BS EN 12972:2015

BSI Standards Publication

Tanks for transport of dangerous goods — Testing, inspection and marking of metallic tanks

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National foreword

This British Standard is the UK implementation of EN 12972:2015. It supersedes BS EN 12972:2007 which is withdrawn.

The user's attention is drawn to the fact that the UK committee voted against this document at the Formal Vote stage.
EN 12972 was developed to support the UN ECE ADR 2015 (European Agreement Concerning the International Carriage of Dangerous Goods by Road). However, the user should note that until EN 12972:2015 is referenced in ADR and RID, it may not be used where the application of a standard is required by the relevant legislation; in such circumstances EN12972:2007 should continue to be used.

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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Compliance with a British Standard cannot confer immunity from legal obligations.

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Tanks for transport of dangerous goods - Testing, inspection and marking of metallic tanks

Citernes destinées au transport des matières dangereuses - Épreuve, contrôle et marquage des citernes métalliques

Tanks für die Beförderung gefährlicher Güter - Prüfung, Inspektion und Kennzeichnung von Metalltanks

This European Standard was approved by CEN on 5 December 2014.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 12972:2015) 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of an identical text or by endorsement, at the latest by August 2015 and conflicting national standards shall be withdrawn at the latest by August 2015.

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 12972:2007.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

Compared with EN 12972:2007 the following fundamental changes have been made:

a) alignment of the standard with RID 2013 [1] and ADR 2013 [2]; and

b) updating of the normative references.

The document has been submitted for reference into the RID and/or in the technical annexes of the ADR.

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

The types and frequencies of the inspections and tests as well as the responsibilities are given by the relevant regulations concerning the transport of dangerous goods.

1 Scope

This European Standard specifies testing, inspection and marking for the type approval, initial inspection, periodic inspection, intermediate inspection and exceptional check of metallic tanks (shell and equipment) of fixed tanks (tank vehicles), demountable tanks, rail tank wagons, portable tanks and tank containers for the transport of dangerous goods.

This European Standard is not applicable to battery-vehicles and battery-wagons comprising cylinders, tubes, pressure drums, bundles of cylinders and multiple element gas containers (MEGCs), independent of whether the elements are receptacles or tanks.

It is essential that the requirements of the applicable regulations for the transport of dangerous goods prevail in all cases over those of this standard.

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 590, *Automotive fuels - Diesel - Requirements and test methods*

EN 837-1, *Pressure gauges - Part 1: Bourdon tube pressure gauges - Dimensions, metrology, requirements and testing*

EN 837–2, *Pressure gauges - Part 2: Selection and installation recommendations for pressure gauges*

EN 837-3, *Pressure gauges - Part 3: Diaphragm and capsule pressure gauges - Dimensions, metrology, requirements and testing*

EN 12079-1, *Offshore containers and associated lifting sets - Part 1: Offshore container - Design, manufacture and marking*

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

EN ISO 3834-2, *Quality requirements for fusion welding of metallic materials - Part 2: Comprehensive quality requirements (ISO 3834-2)*

EN ISO 9606-1, *Qualification testing of welders - Fusion welding - Part 1: Steels (ISO 9606-1)*

EN ISO 9606-2, *Qualification test of welders - Fusion welding - Part 2: Aluminium and aluminium alloys (ISO 9606-2)*

EN ISO 9606-3, *Approval testing of welders - Fusion welding - Part 3: Copper and copper alloys (ISO 9606-3)*

EN ISO 9606-4, *Approval testing of welders - Fusion welding - Part 4: Nickel and nickel alloys (ISO 9606-4)*

EN ISO 14731, *Welding coordination - Tasks and responsibilities (ISO 14731)*

EN ISO 14732, *Welding personnel - Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials (ISO 14732)*

EN ISO 15607, *Specification and qualification of welding procedures for metallic materials - General rules (ISO 15607)*

EN ISO 15609-1, *Specification and qualification of welding procedures for metallic materials - Welding procedure specification - Part 1: Arc welding (ISO 15609-1)*

EN ISO 15614-1, *Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1)*

EN ISO 15614-2, *Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 2: Arc welding of aluminium and its alloys (ISO 15614-2)*

IMO MSC/Circ. 860, *Guidelines for the approval of offshore containers handled in open seas*

UN Manual of Tests and Criteria, Part IV

3 Terms and definitions

The definitions of terms used in this document are taken as those given by the relevant regulations concerning the transport of dangerous goods unless otherwise stated.

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

3.1
capacity of shell or shell compartment for tanks
the total inner volume of the shell or shell compartment expressed in litres or cubic metres. When it is not possible to completely fill the shell or the shell compartment because of its shape or construction, this reduced capacity shall be used for the determination of the degree of filling and for the marking of the tank

3.2
expert
individual or body approved by the competent authority to perform designated inspections and tests

Note 1 to entry: According to RID/ADR testing, inspection and certification duties are allocated to either the competent authority or to inspection bodies or experts approved by the competent authority. RID and ADR include detailed requirements on the qualification, obligations, accreditation and approval of these inspection bodies.

3.3
inspection body
body approved by the competent authority to perform designated inspection and tests

3.4
protective lining or coating
lining or coating protecting the metallic tank material against corrosion or reaction with the substances to be transported

Note 1 to entry: This does not apply to lining or coating used only to protect the substance to be carried.

3.5
repair
correction of a defect which may have impaired the safety of the tank or where equipment that communes directly with the shells content or safety device is replaced; it does not include normal service and maintenance operations of the shell or service equipment or replacement of gaskets or service equipment to the same specification.

3.6
technical code
code or standard(s) according to which the tank has been designed and constructed

Note 1 to entry: RID/ADR use this term in context with tanks which are NOT designed, constructed and tested according to referenced standards. For the purpose of this standard, EN 14025 [3] and EN 13094 [4] are considered to be technical codes.

4 Inspections and tests

4.1 General

In accordance with the relevant regulations concerning the transport of dangerous goods, shells and their equipment shall undergo inspections for issuing the type approval certificate and initial, intermediate and periodic inspections and exceptional checks, if needed, as indicated in the survey table in Annex A and as given in this standard.

4.2 Inspection for type approval

4.2.1 General

The inspection for type approval shall be carried out on a prototype tank of either a single tank or a range of tanks. A type approval which includes a limited variation of the design will allow the following variations to the design without requiring a new approval, if there are no other conflicting technical or legal requirements:

— a decrease in the initial design temperature range;

— a decrease in the maximum gross mass;

— a reduction in volume only resulting from variations in diameter (not applicable to non-cylindrical tanks) and length; the approval file includes a calculation for each proposed diameter, length and number of compartments of the tank under the most unfavourable conditions, i.e.:

  — greatest density of goods;

  — greatest tank length and diameter;

  — greatest tank front compartment;

  — greatest tank rear compartment;

— a variation in the grade of the material used; in the case of austenitic and austenitic-ferritic steels and aluminium alloys different grades may be allowed with the following reserves:

  — use of the same qualified welding procedure;

  — calculation is carried out in the most unfavourable case, in particular the mechanical characteristics selected are for each element the lowest values of the grades used;

  — the instruction manual specifies the alternatives for compatibility with the substances being carried;

— movement or modification of nozzles and manholes provided that the same level of protection is afforded and the tank strength calculation takes into account the most unfavourable case;

— a decrease in the number of nozzles;

— an increase of the number of baffles and surge plates;

— an increase of the wall thickness provided the same welding procedures are used;

— a decrease of the maximum working pressure;

— an increase in the thickness of the insulation used for additional protection;

— an increase in the effectiveness of the thermal insulation of the tank;

— the use of alternative service equipment if there is no change in the technical specification of the equipment and it is placed in the same location.

The inspection for type approval in the case of a modification of a tank shall be carried out on the parts of the tank that have been modified.

4.2.2 Content of inspection

4.2.2.1 Inspection for initial type approval

The inspection for initial type approval shall be carried out in accordance with the following subclauses:

— examination of documents (see 5.2.1);

— check of the design characteristics (see 5.3);

— inspection of the tank interior (see 5.4);

— inspection of the tank exterior (see 5.5);

— hydraulic pressure test (see 5.6);

— vacuum test (see 5.7, only if required and if no calculation or FE-analysis has been provided);

— leakproofness test (see 5.8);

— determination of water capacity (see 5.9);

— inspection of service equipment (see 5.10);

— inspection of frame or other structural equipment of portable tanks and tank containers (see 5.11);

— dynamic longitudinal impact test of portable tanks (see 5.12).

The inspection for type approval to allow the amendment of the type approval shall be carried out as a re-examination of the respective applicable clauses of the original inspection for type approval.

4.2.2.2 Inspection for modifications

If there is a modification to the tank the applicable units of the inspection for initial type approval shall be reappraised.

4.2.3 Documentation

The results of the inspection for type approval shall be recorded by the expert in a test report.

NOTE A preliminary report can be issued after examination of the documents.

In addition to the test report it is recommended that a data sheet is submitted to assist the issuing of type approval (see Annex B).

4.3 Initial inspection

4.3.1 Content of inspection

The initial inspection shall be carried out in accordance with the following subclauses:

— examination of documents (see 5.2.2);

— check of the design characteristics (see 5.3);

— inspection of the tank interior (see 5.4);

— inspection of the tank exterior (see 5.5);

— hydraulic pressure test (see 5.6);

— leakproofness test (see 5.8);

— determination of water capacity (see 5.9; only where required by regulation for individual tanks);

— inspection of service equipment (see 5.10);

— inspection of frame or other structural equipment of portable tanks and tank containers (see 5.11).

4.3.2 Documentation, certification and marking

The results of the initial inspection shall be recorded by the expert on a certificate. An individual tank that has been tested and passed for type approval shall be issued with an initial inspection certificate. Certification and marking shall be in accordance with 5.13.

4.4 Periodic inspection

4.4.1 Content of inspection

The periodic inspection shall be carried out in accordance with the following subclauses:

— examination of documents (see 5.2.3);

— inspection of the tank interior (see 5.4);

— inspection of the tank exterior (see 5.5);

— hydraulic pressure test (see 5.6);

— leakproofness test (see 5.8);

— inspection of service equipment (see 5.10);

— inspection of frame or other structural equipment of portable tanks and tank containers (see 5.11).

For vacuum insulated tanks the inspection of the tank interior and the hydraulic pressure test are not required provided that a satisfactory vacuum in accordance with the manufacturer's specification is confirmed by measurement and simultaneously a leakproofness test is carried out.

If, openings have been made in shells intended for the carriage of refrigerated liquefied gases, the method by which they are hermetically closed before the shells are returned to service shall be inspected according to 4.6.4.

In the case of tanks intended for the carriage of powdery or granular substances the hydraulic pressure test may be omitted and replaced by the leakproofness test (see 5.8).

4.4.2 Documentation, certification and marking

The results of the periodic inspection shall be recorded by the expert on a certificate. Any defect found which can impair the safety of the tank or the equipment and any related repairs carried out shall be recorded on the certificate. Certification and marking shall be in accordance with 5.13.

4.5 Intermediate inspection

4.5.1 Content of inspection

The intermediate inspection shall be carried out in accordance with the following subclauses:

— examination of documents (see 5.2.4);

— inspection of the tank interior (see 5.4; only where required by regulation);

— inspection of the tank exterior (see 5.5);

— leakproofness test (see 5.8);

— inspection of service equipment (see 5.10);

— inspection of frame or other structural equipment of portable tanks and tank containers (see 5.11; only where required by regulation).

4.5.2 Documentation, certification and marking

The results of the intermediate inspection shall be recorded by the expert on a certificate. Any defect found which can impair the safety of the tank or the equipment and any related repairs carried out shall be recorded on the certificate. Certification and marking shall be in accordance with 5.13.

4.6 Exceptional checks

4.6.1 Exceptional check after damage or repair of the shell

The exceptional check after damage of the shell which can have impaired the safety of the tank, and/or after repair, shall be carried out in accordance with the following subclauses to the extent as is applicable:

— examination of documents (see 5.2.5);

— check of the design characteristics (see 5.3);

— inspection of the tank interior (see 5.4);

— inspection of the tank exterior (see 5.5);

— hydraulic pressure test (see 5.6);

— leakproofness test (see 5.8);

— inspection of service equipment (see 5.10).

4.6.2 Exceptional check after the repair or replacement of service equipment

The exceptional check after the repair or replacement of the service equipment shall be carried out in accordance with the following subclauses to the extent as is applicable:

— examination of documents (see 5.2.5);

— check of the design characteristics (see 5.3);

— leakproofness test (see 5.8);

— inspection of service equipment (see 5.10).

4.6.3 Exceptional check after replacement of service equipment involving the application of heat

The exceptional check after exchange of the service equipment involving the application of heat (for example welding or cutting) which can have impaired the safety of the tank or the service equipment shall be carried out in accordance with the following subclauses to the extent as is applicable:

— examination of documents (see 5.2.5);

— check of the design characteristics (see 5.3);

— inspection of the tank interior (see 5.4);

— inspection of the tank exterior (see 5.5);

— hydraulic pressure test (see 5.6);

— leakproofness test (see 5.8);

— inspection of service equipment (see 5.10).

4.6.4 Exceptional check after alteration to the tank

If there is an alteration to the tank within the scope of the type approval the applicable units of the inspection for type approval shall be reappraised .

4.6.5 Exceptional check after exchange or repair of frame or structural equipment

The exceptional check after exchange or repair of frame or structural equipment shall be carried out in accordance with the following subclauses to the extent as is applicable:

— examination of documents (see 5.2.5);

— check of the design characteristics (see 5.3);

— inspection of frame or other structural equipment of portable tanks and tank containers (see 5.11).

4.6.6 Exceptional check before and after repair or replacement of the protective lining or coating

The exceptional check before and after repair or replacement of the protective lining or coating whose defect can impair the safety of the tank shall be carried out in accordance with the following subclauses to the extent as is applicable:

— examination of documents (see 5.2.5);

— check of the design characteristics (see 5.3);

— inspection of the tank interior (see 5.4);

— hydraulic pressure tests after application of heat (for example burning of the existing lining) which can have impaired the safety of the tank (see 5.6);

— leakproofness test (see 5.8).

4.6.7 Documentation, certification and marking

The results of the exceptional check shall be recorded by the expert on a certificate. Any defects found which can impair the safety of the tank or the equipment and any related repairs carried out shall be recorded on the certificate. Certification and marking shall be in accordance with 5.13.

A preliminary report may be issued after examination of documents.

5 Procedures and documentation for inspections and tests

5.1 General

A tank which fails one or more units of inspection shall, once the failure has been investigated and corrected, be retested in accordance with the requirements of those units. If, in the opinion of the expert, the repair may have affected the validity of any previous tests these tests shall be repeated.

Depending on the result of the inspections additional inspections can be necessary.

Where the interior of the tanks is to be inspected the tanks shall be empty, clean and safe to enter (e.g. no electrical services, no heating, safe atmosphere) at the time of inspection. Permits of work according to the legislation dealing with safety and health at work shall be complied with. This is also a requirement when necessary for the safety of the inspecting personnel and any other persons in the vicinity even when other inspections are carried out.

5.2 Examination of documents

5.2.1 Inspection for type approval

5.2.1.1 Required documents

Documents giving the following information shall be provided for the inspection for type approval by the manufacturer or his representative:

— name and address of the applicant;

— description of the tank prototype including planned variations to the design and its special characteristics;

— names and addresses of the manufacturer and the assembler of the tank; in the case of fixed tanks (tank vehicles) or rail tank wagons the design of chassis or wagon; in the case of tank containers or portable tanks the manufacturer and design of frame if applicable;

— certificate of welder, welding procedure qualification and welding quality system in accordance with the technical code; when the technical code does not contain requirements for qualification of the welder and welding procedure the requirements of EN ISO 9606-1, EN ISO 14732, EN ISO 9606-2, EN ISO 9606-3, EN ISO 9606-4, EN ISO 15607, EN ISO 15609-1, EN ISO 15614-1, EN ISO 15614-2 shall be met as applicable;

— description of the assigned mode of operation (e.g. pressure discharging);

— indication of the portable tank instruction T (tank instruction) and TP (tank provision) or tank code and the applicable special provisions TA (type approval), TC (construction),and TE (equipment);

— if required, listing of all substances or groups of substances to be carried by the tank (especially for substances of class 2 and special substances listed in the regulation for which additional requirements can apply);

— schematic drawing of the tank with listing of main dimensions;

— schematic drawings of the piping systems;

— data sheet with the operational data of the tank necessary for calculation;

— calculation and, if required, verification by testing of the tank and its fastenings;

— drawings necessary for verifying the manufacture of the tank, of its equipment and of its fastenings, including an assembly drawing and a parts list indicating the materials;

— drawings for marking (tank plates and others);

— listing of the service equipment with the relevant technical data including certificates of compliance with the appropriate technical codes, standards, specifications and requirements;

— suitability of the safety equipment including the calculation of the relief capacity if relevant;

— material test certificates as required by the applied technical code for the base materials used for tank and structural equipment showing values of material properties as required by the relevant regulation;

— material identification of welding filler materials;

— proof of material grades used for the service equipment;

— record of tests carried out on production control test plates if required by the technical code and/or the relevant regulations concerning the transport of dangerous goods (the records and the relation between the test plates and the tanks shall be verified by the expert);

— when using a protective lining or coating, requirements of the lining or coating manufacturer for testing proof that the protective lining or coating has been applied in accordance with the manufacturer's specification;

— record of non-destructive testing carried out on the welds;

— qualification certificate for personnel undertaking non-destructive test (NDT);

— if relevant, validation of the NDT technique used;

— heat treatment procedure and records of heat treatment.

5.2.1.2 Examination of documents

The documents shall be examined to determine that the requirements of the relevant dangerous goods regulations and technical code have been fulfilled. The compatibility of tank material and any coating or lining and equipment with the assigned dangerous goods shall be verified.

5.2.2 Initial inspection

5.2.2.1 Required documents

The documents shall provide the following information for the initial inspection:

— application for initial inspection;

— type approval certificate;

— information given in the application of type approval where necessary (see 5.2.1.1);

— certificate of welder, welding procedure qualification and welding quality system in accordance with the technical code; when the technical code does not contain requirements for qualification of the welder and welding procedure the requirements of EN ISO 9606-1, EN ISO 9606-2, EN ISO 9606-3, EN ISO 9606-4, EN ISO 15607, EN ISO 15609-1, EN ISO 15614-1 EN ISO 15614-2 shall be met as applicable;

— material test certificates as required by the applied technical code for the base materials used for tank and structural equipment showing values of material properties;

— material identification of welding filler materials;

— proof of material grades used for the service equipment;

— record of tests carried out on production control test plates if required by the technical code and/or the relevant regulations concerning the transport of dangerous goods (the records and the relation between the test plates and the tank shall be verified by the expert);

— when using a protective lining or coating, proof of compatibility of the protective lining or coating with the dangerous goods to be transported;

— when using a protective lining or coating, proof that the protective lining or coating has been applied in accordance with the manufacturer's specification;

— record of non-destructive testing carried out on the welds;

— qualification certificate for personnel undertaking non-destructive test (NDT);

— heat treatment procedure and records of heat treatment;

— calculation of water capacity, if applicable.

5.2.2.2 Examination of documents

The documents shall be examined to determine that the type approval has been complied with and that the requirements of the relevant dangerous goods regulations and the technical code have been fulfilled.

5.2.3 Periodic inspection

5.2.3.1 Required documents

The following documents or copies of them shall be provided for the periodic inspection:

— certificate of initial inspection if the tank has not been subject to periodic inspection;

— certificate of last periodic inspection, if applicable;

— certificate of intermediate inspection if carried out after the previous periodic inspection or after the initial inspection if there has been no periodic inspection;

— if required one or more of the documents mentioned in 5.2.1.1.

5.2.3.2 Examination of documents

The documents shall be examined to determine that they are relevant to the tank to be examined. Any additional requirements and remarks given in these documents shall be taken into account.

5.2.4 Intermediate inspection

5.2.4.1 Required documents

The following documents or copies of them shall be provided for the intermediate inspection:

— certificate of initial inspection if the tank has not been subject to periodic inspection;

— certificate of last periodic inspection;

— if required the documents mentioned in 5.2.1.1.

5.2.4.2 Examination of documents

The documents shall be examined to determine that they are relevant to the tank to be examined. Any additional requirements and remarks given in these documents shall be taken into account.

5.2.5 Exceptional check

5.2.5.1 Required documents

As far as it is relevant for the exceptional checks described in 4.6.1 to 4.6.5 and 4.6.7 the following information shall be provided:

— copy of certificate of type approval;

— information given in the application of type approval where necessary (see 5.2.1.1);

— name and address of the undertaking carrying out the alteration to the tank or the repair;

— certificate of welder, welding procedure qualification and welding quality system in accordance with the technical code; when the technical code does not contain requirements for qualification of the welder and welding procedure the requirements of EN ISO 9606-1, EN ISO 9606-2, EN ISO 9606-3, EN ISO 9606-4, EN ISO 15607, EN ISO 15609-1, EN ISO 15614-1, EN ISO 15614-2 shall be met as applicable;

— heat treatment procedure and records of heat treatment;

— proof that the properties of the materials used for a repair or alteration to the tank are at least equivalent to those of the materials used for the original construction;

— record of non-destructive testing carried out;

— if welding is carried out, a record of tests performed on the production control test plates if required by the technical code and/or the relevant regulations concerning the transport of dangerous goods (the records and the relation between the test plates and the tank shall be verified by the expert);

— when using a protective lining or coating, proof that the protective lining or coating has been applied in accordance with the manufacturer's specification;

— if necessary for repair of service equipment, a schematic drawing of the piping systems;

— if piping is changed, schematic drawings of the piping systems;

— a description of work carried out.

The documents shall give the following information relevant to the exceptional check described in 4.6.6:

— proof of compatibility of the protective lining or coating with the dangerous goods to be transported;

— proof that the protective lining or coating has been applied in accordance with the manufacturer's specification.

5.2.5.2 Examination of documents

The documents shall be examined to determine that the requirements of the relevant dangerous goods regulations and the technical code have been fulfilled.

5.3 Check of the design characteristics

5.3.1 Content of inspection

The check of the design characteristics shall include:

— examination of the manufacturing conditions;

— inspection of the material grades and wall thicknesses;

— examination of the manufacturing methods;

— inspection of the condition of the tank;

— inspection of the main dimensions;

— non-destructive testing of the welds;

— testing of test plates (where required by regulation or relevant technical code).

If the check of the design characteristics is part of the inspection for type approval, the reference to type approval documents shall be taken as reference to design documents (see 5.2.1.1).

5.3.2 Examination of the manufacturing conditions

The suitability of the manufacturing equipment and the competency of personnel as well as the proof of the qualification of the personnel shall be as required by the technical code.

5.3.3 Inspection of the materials and wall thicknesses

The materials used for the shell, the piping and the structural and service equipment shall correspond to the type approval and with the material certificates, where appropriate. The material certificates shall be as required by the technical code.

The tank shall be inspected to determine the traceability between the marking of the materials and the identification given by the material certificates.

The actual thickness of materials of the shell, the piping and the structural equipment shall not be less than that given by the type approval documents. This shall be verified by appropriate measurement on completion of the tank.

5.3.4 Examination of the manufacturing methods

The manufacturing methods and data of the heat treatment, the rolling and the forming of the materials used for the shell, the piping and the structural equipment shall be examined to ensure compliance with the design specifications of the tank.

The type of welded joints shall be examined to ensure compliance with the type specified in the design of the tank.

The welding quality system procedure shall be in accordance with the relevant technical code. When the technical code does not contain requirements for the welding quality system procedure, the requirements of EN ISO 3834-2 and EN ISO 14731 shall be met to the extent as is applicable. When the manufacturer welding quality system has been approved according to the technical code or by default according to these standards, the verification may be limited to the verification of the validity dates and the scope of the certificate.

5.3.5 Inspection of main dimensions

The main dimensions of the tank and if relevant of the framework shall be inspected for conformity with the dimensions given by the type approval documents.

5.3.6 Non-destructive testing of the welds

5.3.6.1 General

The non-destructive testing of the welds shall be by radiographic or ultrasonic methods. Welds which cannot be tested by ultrasonic or radiographic methods because of the design or the position of the weld may be tested by dye penetrant or magnetic particle inspection.

The non-destructive testing of welds shall be carried out in accordance with the technical code used for design and construction of the tank, e.g. EN 14025 for pressure tanks. In each case the minimum requirements given in 5.3.6.2 to 5.3.6.4 shall be met.

If the technical code does not give requirements for non-destructive testing of welds, testing shall be in accordance with 5.3.6.2 to 5.3.6.4 and the relevant regulation.

5.3.6.2 Tanks of a design using a weld efficiency factor λ of 0,8

For tanks of a design using a weld efficiency factor λ of 0,8 all weld "Tee" junctions with the total length of weld examined to be not less than 10 % of the sum of the length of all longitudinal, circumferential and radial (e.g. in tank ends) welds shall be tested.

5.3.6.3 Tanks of a design using a weld efficiency factor λ of 0,9

For tanks of a design using a weld efficiency factor λ of 0,9 the total length of all longitudinal welds, all "Tee" junctions and 25 % of the total length of circumferential and radial (e.g. in tank ends) welds shall be tested.

5.3.6.4 Tanks of a design using a weld efficiency factor λ) of 1,0

For tanks of a design using a weld efficiency factor λ) of 1,0 the total length of all longitudinal, circumferential and radial (e.g. in tank ends) welds shall be tested.

5.3.7 Testing of test plates

The test plates shall be tested in accordance with the applicable regulation or technical code.

5.4 Inspection of the tank interior

5.4.1 Inspection of the condition of the tank

A complete visual inspection shall be performed (provided no protective lining or coating is used) to identify any surface defect.

The wall thickness shall be verified against that given by the type approval documents by appropriate measurement if the tank shows indication of reduction of wall thickness.

Any lining or coating not falling under the definition of protective lining or coating given in this document shall be visually inspected for integrity. In particular bonding defects or delaminations shall be identified and recorded in the report.

5.4.2 Inspection of protective lining or coating

The condition of the protective lining or coating shall be inspected by appropriate methods, e.g. spark test in accordance with the lining or coating manufacturer's specification, and in accordance with the manufacturer's recommendations. In particular bonding defects shall be identified and recorded in the report.

5.5 Inspection of the tank exterior

5.5.1 Inspection of the condition of the tank

A complete visual inspection shall be performed to identify any surface defect and indication of a leak such as dampness, softened paint or staining/unusual cleanliness. Any surface defects shall be evaluated by the expert, and if considered necessary paint shall be removed.

The wall thickness shall be verified against that given by the type approval documents by appropriate measurement if the tank shows indication of reduction of wall thickness.

The inspection of the condition of the tank for the initial inspection shall be carried out before the attachment of any insulation, painting, protective lining or coating. For subsequent inspections sheathing, thermal or other insulation shall be removed only to the extent required to achieve a reliable appraisal of the condition of the tank.

5.5.2 Inspection of the fastenings of the tank and its structural equipment

The following elements shall be inspected by an appropriate method to ensure that they show no evidence for losing their structural integrity:

— structures supporting and reinforcing the tank;

— means of attachment to the frame or vehicle chassis including rubbing plate and tank to chassis mounting;

— any structural protective equipment e.g. the cover assembly, the sun shield.

Sheathing, thermal or other insulation shall be removed only to the extent required to achieve a reliable appraisal.

5.5.3 Inspection of marking

The marking of the tank shall be verified against the applicable regulations concerning the transport of dangerous goods.

5.5.4 Inspection of earth connection

Shells which are required to be fitted with an earth connection shall be inspected for conformity of the earth connection with the design requirements. The electrical continuity between the earth connection and the metallic parts of the tank and equipment, including any frame and where applicable between the earth connection and the vehicle chassis, shall be verified.

5.6 Hydraulic pressure test

5.6.1 General

Before the beg inning of the test the tank shall be dry and clean on its outside so that any leakage can be detected. If the ambient temperature is below 0 °C a hydraulic pressure test with water is only allowed if the contents of the tank, of the measuring equipment and of the piping systems cannot freeze. The expert shall ensure that the test cannot be adversely effected by the weather conditions.

The hydraulic pressure test for the initial inspection shall be carried out before the attachment of any insulation, painting, protective lining or coating.

For the hydraulic pressure test for alteration or repair of the tank, the insulation, painting, protective lining or coating shall be removed only to the extent to achieve a reliable appraisal of the test.

In accordance with the relevant regulation for the transport of dangerous goods the hydraulic pressure test of tanks for the carriage of powdery or granular substances may be omitted and replaced by a leakproofness test according to 5.6 with the agreement of the expert. The test pressure shall be at least equal to the maximum working pressure.

5.6.2 Extent of test

The tank and each self-contained compartment including the partitions shall be tested as prescribed in 5.6.3 to 5.6.8.

During the test of a compartment the adjacent compartment(s) shall be empty and unpressurized.

All service equipment and the whole piping system with the exception of breather devices, safety valves, bursting discs, the pump and/or flow meters including the gas extractor and third closing devices shall be included in the hydraulic pressure test. The shell and its equipment may be tested separately provided that they are subjected to a leakproofness test after assembly.

5.6.3 Test pressure

5.6.3.1 Test pressure of the whole tank

The hydraulic pressure test of the tank shall be carried out at the test pressure given by the tank plate or type approval documents. The test pressure shall be related to the highest point of the tank.

5.6.3.2 Test pressure of compartments

5.6.3.2.1 General

Each compartment of subdivided tank containers, portable tanks and tanks of rail tank wagons shall be tested with the hydraulic pressure required by 5.6.3.1. The test pressure shall be related to the highest point of the compartment.

5.6.3.2.2 Tanks with a working pressure exceeding 0,5 bar

Each compartment of fixed tanks or demountable tanks shall be tested with a hydraulic pressure of minimum 1,3 times the maximum working pressure. The test pressure shall be related to the highest point of the compartment.

5.6.3.2.3 Tanks with a working pressure up to 0,5 bar

Partitions of compartments of fixed tanks or demountable tanks which are designed for a pressure corresponding to 2 times the static pressure of the goods to be carried but not less than 2 times the static pressure of water, shall be tested with a test pressure of 2 times the static pressure arising from the highest possible column of fluid of the heaviest goods to be carried but with not less than 2 times the static pressure of the highest possible column of the fluid of water in the tank. The test pressure shall be related to the bottom of the tank.

5.6.3.3 Test of heating equipment

The hydraulic pressure test of heating equipment shall be carried out with the test pressure of the heating equipment given on the tank plate or in the documents of the type approval.

If not otherwise stated the following test pressures given in Table 1 shall be applied:

Table 1 — Test pressures for hydraulic pressure test of heating equipment

Type of heating equipment	Test pressure
Internal and external heating pipe (not connected with the tank shell	1,5 × working pressure
External heating channel and heating tub (connected with the tank shell	1,3 × working pressure

For the dimensioning, the following should be considered:

— adaptors: Wall thicknesses according to technical codes related to the calculation pressure of the tank,

— pipes: Wall thicknesses according to the design pressure of the heating equipment.

5.6.4 Test fluid

The fluid normally used for hydraulic pressure testing shall be water.

Other liquids may be used with agreement of the expert. Alternative test liquids shall have a flash point of more than 60 °C or be diesel fuel, gas oil or heating oil light as specified in EN 590. Toxic or corrosive liquids shall not be used.

Gases may be used for pressure testing only in special cases and with agreement of the expert. Special cases are:

— When the dangerous goods to be carried are not compatible with even small amounts of water (e. g. concentrated sulfuric acid),

— when the dangerous goods to be carried is a gas and water is not soluble in it,

— when the tank is equipped for top discharge and has no cleaning opening,

— when water contaminated with residues of the dangerous goods will cause severe problems with its disposal.

Flammable or toxic gases shall not be used.

When using gas as the test fluid 5.6.5 shall be applied and Annex C should be observed.

Metallic tanks with a working pressure not exceeding 0.5 bar shall not be considered as a special case.

5.6.5 Precautions for gas as the test fluid

5.6.5.1 General

The test area shall

— be such that the safety distance, in which people not necessary for the hydraulic pressure test shall not be present, and the safety distances to neighbouring properties are respected; the distances in meter can be calculated by

$$\sqrt[3]{\frac{1{,}5 \times V \times p}{\pi}}$$

where

V is the total capacity of the tank in cubic meter

P is the test pressure in bar,

but not less than 5 m to 10 m around the tank.

The safety distance shall be positively separated from the rest of the site using safety restraints to prevent access whether inadvertent or otherwise. Instead of a safety distance a blast pit may be used capable of withstanding the blast or flying projectiles that could result from tank failure.

— be sufficiently silent to hear the noise of a gas flow from a leakage.

A written permit to work shall be given to any personnel necessary to be present in the above mentioned safety distance by the inspection body regarding the risk of a pressure test with gas and the precautions necessary for safety at work. When the tank is pressurised personnel shall not carry out any work on the tank.

5.6.5.2 Additional inspection and testing prior to pressurization

Prior to pressurisation

— an inspection of the condition of the tank according to 5.4.1 and to 5.5.1 shall be carried out with the removal of any part hiding possible defects (e. g. insulation, upper coupler (rubbing plate)) only to the extent necessary to achieve a reliable appraisal of the condition of the tank or compartment,

— additional non-destructive testing shall be carried out in accordance with 5.3.6 at least to the amount of the weld efficiency factor used for the manufacture of the tank but not less than 0,9 and

— fasteners of all openings and blank flanges shall be verified to be tightened with the torque according to the manufacturer's specification. The full number of studs or bolts provided for blanking flanges shall be used. Any studs or bolts with worn or damaged threads shall be replaced.

5.6.5.3 Pressurization

5.6.5.3.1 General

The tank and or its compartments shall be pressurised stepwise with verification of the leakproofness at a pressure of 0,2 bar up to 0,5 bar and, for tanks with a working pressure exceeding 0,5 bar, at a pressure of half the test pressure for the hydraulic pressure test. The holding time shall be according to 5.6.7.

5.6.5.3.2 Pressurisation of compartments

For pressurisation of compartmented tanks only a gas which in no case creates a hazard shall be used.

Compartmented tanks shall be pressurised in stages up to the compartment test pressure. During the test of a compartment all other compartment(s) shall be empty and unpressurized. After a holding time according to 5.6.7 the pressure shall be reduced to at least 0,5 bar below the test pressure to allow visual inspection of the partitions.

As an alternative all compartments may be individually sealed with blanking plates together with their own individual manometer with separate gas feed and monitoring lines (Tee'd feed / return pipework are not permitted). Alternate compartments may be pressurised simultaneously and the pressures monitored; adjacent empty and unpressurised compartments manometers shall be monitored for pressure change (indicating an internal leak). On completion of the first series of tests, the test shall be repeated on the previously empty compartments with the previous pressurised compartments empty and unpressurised. On completion of the testing of all the individual compartments, the blanking plates shall be removed and the tank inspected according to 5.6.9 and a leakproofness test according to 5.8 shall be carried out.

5.6.5.4 Necessary safety devices, measurement and evaluation

For the necessary safety devices in the gas pressurizing system, the measurement and the evaluation of the test, 5.6.6, 5.6.8 and 5.6.9 shall apply respectively.

In addition to 5.6.8 the evaluation of the test shall be carried out at the pressurised tank and not before the holding time according to 5.6.7 has passed.

5.6.6 Pressurization

The tank may be filled with the test fluid and gradually pressurized before the expert commences witnessing the test.

When using a liquid for pressurizing, the tank shall be filled with the test liquid to not less than 99 % of the water capacity.

When using a standpipe for pressurizing, only water shall be used as a test fluid.

When using a gas for pressurizing the test liquid, the tank shall first be filled with the test liquid to not less than 99 % of the water capacity. A non-flammable, non-toxic gas shall be used to pressurize the space above the liquid. A safety device shall be included in the gas pressurizing system. The device shall ensure that the pressure in the shell cannot exceed 105 % of the required test pressure.

5.6.7 Test duration

The test pressure shall be held for the time necessary for the expert to carry out the hydraulic pressure test and its evaluation of the shell or compartment(s) under pressure but not less than 15 min for a non-insulated tank and not less than 30 min for an insulated tank (holding time).

5.6.8 Measurement

The test pressure may be measured either by the height of the column of test liquid standing in the standpipe or U-tube, or by other pressure gauges.

The accuracy of the measuring equipment shall be equal to or less than 1 % of full scale deflection (accuracy classes 0,1 to 1 according to EN 837-1 or -3). Proof of the accuracy shall be given. Accuracy of electronic measurement equipment shall be used. For selection and installation of mechanical pressure gauges EN 837-2 shall be used. Electronic pressure gauges may be used in the range attested by the gauge manufacturer.

When only a gas is used as test fluid the pressure in the tank shall be indicated in a way that it may be seen from a safe location (see Annex C).

5.6.9 Evaluation of the test

The tank fails the hydraulic pressure test if any of the following occur during the test period:

— a leak is detected;

— there is an unaccountable fall in pressure during the test period;

— there is visible permanent deformation.

When using gas as the test fluid the final evaluation shall be carried out after the holding time given in 5.6.6.

5.7 Vacuum testing

5.7.1 Test procedure

The tank shall start the test empty and at atmospheric pressure.

All openings of the tank shall be closed except the discharge openings. A pressure of 1,5 times more severe than the external design pressure shall be created inside the tank and held for 5 min.

For vacuum operated waste tanks a negative internal pressure of 1 bar (absolute) may be applied.

5.7.2 Measurement

The accuracy of the measuring equipment shall be equal to or less than 1 % of full scale deflection (accuracy classes 0,1 to 1 according to EN 837-1 or -3); this accuracy shall be attested by a calibration certificate. For selection and installation of pressure gauges EN 837-2 shall be used.

5.7.3 Evaluation of the test

The tank fails the test if any of the following occur:

— a leak is detected;

— there is an unaccountable rise of pressure at the pressure gauge;

— there is visible permanent deformation.

5.8 Leakproofness test

5.8.1 General

Before the beginning of the test the tank shall be dry and clean on its outside so that any leakage can be detected. If the ambient temperature is below 0 °C a leakproofness test with water is only allowed if the contents of the tank, of the measuring equipment and of the piping system cannot freeze.

5.8.2 Extent of test

The leakproofness test shall be carried out on the shell and its service equipment which will be used with the tank including any permanently attached hoses after assembly in accordance with the requirements of 5.8.3 to 5.8.6 and 5.8.8. This testing shall include each compartment partition. During the test of a compartment the adjacent compartments shall be empty and unpressurized.

Where shut-off valves are fitted in series they shall be tested separately to ensure that with the pressure on the tank side of the device the leakage does not exceed the rate given in 5.8.8.

When the device is a valve, the test is to determine the leak-tightness of the valve seat and the glands of the valve operating mechanism.

The leakproofness of breather devices which are designed to work at a maximum pressure lower than the leakproofness test pressure of the tank and of bursting discs precedent to a relief valve shall be tested according to 5.8.7.

5.8.3 Leakproofness test pressure

The leakproofness test shall be carried out with the pressure given by the relevant regulation. If there is no specific regulation the following test pressures given in Table 2 shall be applied, in these cases the expert shall decide about the exact pressure applied for the leakproofness test.

Table 2 — Test pressures for leakproofness test

Kind of substance to be transported	Test fluid	Test pressure
Liquids, solids in the granular or powdery	liquid	At least equal to the maximum (allowable) working pressure with a minimum of 0,2 bar
Liquids, solids in the granular or powdery	gas	at least equal to 25 % of the maximum working pressure with a minimum of 0,2 bar
compressed, liquefied or dissolved gases (fixed tanks (tank vehicles), demountable tanks, rail tank wagons, tank containers)	Liquid, gas	not less than 20 % of the test pressure
compressed, liquefied or dissolved gases (portable tanks)	gas	At least equal to 25 % of the maximum allowable working pressure
refrigerated liquefied gases	Liquid, gas	not less than 90 % of the maximum (allowable) working pressure

The test pressure shall be related to the highest point of the tank or compartment.

Internal leakproofness of shut-off devices shall be tested at the leakproofness test pressure as well as at a pressure of not more than 0,2 bar.

5.8.4 Leakproofness test fluid

The test fluid shall be compatible with the materials of the tank and the goods to be transported.

The test fluid shall in no case create a hazard to the inspecting personnel or any other persons in the vicinity.

5.8.5 Pressurization

5.8.5.1 General

The tank may be filled with the test fluid and gradually pressurized before the expert commences witnessing the test.

5.8.5.2 Only liquid as test fluid

The tank shall be filled with the test liquid to not less than 99 % of the water capacity.

When using a standpipe for pressurizing the tank, only water shall be used as a test fluid.

5.8.5.3 Liquid and gas as test fluids

For tanks having a working pressure not exceeding 0,5 bar an alternative test procedure may be carried out using water or another liquid as follows:

— the tank shall be filled with the test liquid to not less than 95 % of the water capacity, a non-flammable, non-toxic gas shall be used to pressurize the space above the liquid and;

— a safety device shall be included in the gas pressurizing system. The device shall ensure that the pressure in the shell does not exceed 105 % of the required leakproofness test pressure.

5.8.5.4 Only gas as test fluid

When using only gas as test fluid

— the test area shall be sufficiently silent to hear the noise of a gas flow from a leakage,

— a written permit to work shall be given to any personnel necessary to be present in the vicinity of the tank regarding the risk of a leakproofness test with gas and the precautions necessary for safety at work,

— during the test duration according to 5.8.6 no work shall be carried out on the tank and

— a safety device shall be included in the gas pressurizing system. The device shall ensure that the pressure in the shell cannot exceed 105 % of the required test pressure.

5.8.6 Test duration

The test pressure shall be held for the time necessary for the expert to carry out the leakproofness test of the shell, a compartment or the equipment but not less than 5 min in each case.

5.8.7 Special leakproofness test of the mounting of certain items of equipment

5.8.7.1 Service equipment designed to work at a maximum pressure lower than the leakproofness test pressure of the tank

For items of service equipment which are designed to work at a maximum pressure lower than the leakproofness test pressure of the tank the following shall apply:

— They shall be blocked or the opening of the shell shall be blanked off for the test, if a blanking-off or blocking is not possible due to technical reasons they shall be removed and the shell blanked off for the test.

— The leakproofness test according to 5.8.3 to 5.8.6 shall be carried out on the shell with the other items of service equipment in place.

— When using gas as the test fluid for pressurization the removed items of service equipment shall be tested for leakproofness according to 5.8.3 to 5.8.6 at a pressure of 90 % of the minimum opening pressure of the service equipment.

— When exclusively using water as the test fluid for pressurization the removed items of service equipment shall be checked whether their gaskets are renewed and placed correctly and whether their fasteners are tightened with the torque according to the service equipment manufacturer's specification.

5.8.7.2 Relief valve preceded by a bursting disc

Where a relief valve is preceded by a bursting disc, it shall be checked that the gaskets of the bursting disc are in good condition and, if necessary, renewed and placed correctly and that the fasteners are tightened with the torque according to the manufacturer's specification.

5.8.8 Evaluation of the test

The maximum allowable leakage rate shall be in accordance with Table A.5 of EN 12266-1:2012 Rate A.

NOTE "No visually detectable leakage" means no visible weeping or formation of drops or bubbles and is a lower leakage rate than Table A.5 of EN 12266-1:2012, Rate B.

For this purpose it is not necessary to enter adjacent compartments.

5.9 Determination of capacity

The determination of capacity shall be carried out using an appropriate calculation (if not forbidden), volumetric or gravimetric method. For volumetric and gravimetric methods any error shall be less than 1 % of the measurement value. If not otherwise required the capacity of the tank shall be determined for a reference temperature of 20 °C.

The volumetric or gravimetric determination of capacity of the tank and, where appropriate, each compartment shall be carried out by completely filling the tank or compartment with water.

NOTE An appropriate method of determination of capacity can be found in the Recommendation of the Organisation Internationale de Métrologie Légale OIML R80 [5].

5.10 Inspection of service equipment

5.10.1 Inspection of service equipment for type approval of the tank

The inspection shall determine that the service equipment and its marking conform to the requirements of the applicable regulations. The inspection shall also determine that all the service equipment is suitable for the operating conditions of the tank.

5.10.2 Inspection of service equipment for other inspections

The inspection shall determine that the service equipment and its marking is in accordance with that given in the type approval.

5.10.3 Check of satisfactory operation of service equipment

All service equipment including any permanently attached hoses shall be inspected in the mounted position for correct functioning and satisfactory condition (e.g. regarding wear). Where it is not possible to inspect the equipment in the mounted position, e.g. in the case of breathing devices, the equipment shall be tested separately.

The parts of breathing devices which are open during transport (e.g. breathing valve) shall be tested to ensure that they are leaktight in the 90°, 180° and 270° positions. The test pressure shall be at least 1,1 times the static pressure of the substances to be transported (e.g. petrol, diesel-, heating-oil) which arises from the possible fluid column on the breathing device. If the breathing devices need a relief pressure to open during transport they shall be tested for correct opening at this relief pressure and re-sealing.

The adjustment of the start-to-discharge-pressure of safety valves shall be inspected for conformity with the relevant regulations. If there is no adjustment, the safety valves shall be tested to verify that their start to discharge and reseat pressures conform with the relevant regulations.

If bursting discs are installed they shall be inspected for integrity and correct rating in accordance with the applicable regulation for the transport of dangerous goods.

Pipework including flexible joints and fixed hoses as part of the filling and/or discharging system shall be visually inspected. Paint or coating shall be removed where necessary.

5.11 Inspection of frame or other structural equipment of portable tanks and tank containers

5.11.1 Inspection of frame or other structural equipment for type approval

The frame or other structural equipment of a portable tank or tank container which has not been designed or constructed in accordance with a standard (e.g. ISO 1496-3 [6] or EN 1432 [7]) or other requirements (e.g. UIC 591 [8] and 592-4 [9]) of off-shore tanks which have not been designed or constructed in accordance with IMO MSC/Circ 860 or EN 12079-1 shall be shown to be suitable for the intended purpose either by calculation or, if required, by testing (e. g. the appropriate tests specified in ISO 1496-3).

In addition, any portable tank which meets the definition of a "container" within the terms of the CSC [11] shall fulfil the applicable requirements of that Convention.

5.11.2 Initial, periodic, intermediate inspection and exceptional check of the frame or other structural equipment of portable tanks and tank containers

The frame and other structural equipment shall be inspected to determine that they are safe in accordance with the requirements of 6.7 ADR/RID resp. 6.7 IMDG-Code [10]. This inspection shall include a visual inspection of the welded joints and the surface of all structural parts. Where necessary, the insulation shall be removed to the extent required to achieve a reliable appraisal of the condition of the frame or other structural equipment.

Any damage or corrosion which could influence the safety or function of the frame shall be repaired.

5.12 Dynamic longitudinal impact test

Portable tanks meeting the definition of container in the International Convention for Safe Containers (CSC) shall be subjected to the dynamic longitudinal impact test prescribed in the UN Manual of Tests and Criteria, Part IV, Section 41.

5.13 Test report, certification and marking

5.13.1 Test report for type approval

A test report of the inspection for type approval shall be completed. The data sheet referred to in 4.2.3 is given in accordance with Annex B.

5.13.2 Certification of initial, periodic and intermediate inspection and exceptional check

Following the completion of the initial, periodic or intermediate inspection or the exceptional check a certificate shall be issued, even in the case of negative results. An example for the certificate is given in Annex D.

Additional requirements or remarks, which might influence the next regular inspection or exceptional check, shall be stated on the certificate.

NOTE The certificate states the accordance of the tank with the relevant regulations for the transport of dangerous goods at the date of inspection.

5.13.3 Marking

The tank plates for fixed tanks (tank vehicles) and demountable tanks shall contain the information required by Annex E. For tank plates for rail tank wagons RID refers. The tank plates for portable tanks and tank containers shall contain the information required by Annex F. In these annexes the sequence of information and the general layout is normative. To avoid any linguistic misunderstanding the lines of the plates shall be numbered (see annexes). The minimum height of the letters shall be 3 mm.

Any modification to any data on the tank plate required by this European Standard shall be attested by the expert's stamp close to the modified information.

The wording on the tank plate for fixed tanks (tank vehicles), demountable tanks and tank containers shall be in one of the official languages of the country of registration and, as an option, in English.

The wording on the tank plate for portable tanks shall be in English; in addition another language may also be used.

Markings not necessarily required to be given on the tank plate shall comply with the relevant regulation. If information is given on the tank plate as well as in other places (e.g. on the shell) this information shall be identical. In each case the information shall comply with the valid documents.

Annex A
(informative)

Applicable items of tank inspection – Survey Table

Table A.1 shows as a summary the applicable items of tank inspection.

Table A.1 — Applicable items of tank inspection

Type of inspection Subclause	Inspection for type approval	Initial inspection	Periodic inspection	Intermediate inspection	Exceptional check						
					after damage or repair of the tank	after repair or replacement of service equipment	after replacement of service equipment, involving the application of heat	after alteration to the tank	after replacement or repair of frame or structural equipment	before and after repair or replacement of protective lining or coating	to allow amendment of type approval
Examination of documents (5.2)	X	X	X	X	X	X	X	X	X	X	X
Check of the design characteristics (5.3)	X	X	-	-	X	X	X	X	X	-	X
Inspection of the tank interior (5.4)	X	X	X	X [b]	X	-	-	X	-	X	X
Inspection of the tank exterior (5.5)	X	X	X	X	X	-	-	X	-	-	X
Hydraulic pressure test (5.6)	X	X	X	-	X	-	X	X	X	-	X
Vacuum testing (5.7)	X	-	-	-	-	-	-	X	-	-	X
Leakproofness test (5.8)	X [a]	X	X	X	X	X	X	X	-	-	X
Determination of water capacity (5.9)	X	X	-	-	-	-	-	X	-	-	X
Inspection of service equipment (5.10)	X	X	X	X	X	X	X	X	-	-	X
Frame inspection (5.11)	X	X	X	X [b]	X	-	-	-	X	-	X
Dynamic longitudinal impact test	X	-	-	-	-	-	-	-	-	-	X
Test report, certification and marking (5.13)	X	X	X	X	X	X	X	X	X	X	X

[a] Only for service equipment.
[b] If required by regulation.

Annex B
(informative)

Technical data for type approval

0	General:	
0.1	Manufacturer	
0.1.1	Name:	
0.1.2	Address:	
0.2	Manufacturing location:	
0.3	Type:	
0.4.	Tank code, portable tank instruction, special provisions:	
0.5	IMO tank type/tank instruction, special provisions:	
0.6	If required (e.g. 6.8, 6.7 ADR/RID): Substances/groups of substances to be carried:	
1	Characteristics and general description	
1.1	General description:	
1.1.1	Shell section:	
1.1.2	Internal lining:	
1.1.3	Technical code:	
1.2	Tank type (on chassis or self-supporting):	
1.3	End type (e.g. torospherical, spherical):	
1.4	Internal baffle or partition type:	
1.5	Insulation (material, thickness, cladding):	
2	Dimensions	
2.1	Total length (maximum):	
2.2	Maximum height and maximum width of the shell:	
2.3	Radius of convexity of the shell walls:	
2.3.1	Top:	
2.3.2	Bottom:	
2.3.3	Sides:	
2.3.4	Corners:	
2.4	Minimum thickness of the shell (indicate the corrosion allowance):	
2.5	Minimum thickness of the ends (indicate the corrosion allowance):	
2.6	Minimum thickness of the partitions (indicate the corrosion allowance):	
2.7	Minimum thickness of the baffles and surge plates (indicate the corrosion allowance):	
2.8	Capacity	

Compartment	1	2	3	4	5	6	7	8	total
Capacity in litre									

2.9	Description of the reinforcements:	
2.9.1	Side reinforcement against impact:	
2.9.2	External design pressure:	
2.10	Maximum distance between two reinforcements:	

2.11	Design temperature and working temperature, if necessary (maximum and minimum):	
2.12	Pressure:	
2.12.1	Maximum working pressure (gauge pressure):	
2.12.2	Design pressure:	
2.12.3	Calculation pressure:	
2.12.4	Test pressure:	
2.12.5	Negative internal design pressure (e.g. partial vacuum condition):	
2.13	Measures used for additional protection if wall thickness reduction shall be applied:	
3	Construction	
3.1	Shell wall material:	
3.1.1	Grade:	
3.1.2	Minimum mechanical properties according to normative reference [1)] (R_e, R_m, A, product R x A)	
3.1.3	Heat treatment:	
3.1.4	Protective lining (internal and resp. external):	
3.1.5	Other lining:	
3.2	Shell end material:	
3.2.1	Grade:	
3.2.2	Minimum mechanical properties according to normative reference: (R_e, R_m, A, product R x A)	
3.2.3	Heat treatment:	
3.2.4	Protective lining (internal and resp. external):	
3.2.5	Other lining:	
3.3	Partition material	

1) When austenitic steels are used, the specified minimum values of R_e and R_m according to the material standards may be exceeded by up to 15 % if these higher values are attested in the inspection certificate. An additional minimum wall thickness arising from these values should be stated in this data sheet.

3.3.1	Grade:	
3.3.2	Minimum mechanical properties according to normative reference[1)]: (R_e, R_m, A, product R x A)	
3.3.3	Heat treatment:	
3.3.4	Protective lining (internal and resp. external):	
3.3.5	Other lining:	
3.4	Frame/attachment material:	
3.4.1	Grade:	
3.4.2	Minimum mechanical properties according to normative reference:	
3.4.3	Heat treatment:	
3.5	Tank	
3.5.1	Construction of the ends:	
3.5.1.1	Length of the cylindrical part of the end, if required by the technical code:	
3.5.1.2	Knuckle radius:	
3.5.1.3	Radius of spherical part:	
3.5.1.4	Description of attachment to the shell wall (e.g. see drawing number ...):	
3.5.2	Construction of partitions:	
3.5.2.1	Length of the cylindrical part of the end, if required by the technical code:	
3.5.2.2	Knuckle radius:	
3.5.2.3	Radius of spherical part:	
3.5.2.4	Description of attachment to the tank (e.g. see drawing number ...):	
3.5.3	Construction of the baffles and surge plates:	
3.5.3.1	Description of baffles and surge plates and their attachment to the tank (e.g. see drawing number ...):	
3.5.4	Welding procedures:	
3.5.5	Welding coefficient:	
3.6	Manholes or cleaning openings	
3.6.1	Type of closure:	
3.6.2	Dimensions:	
3.7	Service equipment	
3.7.1	Description of pipes passing through the tank shell (e.g. drain tubes, vapour recovery tubes):	
3.7.2	General description of loading and discharge systems including schematic drawings:	
3.7.3	Listing of the service equipment with the relevant technical data or relevant standard:	

3.7.4	Heating system	
3.7.4.1	Type of heating system:	
3.7.4.2	Material heating coils:	
3.7.4.3	Test pressure of heating coils:	
3.7.5	Gasket (compatibility of the gaskets with the carried products):	
3.7.6	Other devices (type of attachment to the shell):	
3.8	Protection of the tank and its equipment	
3.8.1	Top (type and characteristics):	
3.8.2	Equipment located underneath the tank (type and characteristics):	
3.8.3	Rear end (type and characteristics):	
3.9	Attachment of the tank:	
4	Miscellaneous	
4.1	List of design documents and drawings:	
4.2	Maximum permissible gross and tare mass if applicable:	
4.3	Reduction in volume permitted (Yes/No):	
4.4	Any additional information:	

Annex C
(informative)

Hydraulic pressure testing with gases – hazards and precautions

Pressure testing using gases (including air) as the pressurising medium is potentially dangerous. The energy stored within a tank under test could be released explosively if the tank should fail.

The size and type of tank and the level of pressure are factors which have a bearing on the degree of danger involved and on the nature of precautions to be taken. This annex outlines some of the factors to be considered.

Before testing, an assessment of the tank should be made and a detailed inspection should be carried out. Prior to the pressure test radiographic or other non-destructive inspection should have been carried out followed by any necessary repairs and post-weld heat treatment.

Where practicable, steps should be taken to reduce to a minimum the internal volume of the system to be tested. This has the effect of reducing the consequences of a rupture under test.

Local chilling during filling and emptying of the tank can be reduced by exercising sufficient control to avoid sudden changes in flow rate across inlet and exhaust control valves or nozzles. The temperature of the gas entering the tank should not be lower than the agreed test temperature.

The possibility of condensation occurring within the tank due to the effect of pressure and temperature changes on the relative humidity of the test gas should be considered. Condensation within the tank would defeat the object of pneumatic testing when it was used rather than hydraulic testing to avoid contamination of the interior.

Care should be taken to ensure that the methods used for sealing openings in the tank under test are suitable.

The test gas supply can be controlled by using reducing valves and other valves that regulate the flow of test gas into the tank. Pressure and, if necessary, temperature gauges should be located where they can be easily seen by the operator.

Safety valves of adequate size, properly set, sealed and marked with the set pressure, can be installed in the test supply line to prevent the test pressure from being exceeded.

Flexible pipes and their connections should be regularly examined to reduce the risk of failure.

The risk of injuries to persons nearby can be reduced by the use of safety restraints attached on either side of the connection.

Tanks undergoing pneumatic tests should be isolated or enclosed to ensure safety of persons in nearby buildings, public roads or open areas. If the tank is not safely isolated it should be contained within a blast pit retaining walls or substantial enclosure demonstrably capable of withstanding the blast or flying projectiles that could result from tank failure. The air, or gas suddenly released by failure should be exhausted safely.

A tank should not be subjected to any form of shock loading such as hammer testing whilst undergoing a pressure test.

The tank at pressure should not be approached for close examination until a reasonable period of time has elapsed and the pressure has been reduced. The pressure at which the tank can be approached for close examination should be specified in the test procedures.

There is a risk of injury from particles of dirt and high velocity jets ejected during a hydraulic test at high pressure. A much greater risk exists during a pneumatic test. Personal protection including eye protection should therefore be provided and used by persons required to work within the pressure test facility.

Supervisors and operators of pressure test facilities should receive specific training and instruction. Additionally, a permit-to-work system can be implemented to control work procedures during pressure testing.

Interchangeable pressure test components such as blank flanges, mounting studs, pressure gauges, pressure relief devices and flexible connections should be the subject of regular examination by an appointed person. The appointment can be confirmed in writing to the person and others associated with the pressure test facility. Pressure test components should be properly stored and identified to assist correct selection and use for the purpose intended. Their issue should be recorded.

Special care is required when tanks with more than one compartment are subjected to leak testing. Fatal accidents have been known to occur, for instance, during inspection of the partition welds for leaks when the partitions collapsed under quite low differential pressures. No persons should enter a multi-compartment tank for leak testing until the mechanical integrity of the partition has been confirmed. The leak test pressure should be substantially below the pressure used to confirm the mechanical integrity.

All pressure gauges and temperature gauges used for pressure testing should be compared regularly with a calibrated gauge and records of the comparison kept.

A range of air pressures can be required from a common source of supply. In order to reduce the risk of an incorrect pressure being connected, it can be advisable to have different sizes or types of connections on hose ends, and to arrange that the tank being tested has compatible connections.

Where flexible tube connections are used, they should be securely fastened. Tubing (flexible tubes) simply being pushed onto a pipe or spigot on the test component cannot be accepted as a method of preventing the safe working pressure from being exceeded. Proper pressure relief device should always be provided and used for pressure testing.

As it is vital that safety valves are supplied and maintained in proper working order, a test of the setting should be carried out at the initial and subsequent periodic examination, repair or replacement. Safety valves should be removed regularly and be stripped, cleaned, examined and before re-use the set pressure checked.

Annex D
(informative)

Certificate of initial, periodic and intermediate inspection and exceptional check

In Table D.1 an example for a certificate according to 5.13.2 is given.

NOTE Copying of the certificate is permitted.

Table D.1 — Example for a certificate according to 5.13.2

<table>
<tr><th>Name of the expert's organisation and address</th><th>Sign of expert's organisation</th></tr>
<tr><td>Number of test report:
_____
Applicant/
User
_____
Street
_____
Postal Code
_____
Town
_____
Country
_____</td><td>Number of type approval
_____
Name of manufacturer
_____
Country
_____
Manufacturer's serial number
_____
Year of manufacture
_____
Date and kind of last inspection
_____
Owner's/operator's tank identification
_____</td></tr>
<tr><td colspan="2">IMO tank type/tank instruction/tank code/special provision(s) _____
Wall thickness shell, required: _____ mm, actually measured: _____ mm
Wall thickness ends, required: _____ mm, actually measured: _____ mm
Wall thickness partitions, required: _____ mm, actually measured: _____ mm
Test pressure: _____ bar
Maximum allowable working pressure: _____ bar, external design pressure _____- bar
Design pressure: min. bar, max. bar</td></tr>
<tr><td colspan="2">
<table>
<tr><td>Compartment</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>total</td></tr>
<tr><td>Capacity in litre</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td colspan="2">Examination of documents O
Check of the design characteristics O
Inspection of the tank interior O
Inspection of the tank exterior O
Hydraulic pressure test O
Inspection of service equipment O
Leakproofness test tank/equipment O
Vacuum testing O
Determination of water capacity O
Inspection of frame or other structural equipment of portable tanks O
Safety valve set to bar overpressure Vacuum valve set to bar underpressure
Other inspections and tests</td></tr>
<tr><td colspan="2">Remarks/defects which can impair the safety of the tank or the equipment:</td></tr>
</table>

Additional requirements of type approval:												
Initial inspection	O	passed	O	failed	O	ADR	O					
Periodic inspection	O	passed	O	failed	O	RID	O					
Intermediate inspection	O	passed	O	failed	O	IMDG-Code	O					
Exceptional check	O	passed	O	failed	O	Other	O					
Next regular inspection _____ Location and date of inspection _____												
Periodic inspection O												
Intermediate inspection O Signature and stamp _____												
Inspections carried out in accordance with EN 12972:2015												
Remarks												

Annex E
(normative)

Tank plates for fixed tanks (tank vehicles) and demountable tanks for the transport of dangerous goods

E.1 Tank plate

The general layout of the tank plate for fixed tanks (tank vehicles) and demountable tanks for the transport of dangerous goods shall be as given in Table E.1.

NOTE 1 According to ADR/RID the use of "bar" instead of "MPa" is allowed.

NOTE 2 If applicable the requirements of the Directive 2010/35/EC according to the Pi-marking will be applied in addition.

Table E.1 — Tank plate

EN 12972

1	Manufacturer				
2	Approval number				
3	Manufacturer's serial number				
4	Year of manufacture				
5	Test pressure	a) whole tank			MPa
		b) compartments			MPa
6	Capacity of the tank (total) /				litres
	Capacity of the compartments	l	l	l	l
		l	l	l	l
7	Design temperature				°C
8	Tank material and material reference				
9	Material protective lining/coating				
10	Insulation				
11	Maximum working pressure				MPa
12	External design pressure				
13	Name of dangerous good(s)	14 Maximum mass	15 Maximum filling pressure	16 Filling temperature	
		kg	MPa	°C	
17	Stamps of expert (initial, intermediate and periodic inspection)				
NOTE Lines 5 b), 7, 9, 10, 11, 13, 14, 15 and 16 only if required, otherwise to be omitted.					

E.2 Content of the marking of the tank plate

The content of the tank plate for fixed tanks (tank vehicles) and demountable tanks for the transport of dangerous goods shall be as given in Table E.2.

Table E.2 — Content of the marking of the tank plate

No.	Content
1	Manufacturer's name or mark
2	Approval number given by the competent authority or body designated by this authority
3	Serial or production number issued by the manufacturer
4	Year of manufacture
5	Test pressure of the shell as a whole and test pressure by compartment in MPa (gauge pressure where the test pressure of each compartment is less than the test pressure of the shell
6	Capacity in litres; after the indication of litres followed by the symbol "S" if the shell or the compartments of more than 7 500 l are divided by surge plates into sections of not more than 7 500 litres capacity.
7	Design temperature in °C (if above 50 °C or below − 20 °C)
8	Materials of the shell and of the ends if different
9	Material of protective lining or coating if applicable. Brand names may be used if they are in common use
10	Type of insulation of the tank in words, e.g. "thermally insulated" or "thermally insulated by vacuum", if applicable
11	Maximum working pressure (gauge) in MPa
12	External design pressure in MPa
13	The proper shipping name and in the case of n.o.s. entries the technical name of the gas(es) for which the tank is approved
14	Maximum allowable mass of gases according to no 13
15	Maximum filling pressure of gases at 15 °C
16	Filling temperature of gases if below − 20 °C
17	Month and year of the initial inspection and of each subsequent intermediate and periodic inspection and stamp of the expert who carried out the inspection followed by the letter "L" in the case of an intermediate inspection or "P" in the case of an initial or periodic inspection
NOTE	The lines 5 b), 7, 9, 10, 11, 13, 14, 15 and 16 only if required, otherwise to be omitted.

Annex F
(normative)

Tank plates for tank containers or portable tanks for the transport of dangerous goods

F.1 Tank plate for tank containers or portable tanks for the transport of dangerous liquids and solids

The general layout of the tank plate for tank containers or portable tanks for the transport of dangerous liquids and solids shall be as given in Table F.1.

Table F.1 — Tank plate

EN 12972

1	Manufacturer's name				
2	Manufacturer's serial number				
3	Country of manufacture				
4	Country of approval				
5	Approval number(s)				
6	Authorised body for design approval				
7	Owner's registration number				
8	Regulations to which tank is approved				
9	Pressure vessel code to which tank is designed				
10	Year of manufacture				
11	Hydraulic test pressure				
12	External design pressure				
13	Water capacity of the tank at 20 °C			l	
14	Water capacity of each compartment at 20 °C	1. l	2. l	3. l	
		4. l	5. l	6. l	
15	Tank material and material reference				
16	Equivalent thickness in reference steel			mm	
17	Lining material				
18	Type of insulation				
19	Maximum (allowable) working pressure				
20	Maximum permissible gross mass			kg	
21	Tare mass			kg	
22	Original hydraulic pressure test date and stamp				

	of expert		
23	Date of most recent inspection and stamp of expert followed by the letter "L" or "P"		
24	Metallurgical design temperature range if below -20 °C or above +50 °C	°C	
25	Maximum allowable working pressure of heating/cooling system (where used)	bar/kPa	

If the maximum usable capacity is lower than the total inner capacity this reduced capacity shall be indicated on the tank plate in lines 13 and 14.

NOTE 1 The marking with "UN" and the lines 3 to 7, 9, 12, 16 and 25 only for portable tanks according to chapter 6.7 ADR/RID.

NOTE 2 In the right column a voluntary wording in a second language may be included.

NOTE 3 Marking in line 23 with the letters "L" or '"P" only if required by regulation.

NOTE 4 After the indication of litres followed by the symbol "S" if the shell or the compartments of more than 7 500 l are divided by surge plates into sections of not more than 7 500 l capacity.

NOTE 5 In the lines 11, 12, 19 and 25 the chosen measuring unit bar or kPa will be given after the numerical value.

F.2Tank plate for tank containers or portable tanks for the transport of gases

The general layout of the tank plate for tank containers or portable tanks for the transport of gases shall be as given in Table F.2.

NOTE If applicable the requirements of the Directive 2010/35/EC according to the Pi-marking will be applied in addition.

Table F.2 — Tank plate

EN 12972

1	Manufacturer's name		
2	Manufacturer's serial number		
3	Country of manufacture		
4	Country of approval		
5	Approval number(s)		
6	Authorised body for design approval		
7	Owner's registration number		
8	Regulations to which tank is approved		
9	Pressure vessel code to which tank is designed		
10	Year of manufacture		
11	Hydraulic test pressure		
12	External design pressure		other gases
13	Water capacity of the tank at 20 °C	l	

14	Water capacity of each compartment at 20 °C	1. l	2. l	3. l	other gases
		4. l	5. l	6. l	
15	Tank shell material and material reference				
16	Equivalent thickness in mild steel			mm	
17	Material of protective lining				
18	Type of insulation				
19	Maximum allowable working pressure				
20	Maximum permissible gross mass			kg	
21	Tare mass			kg	
22	Original hydraulic pressure test date and stamp of expert				
23	Date of most recent inspection and				
	stamp of expert followed by the letter "L" or "P"				
24	Metallurgical design temperature if below -30 °C			°C	
25	Design reference temperature			°C	other gases
26	Filling temperature, if below -20 °C			°C	
27	Maximum filling pressure at 15 °C				
28	The names, in full, of the gases for whose carriage the shell is approved and the maximum permissible load mass			kg	
				kg	
				kg	
				kg	
29	Either	"thermally insulated" or "vacuum insulated"			
30	Effectiveness of the insulation system			watts (W)	
31	Reference holding time and pressure and degree of filling for each refrigerated liquefied gas permitted for transport			days	

If the maximum usable capacity is lower than the total inner capacity this reduced capacity shall be indicated on the tank plate in lines 13 and 14.

NOTE 1 Line 27 only for compressed gases, otherwise to be omitted.

NOTE 2 In the right column, a voluntary wording in a second language may be included.

NOTE 3 For the completion of line 18 see E.2 line 10.

NOTE 4 Lines 30 and 31 only for portable tanks for refrigerated liquefied gases.

NOTE 5 In line 25 design reference temperature will be taken as minimum design temperature for refrigerated gases.

NOTE 6 UN and lines 3 to 7, 12, 16 and 25 only for portable tanks according to chapter 6.7 ADR/RID.

NOTE 7 Marking in line 23 with the letters "L" or "P" only if required by regulation.

NOTE 8 After the indication of litres in lines 13 and 14 followed by the symbol "S" if the shell or the compartments of more than 7 500 l are divided by surge plates into sections of not more than 7 500 l capacity.

NOTE 9 In the lines 11, 12, 19, 27 and 31 the chosen measuring unit bar or kPa will be given after the numerical value.

Bibliography

[1] INTERGOVERNMENTAL ORGANISATION FOR INTERNATIONAL CARRIAGE BY RAIL (OTIF). Regulations concerning the International Carriage of Dangerous Goods by Rail (RID)[2)]

[2] UNITED NATIONS. European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)[3)]

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

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

[5] OIML R 80[4)], *Road and rail tankers*

[6] ISO 1496-3, *Series 1 freight containers - Specification and testing - Part 3: Tank containers for liquids, gases and pressurized dry bulk*

[7] EN 1432, *Swap bodies - Swap tanks - Dimensions, requirements, test methods, operation conditions*

[8] UIC 591, *Roller units for horizontal transhipment - Technical conditions governing their use in international traffic*

[9] UIC 592-4[5)], *Swap bodies for grab handling and spreader gripping - Technical conditions*

[10] International Maritime Dangerous Goods (IMDG) Code[6)]

[11] International Convention for Safe Containers (CSC)

2) Commonly known as RID, may be purchased from: Zwischenstaatliche Organisation für den internationalen Eisenbahnverkehr (OTIF), Gryphenhübeliweg 30, CH-3006 Bern.

3) Commonly known as ADR, may be purchased from United Nations Sales Section, Geneva, or bookstores and distributors of United Nations Publications.

4) May be purchased from: Organisation internationale de métrologie légale, 11, rue Turgot, F-75009 Paris.

5) May be purchased from: UIC Bureau RIV-RIC, 16 rue Jean Rey, F-75015 Paris.

6) May be purchased from: International Maritime Organisation, 4 Albert Embankment, London SE1 7SR.

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