LPG equipment and accessories — Transportable refillable composite cylinders for Liquefied Petroleum Gas (LPG) — Periodic inspection

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ICS 23.020.30
National foreword

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The UK participation in its preparation was entrusted to Technical Committee PVE/19, LPG containers and their associated fittings, which has the responsibility to:

— aid enquirers to understand the text;
— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
— monitor related international and European developments and promulgate them in the UK.

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

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 21 and a back cover.

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LPG equipment and accessories - Transportable refillable composite cylinders for Liquefied Petroleum Gas (LPG) - Periodic inspection

This European Standard was approved by CEN on 27 October 2005.

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Foreword

This European Standard (EN 14767:2005) has been prepared by Technical Committee CEN/TC 286 “Liquefied petroleum gas equipment and accessories”, the secretariat of which is held by NSAI.

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of an identical text or by endorsement, at the latest by June 2006, and conflicting national standards shall be withdrawn at the latest by June 2006.

This European Standard has been submitted for reference into the RID and/or in the technical annexes of the ADR. Therefore the standards listed in the normative references and covering basic requirements of the RID/ADR not addressed within this European Standard are normative only when the standards themselves are referred to in the RID and/or in the technical annexes of the ADR.

Photographs presented in Annex B should be considered in colour in order to improve pictorial guidance.

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

The primary objective of the periodic inspection of transportable refillable composite liquefied petroleum gas (LPG) cylinders is that, at the completion of the tests, the cylinders can be re-introduced into service for a further period of time.

Periodic inspection is normally carried out at a test station operated under the responsibility of a competent gas organisation, or of a third party.

This European Standard has now been prepared to reflect the current state of the art for periodically inspecting composite LPG cylinders.

This European Standard calls for the use of substances and procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

It has been assumed in the drafting of this European Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

Where judgements are called for, it has been assumed that they are made by competent persons who have been trained specifically for the tasks.

1 Scope

This European Standard specifies periodic inspection intervals, procedures for inspection, inspection and testing for transportable refillable composite LPG cylinders with a water capacity from 0,5 l up to and including 150 l.

This European Standard is applicable to cylinders that comprise a liner of metallic material (welded or seamless), or non-metallic material, (or a mixture thereof), reinforced by a wound composite consisting of fibres of glass or carbon or aramid (or a mixture thereof) embedded in a matrix.

This European Standard is also applicable to composite cylinders without liners.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

EN 13152, Specification and testing of LPG cylinder valves — Self closing

EN 13153, Specification and testing of LPG cylinder valves — Manually operated
3 Terms and definitions

For the purpose of this European Standard, the following terms and definitions apply.

3.1 competent body
person or corporate body defined by the national authority, which by a combination of appropriate qualification, training, experience and resources is able to make objective judgements on the subject

3.2 competent person
person who by a combination of training, experience and supervision is able to make objective judgements on the subject

3.3 periodic inspection
activities carried out at defined intervals, such as examining, measuring, testing or gauging the characteristics of a cylinder and comparing these with specified requirements as defined in EN 14427 and marking to attest conformity

3.4 LPG (liquefied petroleum gas)
mixture of predominantly butane or propane with traces of other hydrocarbon gases classified in accordance with UN number 1965, hydrocarbon gases mixture, liquefied, NOS or UN number 1075, petroleum gases, liquefied

NOTE In some countries, UN number 1011, 1978 may also be designated LPG.

3.5 tare weight
sum of the mass of the empty cylinder, the mass of the valve including a dip tube where fitted, and the mass of all other parts that are permanently attached to the cylinder when it is being filled, e.g. fixed valve guard

3.6 casing
permanently attached sleeve covering part of or the whole of the pressure containing envelope usually incorporating a foot ring and a shroud

NOTE Permanently attached means that the casing cannot be removed during service without being destroyed, or by using special tools.
4 Written scheme of inspection

The determination of the interval between periodic inspections shall be dependent on the content of a written scheme that shall be approved by a competent authority as complying with the conditions outlined in Annex A.

NOTE The interval between periodic inspections shall be 5 years. Nevertheless, a longer interval may be agreed provided the requirements of Annex A are fully met.

The inspection procedures to be applied shall be selected from the alternatives given in Clause 5.

5 Procedures for periodic inspection

5.1 General

Procedures for periodic inspection shall consist of an external visual inspection as described in 5.2, an internal visual inspection as described in 5.3, and additionally, at least one of the procedures listed in 5.4. For transparent composite cylinders, the internal visual inspection may be made from outside.

Periodic inspections/tests shall be carried out under the responsibility of a body approved by a competent authority.

5.2 External visual inspection

5.2.1 Preparation

If required the cylinder shall be cleaned and have all labels, tar oil or other foreign matter removed from its external surface e.g. by water jet cleaning, chemical cleaning or other suitable methods.

Care shall be taken to avoid damaging the cylinder.

Cylinders rejected shall be segregated for rendering unserviceable.

NOTE In some countries, render unserviceable means scrapping.

5.2.2 Inspection procedure

The entire surface of the cylinder shall be inspected for:

a) Cuts, gouges, bulges, cracks or de-laminations, applying the criteria for acceptance/rejection in 5.2.3.

b) Other defects e.g. depressed bung or fire damage applying to the criteria for acceptance/rejection in Table 1.

c) Integrity of all permanent attachments.

d) The integrity of the mandatory permanent marking.

Any cylinder rejected by the competent person shall be segregated for scrapping.

5.2.3 Visible defects

The owner (or his authorized representative) shall provide to the filler acceptance/rejection criteria for physical and material defects and heat damage on the cylinder/casing.
Those criteria shall be at least those established by the manufacturer taking into account the design conditions of the cylinder type (e.g.: nature of the casing if any, nature and type of the fibre and of the resin system).

Rejection criteria for defects on cylinders are described in Table 1.

For rejection criteria described in Table 1, if applicable, the limit shall be defined in accordance with the following method:

— for each type of cylinder as defined in EN 14427:2004, A.2.1, the manufacturer shall provide samples;

— for each rejection criteria, the manufacturer shall provide at least 4 cylinders with the same defect. The size of this defect is recorded. If the defects of the cylinders are different sizes, the size of the smaller defect shall be recorded;

— two cylinders shall be submitted to the burst test (see EN 14427:2004, 5.2.5) and two cylinders shall be submitted to the pressure cycle test (see EN 14427:2004, 5.2.6);

— if the cylinders pass the tests, the defect is acceptable. The rejection limit can be defined by the size of that defect;

— when all rejection criteria have been established for a design of cylinder as defined in EN 14427:2004, A.2.1, Table 1 shall be completed by the owner/manufacturer of the cylinder. Annex B shows an example of a completed table.
### Table 1 — Acceptance/Rejection criteria

<table>
<thead>
<tr>
<th>Defect</th>
<th>Description</th>
<th>Rejection limit</th>
</tr>
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<tbody>
<tr>
<td>Abrasion damage or damage from cuts</td>
<td>Abrasion damage caused by wearing, grinding or rubbing material away by friction.</td>
<td>See 5.2.3</td>
</tr>
<tr>
<td></td>
<td>Cuts or gouges caused by contact with sharp objects in such a way as to cut into the composite, reducing its thickness at that point.</td>
<td></td>
</tr>
<tr>
<td>De-lamination and impact damage</td>
<td>Inter-laminar de-lamination where there is a separation of layers of strands.</td>
<td>See 5.2.3</td>
</tr>
<tr>
<td></td>
<td>Intra-laminar de-lamination where there is a separation between strands within the same layer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impact damage appearing as hairline cracks in the resin or de-lamination or cuts of the composite material.</td>
<td></td>
</tr>
<tr>
<td>Chemical damage</td>
<td>Chemical attack appearing as the dissolution of the resin matrix surrounding the fibres, where the cylinder surface is sticky.</td>
<td>See 5.2.3</td>
</tr>
<tr>
<td></td>
<td>If the casing is not drainable, chemical attack might appear inside the casing.</td>
<td></td>
</tr>
<tr>
<td>Damage of casing</td>
<td>Minor damage that does not affect the protecting function of the casing is acceptable. If it cannot be established that the cylinder is unaffected, the cylinder shall be put aside for further investigation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unacceptable damage is, for example, a broken casing. The casing is then to be removed and the cylinder inspected underneath. A damaged cylinder shall be rejected. If the cylinder is not damaged, a new casing can be assembled.</td>
<td></td>
</tr>
<tr>
<td>Heat/fire damage of casing or cylinder</td>
<td>Heat or fire damage evident by discolouration, scarring or burning of the composite overwrap, casing, labels and non-metallic components of the valve.</td>
<td>See 5.2.3</td>
</tr>
<tr>
<td>Other defects</td>
<td></td>
<td>See 5.2.3, if applicable</td>
</tr>
</tbody>
</table>

**NOTE 1** Inter-laminar de-lamination is a separation of layers of strands, while intra-laminar de-lamination is separation between strands within the same layer.

**NOTE 2** For cylinders with liners, an area with no adhesion between liner and composite is not regarded as de-lamination.

### 5.3 Internal visual inspection

#### 5.3.1 General

An internal visual inspection shall be performed to detect internal defects or presence of foreign matter in non-transparent cylinders.
5.3.2 Preparation of cylinders

a) The cylinders shall be depressurized in a safe and controlled manner before proceeding.

b) Cylinders with inoperative or blocked valves shall be brought to a place for safe valve removal.

c) Valves shall be removed from cylinders. For inspection, maintenance and scrapping of cylinder valves see prEN 14912.

d) Care shall be taken when clamping composite cylinders in order to avoid damage of the overwrapping.

5.3.3 Procedure

After removing, where necessary, residual liquid and any other foreign matter from the interior, cylinders shall be inspected internally for any signs of internal corrosion (for metallic liner) or other signs that may affect its integrity, using a safe inspection lighting system with appropriate internal illumination (e.g. an endoscope).

Cylinders showing signs of internal defects, e.g. cracks, damaged liner, internal corrosion or chemical attack, shall be scrapped. If cleaning is required, care shall be taken to avoid damaging the cylinder walls. Cylinders shall be re-inspected after cleaning.

5.4 Additional inspection /test procedures

5.4.1 General: preparation of cylinders

As a minimum:

a) Cylinders with inoperative or blocked valves shall be brought to a place for safe valve removal.

b) Valves shall be checked in accordance with prEN 14912 at every third periodic inspection (this assumes that the periodic inspection interval is 5 years).

5.4.2 Hydraulic proof pressure test

5.4.2.1 General

A liquid shall be used as the test medium, e.g. water or kerosene.

5.4.2.2 Preparation of cylinders

In addition to requirements in 5.4.1, the external surface of the cylinder shall be in such condition that any leak can be detected. If the cleaning method involves the wetting of the outside surface, the outside surface shall be completely dried before commencing the test procedure.

The cylinders shall be emptied of any liquid and depressurised in a safe and controlled manner before proceeding.

5.4.2.3 Test equipment

Pressure gauges that are used to read the cylinder test pressure shall be in accordance with EN 837-1 and EN 837-3 accuracy class 1.6 or better. They shall be calibrated or checked for accuracy against a master gauge at regular intervals and in any case not less frequently than once a month. The master gauge shall be re-calibrated in accordance with national requirements.

The design and installation of the equipment and the cylinders connected to it shall ensure that no air is trapped in the system.
All joints within the system shall be leak tight.

A device shall be fitted to the test equipment to ensure that no cylinder is subjected to pressure in excess of its test pressure by more than the tolerance given in 5.4.2.4.

The test equipment shall not restrict the expansion of the cylinder.

5.4.2.4 Procedure

a) The pressure of the test shall be at least the test pressure marked on the cylinder.

b) The pressure shall be increased gradually in the cylinder until the test pressure is reached. Then the cylinder shall be isolated from the pumping system.

c) The test pressure shall not be exceeded by more than 20 % or 6 bar, whichever is the lesser. More than one cylinder may be tested at a time provided they all have a test pressure within the tolerance specified. If the cylinder is tested to a higher pressure than that marked, a competent person shall check that the actual pressure applied does not result in a general membrane stress in the cylinder wall more than 95 % of the yield strength of the material used in the cylinder.

d) The test pressure shall be held for the time necessary to inspect the cylinder and check it out for any leak and/or other defects.

e) If there is a leakage in the pressure system, it shall be corrected and the cylinders re-tested.

f) Cylinders that do not leak or show any visible permanent distortion after the pressure has been released shall be deemed to have passed this test. Cylinders showing other visible defects shall be examined by a competent person.

g) Cylinders that fail shall be rejected.

5.4.3 Pneumatic proof test and leak test

5.4.3.1 Preparation of cylinders

Air or another suitable gas shall be used as a test medium.

Cylinders shall be prepared in accordance with 5.4.1 a) and b).

5.4.3.2 Procedure

5.4.3.2.1 Proof test

a) Cylinders shall be tested in a safe enclosure to protect against rupture under pneumatic pressure.

b) The pressure of the test shall be at least the test pressure marked on the cylinder.

c) The leakage check shall be for the entire cylinder and shall be by full water immersion or an equivalent detection system.

d) After the cylinder has been placed in a safe enclosure, it shall be charged with the pneumatic test medium (e.g. natural gas, air, nitrogen) to the test pressure and held at that pressure for 5 s to 7 s.

e) The cylinder passes the proof test if it does not leak.

f) The cylinder shall be isolated from the pressure source.
5.4.3.2.2 Leak test

a) The pressure shall be reduced to a pressure not less than 6 bar.

b) The reduced pressure shall be held for the time necessary to inspect the cylinder and checked it out for any leaks.

c) Cylinders that do not leak or show any visible permanent distortion after the pressure has been released shall be deemed to have passed this test.

d) Cylinders that fail shall be rejected.

5.4.4 Pneumatic leak test

Pneumatic leak test may be used as an alternative test method to the method described in 5.3.2.2 provided that the cylinder design burst pressure is known, or can be shown to be at least:

- 35 bar for commercial butane cylinders and
- 70 bar for commercial propane cylinders.

5.4.4.1 Preparation of cylinder

Cylinders shall be prepared in accordance with 5.4.1 a) and b).

5.4.4.2 Procedure

a) The test shall consist of full immersion of the cylinder in water or an equivalent detection system.

b) The cylinder shall be filled with a pneumatic test medium (e.g. natural gas, air, nitrogen) in such a way that the internal pressure developed in the cylinders at the time they are checked for leakage shall not be less than 6 bar.

c) Propane vapour may also be used as the test medium. Then the cylinder shall be isolated from the pressure source.

   NOTE To achieve this pressure the ambient temperature should be at least 20 °C.

d) The gas tightness check shall be capable of detecting any leak from any part of the cylinders and their equipment.

e) Cylinders that do not leak or show any visible permanent distortion after the pressure has been released shall be deemed to have passed the test.

f) Cylinders that fail shall be rejected.

6 Inspection of cylinder threads

6.1 Threads

When the valve (or any other fitting) is removed during periodic inspection, the cylinder threads concerned shall be inspected in accordance with 6.2 to 6.4.
6.2 Internal threads

The internal threads of the cylinder shall be examined to ensure that they are of full form and clean. They shall be checked for burrs, cracks, and other thread damage.

6.3 External threads

External neck threads, which are required for operational reasons, shall be examined for integrity and for thread damage.

6.4 Damaged threads

Where necessary, and where the design permits, damaged threads may be rectified by a competent person. Alternatively, the cylinder shall be rendered unserviceable in accordance with Clause 9.

7 Final operations

7.1 Drying

Following a hydraulic test with water, the inside of the cylinder shall be dried e.g. by using dry compressed air.

7.2 Valving

When a new, inspected or refurbished valve, incorporating a pressure relief valve and suitable for the intended use, is fitted to the cylinder, a sealing material/system and the optimum torque shall be used to ensure a seal between the valve and the cylinder.

The torque applied shall be consistent with both the cylinder and valve manufacturers’ recommendations.

New valves shall be in accordance with EN 13152 and EN 13153, inspected or refurbished valves shall be in accordance with prEN 14912.

NOTE Care needs to be taken when clamping composite cylinders in order to avoid damage of the over wrapping.

7.3 Tare weight

The tare weight or indication of tare weight of the cylinder shall be re-established if any modification or revailing has been made that affects the tare weight of the cylinder.

If the new tare is different from the old tare weight, it shall be marked on the cylinder and the former tare shall be made unreadable.

7.4 Marking

After successful completion of the periodic inspection, each cylinder shall be legibly and durably marked in accordance with prEN 14894.

NOTE In case of periodic inspection conducted as described in 5.4 special provisions for marking/registration may be defined and agreed by the competent authority.

7.5 Purging

Air shall be removed from the cylinder, e.g. by evacuation or by displacement with LPG.

NOTE This may be performed at the test station or at the filling station.
Cylinders with the following marking:

"WARNING – THIS CYLINDER MUST NOT BE SUBMITTED TO A VACUUM OR BE FILLED WITH BUTANE"

shall not be subjected to a pressure below atmospheric pressure.

8 Records

The organisation operating the testing station shall maintain records including quality system, inspection reports and test data, calibration data and reports concerning the qualifications or approvals of the competent persons.

Inspection reports and test data for cylinders shall be kept and maintained by the organisation operating the testing station at least for the retest period plus 2 years.

An inspection report or test data can cover one or more cylinders.

9 Rendering cylinders unserviceable

With the agreement of the owner, a cylinder shall be rendered unserviceable, so that it cannot be re-issued into service as a pressure vessel using one of the following methods:

— by crushing or shredding the cylinder using mechanical means;
— drilling two holes of approximately 20 mm in diameter in the cylinder wall;
— by irregular cutting of the neck;
— by irregular cutting of the cylinder in two or more pieces;
— by bursting (in a controlled and safe manner);
— by other suitable safe method.
Requirements for 10-year periodic inspection interval

A.1 General

For a cylinder to qualify for a 10-year time interval, all of the following requirements shall apply:

a) Each type of cylinder as defined in EN 14427:2004, A.2.1 shall undergo and pass the following tests:
   — 100 cylinders older than 5 years shall be picked at random;
   — 80 cylinders shall be subjected to and pass a burst test in accordance with test no. 5 in EN 14427:2004;
   — 20 cylinders shall be subjected to and pass a fatigue test in accordance with test no. 6 in EN 14427:2004.

b) The cylinder shall be filled in accordance with the criteria contained in EN 14763 or an equivalent standard approved by a competent authority with particular emphasis on:
   — cylinder identification (e.g. design code, tare weight, mark of the competent body) (see prEN 14894);
   — external cylinder condition (see 5.2).

c) Cylinders are designed, manufactured and tested to EN 14427, or an equivalent standard approved by a competent authority. The LPG quality shall comply with the limitations on corrosive contaminants specified in Error! Reference source not found..

d) The cylinders shall be under the control of a competent gas organisation responsible for their distribution, filling and maintenance. The concept of control of cylinders is as stated in A.2.

e) Other conditions to be met are listed in A.3.

A.2 Concept of control

a) Cylinders shall be owned by and under the responsibility for checking, filling and maintenance of a competent gas organisation, which loans or hires them to distribution undertakings, consumers or other users under the conditions used in A.3.

or

b) Cylinders are not owned by, but their distribution, filling and maintenance are under the responsibility of a competent gas organisation.

and

The responsible competent gas organisation may contract the filling, maintenance and/or testing to other competent organisations, ensuring that the cylinders are filled, maintained and tested only as contracted in accordance with the procedures of that competent gas organisation.
A.3 Conditions

The following conditions shall be fulfilled:

a) The responsible competent gas organisation shall ensure that the cylinders are returned for filling, maintenance and/or testing to the responsible competent gas organisation or an authorized contractor, or shall be exchanged for a full cylinder at a retail outlet serviced by the responsible competent gas organisation or an authorized contractor.

b) The responsible competent gas organisation or their contractor shall have established appropriate filling, maintenance and test facilities under their control.

c) The responsible competent gas organisation shall have a policy of taking all necessary measures to ensure that their cylinders are filled, maintained and tested only at the facilities stated in b).
**Annex B**  
(informative)

**Examples of acceptance/rejection criteria**

The acceptance/rejection criteria given in Table B.1 are an example applicable to cylinders without liner manufactured from glass fibre and vinyl ester / epoxy fitted with a thermoplastic casing.

**NOTE** References to percentages will be replaced in absolute values (in mm) for particular cylinder design.

<table>
<thead>
<tr>
<th>Defect</th>
<th>Description</th>
<th>Rejection limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion damage or damage from cuts</td>
<td>Abrasion damage caused by wearing, grinding or rubbing material away by friction, see Figure B.1. Cuts or gouges caused by contact with sharp objects in such a way as to cut into the composite, reducing its thickness at that point, see Figure B.2.</td>
<td>— Depth exceeds 10% of composite overwrap thickness, or — total length of cut(s) exceeds 50% of the diameter of the cylinder, or — damaged area maximum diameter ( a ) exceeds 50% of the diameter of the cylinder. Cuts that do not sever a fibre are not included in the above.</td>
</tr>
<tr>
<td>Chemical damage</td>
<td>Chemical attack appearing as the dissolution of the resin matrix surrounding the fibres, where the cylinder surface is sticky. If the casing is not drainable, chemical attack might appear inside the casing.</td>
<td>Chemical attack resulting in damage to the resin matrix surrounding the fibres.</td>
</tr>
<tr>
<td>Damage of casing</td>
<td>Broken casing. The casing shall be removed and the cylinder inspected. A damaged cylinder shall be rejected. If the cylinder is not damaged, a new casing can be assembled. See Figure B.6. (Minor damage that does not affect the protecting function of the casing is acceptable. Acceptable damage can be, for example, small cracks, see Figure B.5. If it cannot be established that the cylinder is unaffected, the cylinder shall be put aside for further investigation.)</td>
<td></td>
</tr>
<tr>
<td>Heat/fire damage of casing or cylinder</td>
<td>Heat or fire damage evident by discolouration, scarring or burning of the composite overwrap, casing, labels and non-metallic components of the valve.</td>
<td>Visible damage from heat and/or fire. See Figure B.7.</td>
</tr>
<tr>
<td>Corrosion of bung</td>
<td>Severe corrosion.</td>
<td></td>
</tr>
</tbody>
</table>

\( a \) The maximum diameter of the damage area is the diameter of the smallest circle that includes the damaged area.

**NOTE** Inter-laminar de-lamination is a separation of layers of strands, while intra-laminar de-lamination is separation between strands within the same layer intra-laminar de-lamination appears as a whitish patch like a blister or air bubble beneath the surface. See Figures B.3 and B.4, for examples.
Figure B.1 —Damage from abrasion

Figure B.2 —Damage from cuts
Figure B.3 — Impact damage in combination with de-lamination and surface defects

Figure B.4 — De-lamination with no signs of surface damage
Figure B.5 — Defect casing

Figure B.6 — Defect casing: broken casing
Figure B.7 — Heat and fire damage
Bibliography

[1] ADR, European Agreement concerning the international carriage of Dangerous goods by Road
[2] RID, Regulations concerning the International Carriage of Dangerous Goods by Rail
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