8	LibProd	Product type label	2
9	CompatibilityCode	Compatibility Code	3
10	VolProd	Volume of product transferred (litres)	1
11	Emptiness	Emptiness state after discharge	1
12	Date-Time Stop	Date/time stamp of event	1

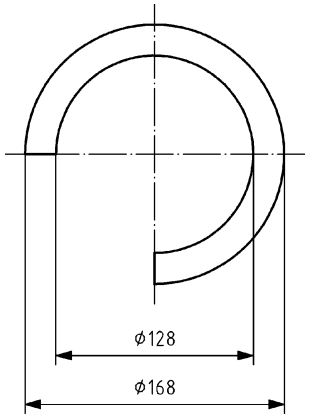
A.9 DTMQ tank identifier

The DTMQ tank identifier is a steel vane mounted on the tank's vapour adaptor.

A device is fitted to the vapour loading arm coupler such that it is able to sense the presence of the vane when the coupler is connected to the adaptor. This device provides an input signal to the TD or TR when it senses the presence of the vane.

The sensor and its installation shall meet the requirements for installation and operation in a hazardous area.

Dimensions in millimetres



Material: steel plate, minimum thickness 2 mm.
Dimensionnel tolerance: + 1,0/ −0,0 mm

Figure A.4 — DTMQ identification flag

Dimensions in millimetres

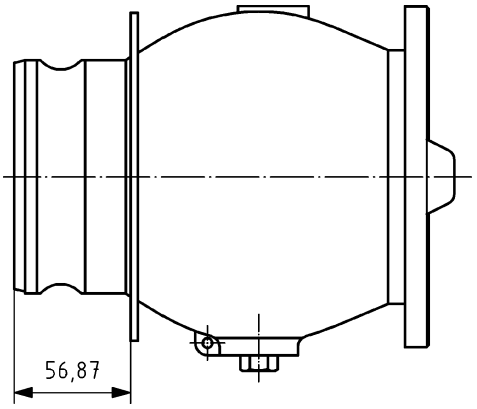
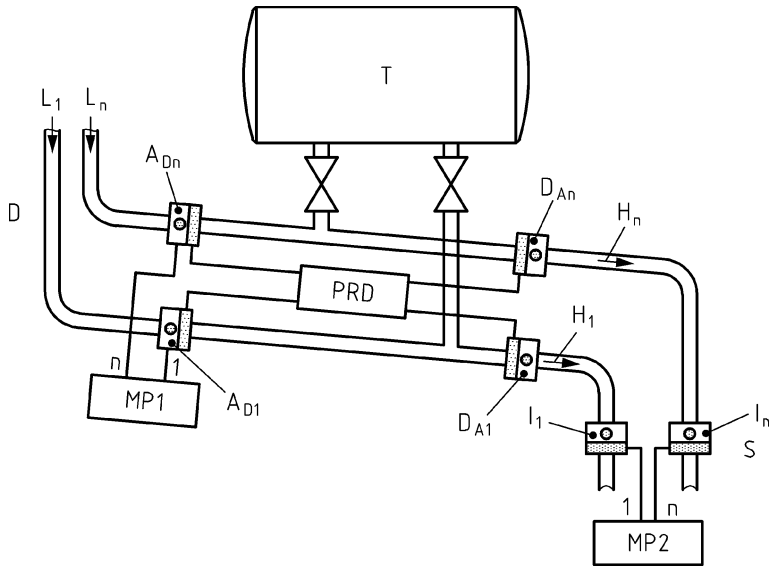


Figure A.5 — Position of the flag on the vapour recovery adaptor

Annex B
(normative)
PID protocol

B.1 System architecture

The system architecture shall be according to Figure B.1



Key

D	depot (Terminal)	H_X	delivery hose
S	station	I_X	inlet at station
T	transport tank	A_{DX}	loading adaptor
L_x	loading arm	D_{AX}	discharge adaptor
MP1	multi-PID on depot		
MP2	multi-PID on station		

Figure B.1 — System architecture

Communication will be performed by current loops, produced by PRD and replied by the corresponding MultiPID via delivery hoses or loading arms. For this purpose all couplings shall be isolated and wired. For details see EN 14116.

B.2 Sequences of operation

B.2.1 General

The messages mentioned below shall be according to EN 14116.

B.2.2 Standard operation

The sequence shall be as follows:

Loading
- tank vehicle system shall check status of each parcel before loading;
- after connection of the loading arm PRD shall receive message #1 “Product description and overfill status” and message #2 “Location and product details” periodically;
- PRD shall send message #6 “Loading information” with “loading allowed”, if connected loading arm is of intended grade;
- PRD shall receive messages #1, #2 and #5 “Rack meter information” and message #32 “CRC 16” for loading status continuously until transfer has finished;
- PRD shall send message #6 with “loading not allowed” after having checked CRC 16 of message #32. Tank vehicle received loaded volume and grade;

Transport
- tank vehicle system shall monitor status of ports, keeping track of seal status of parcel;

Discharge
- tank vehicle system shall check status of each parcel before discharge;
- after connection of the discharge hose PRD shall receive message #1 “Product description and overfill status” and message #2 “Location and product details” periodically;
- PRD shall send message #7 “Delivery information” with grade and volume to be discharged;
- PRD shall receive messages #1 and #8 “Station information” periodically with ullage and permission of discharge;
- during discharge tank vehicle system shall control status of discharge hose and ports;
- confirmation of emptiness of parcel. If emptiness cannot be achieved proceed according to B.2.3;
- PRD shall send messages #7 and #32 “CRC 32” with discharge result periodically.

B.2.3 Frustrated delivery

The procedure of B.2.2 shall be fulfilled until stop of discharge without achieving emptiness.

Discharge
- PRD shall send message #7 “Delivery information” with status “resealed at station (frustrated delivery)” periodically.

Transport
- tank vehicle system shall control status of ports, keeping track of seal status of parcel.

Return
- tank vehicle system shall control status of each parcel before discharge;
- after connection of the discharge hose PRD shall receive messages #1 “Product description and overfill status” and #8 “Station information” periodically identifying point of discharge as return station;
- PRD shall receive messages #1, #2, #5 “Rack meter information”, #8 and message #32 “CRC 16” for discharge permitted status continuously until transfer has finished;
- confirmation of emptiness of parcel together with correct CRC 16 check successfully finishes the return process;

If product is returned into another compartment the regular loading procedure shall apply simultaneously.

B.2.4 Unattended delivery

The procedure of B.2.2 shall be fulfilled until automatic recognition of emptiness.

Location of station and tanks are positively identified, refer to messages #1 “Product description and overfill status” and #2 “Location and product details”.

Accidental or fraudulent withdrawal of liquid is detected by continuous monitoring of hose and ports.

The retrieval of measuring data are done by message #7 “Delivery information” and the transaction is completed as soon as the compartment and pipework are empty (or resealed in case of frustrated delivery).

B.2.5 Unattended frustrated delivery

The procedure of B.2.3 and B.2.4 shall be fulfilled.

Hose monitoring ensures the automatic recognition of the end of delivery at the station and point of return.

Annex C
(normative)
Correspondence system

C.1 General

This annex describes the additional requirements necessary to provide a method by which correspondence can be used to provide the necessary data transfer for a SPDS system.

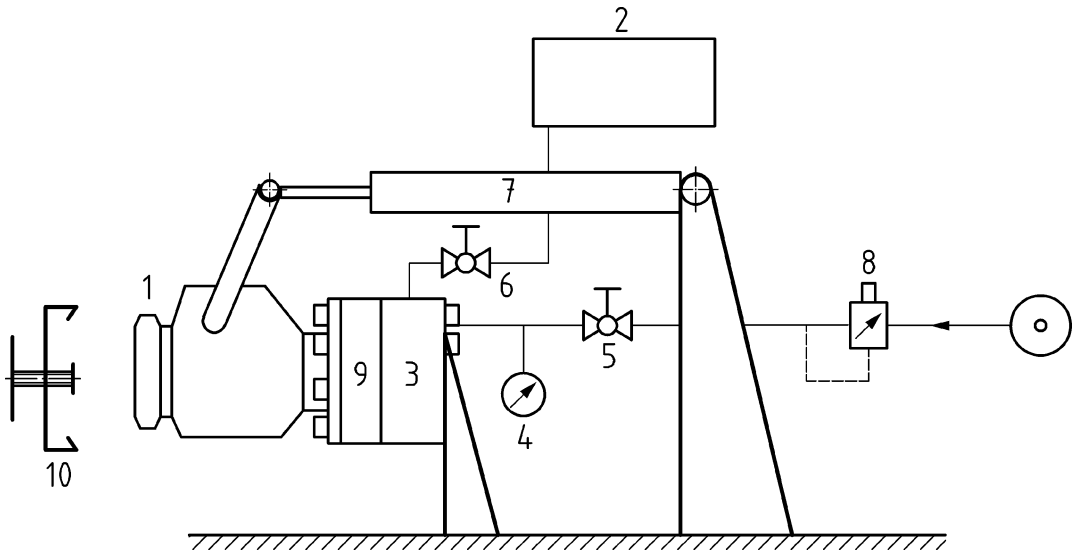
Such a system shall comply with the requirements of 4.1 and 4.2 only.

Such systems shall not be used for unattended deliveries.

C.2 Data transfer method

Data transfer at the loading rack or transfer station shall be by means of time/date stamped loading tickets, which shall include loading arm, product details and ticket number.

Annex D
(informative)
Mechanical endurance test apparatus



Key

1 port under test
2 test fluid reservoir
3 pressurised vessel
4 pressure gauge
5 valve
6 reservoir isolating valve
7 pneumatic cylinder to open/close port
8 pneumatic pressure regulator
9 sight glass
10 device for cracking open port

Figure D.1 — Mechanical endurance test apparatus

Bibliography

[1] ADR — *European Agreement concerning the International Carriage of Dangerous Goods by Road*

[2] OIML R 117, *Measuring systems for liquids other than water*

[3] Welmec 10.2, *Guide to Metrological Devices for Transferring Measured Quantities (DTMQ) associated to bottom loading measuring systems*

[4] EN 60079-11, *Explosive atmospheres — Part 11: Equipment protection by intrinsic safety "i" (IEC 60079-11)*

[5] EN 15207, *Tanks for transport of dangerous goods - Plug/socket connection and supply characteristics for service equipment in hazardous areas with 24 V nominal supply voltage*

[6] EN 15969-1, *Tanks for transport of dangerous goods - Digital interface for the data transfer between tank vehicle and with stationary facilities - Part 1: Protocol specification - Control, measurement and event data*

[7] EN 15969-2, *Tanks for transport of dangerous goods - Digital interface for the data transfer between tank vehicle and with stationary facilities - Part 2: Commercial and logistic data*

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