



**Committee of Experts on the Transport of Dangerous Goods
and on the Globally Harmonized System of Classification
and Labelling of Chemicals****Sub-Committee of Experts on the Transport of Dangerous Goods****Fifty-seventh session**

Geneva, 29 June-8 July 2020

Item 3 of the provisional agenda

Listing, classification and packing**Special Provision for UN 1013, Carbon Dioxide****Transmitted by the Council On Safe Transportation of Hazardous
Articles COSTHA***

1. During the fifty-sixth session of the Sub-Committee COSTHA submitted ST/SG/AC.10/C.3/2019/62 proposing to incorporate a new special provision based on SP 653 from the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) into the UN Model Regulations. The proposal received comments from the experts from Canada, Germany, the Netherlands, Sweden, Switzerland and the United States of America. In the paper COSTHA pointed out that Canada and the United States of America have issued approvals¹ to authorize the alternative marking in ADR SP 653 for Carbon Dioxide (CO₂), UN 1013 and that the Israeli competent authority has authorized the alternative marking on packages containing CO₂ cylinders which were offered for transport by sea when in cargo transport units that are placarded and marked according to the International Maritime Dangerous Goods (IMDG) Code. Since submission of the previous proposal the United States of America has granted another approval to a separate company.

2. COSTHA experts have identified the comments received at the previous session and are providing the following responses:

- (a) The expert from Canada referred to the approval they issued and requested that the packaging have an indication of the number of cylinders and that the cylinders be limited to a maximum volume of 0.64 litre. They also indicated support for revising the limited quantity provisions to, for instance, consider revising the 120 ml limit for Division 2.2 gases. It is noted that the Canadian Temporary Certificate of Equivalency requires the gas cylinders to bear a reduced size Class 2 label and requires additional marking requirements on the outer packaging (e.g. an emergency response number, package closure instructions and information for contacting the shipper's customer service representatives). As stated previously COSTHA would support amending the

* 2020 (A/74/6 (Sect.20) and Supplementary, Subprogramme 2)

¹ Referred to as special permits in the United States of America and Equivalency Certificates in Canada. The Canadian approval is a Temporary Certificate of Equivalency which was issued to gain further experience with the proposed alternative marking and to give the company a chance to demonstrate the practical need for it.

limited quantity provisions for Division 2.2 gases. COSTHA believes that the adoption of special provisions ADR SP 653, which have been in place for over 13 years, is a separate, but supportive interim measure for the larger effort of amending the limited quantity provisions.

In relation to indicating the maximum number of cylinders on the packaging COSTHA is not opposed to this but it is not a requirement in Europe and most regulators we spoke to from Europe did not agree it was necessary.

(b) The expert from the United States of America requested additional technical data and was interested in gaining more experience with the approval they granted. Since granting the initial approval the US Department Of Transport (US DOT) has issued a second approval to another company that ships small CO₂ cylinders in a manner similar to SP 653 of the ADR. This is evidence that there is not a concern over the technical or safety aspects of these provisions. There have been no reported incidents that we are aware of since the US DOT approval was issued, and shipments are being accepted by carriers without any restrictions. In addition, the US Postal Service has agreed to authorize the acceptance of cylinder returns from consumers through the postal mail service.

(c) The expert from Sweden was generally supportive of the proposal but preferred to limit the cylinder size. COSTHA proposed a maximum volume of 1 litre but in reality, the largest cylinder of CO₂ that is transported under the exception is 0.64 litre. Based on a review of the history of the incorporation and subsequent amendments to SP 653 in the ADR, COSTHA found that Sweden was responsible for an amendment that was introduced in the 2013 editions of the RID, ADR and ADN based on ECE/TRANS/WP.15/AC.1/2011/12 as follows:

“653 The carriage of this gas in cylinders having a test pressure capacity product of maximum **15.2 MPa.litre (152 bar.litre)** is not subject to the other provisions of ADR if the following conditions are met:

- The provisions for construction and testing of cylinders are observed;
- The cylinders are contained in outer packagings which at least meet the requirements of Part 4 for combination packagings. The general provisions of packing of 4.1.1.1, 4.1.1.2 and 4.1.1.5 to 4.1.1.7 shall be observed;
- The cylinders are not packed together with other dangerous goods;
- The total gross mass of a package does not exceed 30 kg; and
- Each package is clearly and durably marked with "UN 1006" for argon compressed, "UN 1013" for carbon dioxide, "UN 1046" for helium compressed or "UN 1066" for nitrogen compressed. This marking is displayed within a diamond-shaped area surrounded by a line that measures at least 100 mm by 100 mm.”

The reason was that the water capacity indicated on many CO₂ small cylinders used in Europe was (according to Chapter 6.2) 0.605 litre (water capacity measured without the safety valve). For these cylinders, the product of the test pressure and the capacity (250 X 0.605) is 151.25 bar.litre, i.e. a little more than the required value of 150 bar.litre. Nevertheless, in practice, once the safety valve is fitted, the water capacity is only 0.595 litre, which leads to a product of 250 X 0.595=148.75 bar.litre, i.e. below the 150 bar.litre limit.

On this basis COSTHA can agree to limit the maximum size of the cylinders to having a test pressure capacity product of maximum 15.2 MPa.litre (152 bar.litre).

The expert from Sweden was also opposed allowing a smaller mark and COSTHA has subsequently removed that from the proposal.

The expert from Sweden did not believe that it is necessary to require closure instructions and training requirements. For clarification the proposal requires that the person offering the package for transport just be knowledgeable of the applicable requirements of this special provision. These provisions were added because they were required by Canada and the United States of America in the approvals that were issued. If there is a majority not in favor of these requirements COSTHA is open to removing them.

(d) The expert from Germany was not opposed to the proposal.

(e) Some experts expressed concern with authorizing the provisions for sea transport but others such as the expert from Germany were not opposed to including a special provision SP 653 like provision in the IMDG Code. Since any amendment adopted by the TDG Sub-Committee would require modal agreement, COSTHA suggests that the International Maritime Organization (IMO) will have the ability to discuss the merits of including the special provision proposed in due course. During those discussions IMO can address any additional requirements necessary (e.g. requiring cargo transport units to be placarded). It is also noted that at least one exemption to the IMDG Code has been issued to authorize sea transport.

(f) In this proposal COSTHA has taken account of the amendment to the ADR on the basis of a proposal from the expert from Switzerland to require compliance with filling provisions for cylinders in document ECE/TRANS/WP.15/AC.1/2019/10.

(g) Some members of the Sub-Committee have expressed reservations on this proposal as it does not appear to be a concern of general applicability. Our position is that this topic represents an area where the existing regulations are overly burdensome. The UN Model Regulations are quite mature and represent the baseline for the safe transport of Dangerous Goods. However, there are areas of the regulations that have commonly been granted relief from, and those areas should regularly be reviewed to determine whether they are too conservative and hindering the flow of commodities. It is the position of COSTHA that this is a representative example of where the existing regulations are burdensome and an area where data can be compiled and precedent set to review other related commodities for appropriate safety conditions.

3. For the information of the Sub-Committee COSTHA has prepared a comprehensive chronological summary of how SP 653 evolved from first being adopted under a multilateral approval to being included in the ADR, RID and ADN including technical justification based on the work of the German Federal Institute for Materials Research and Testing (BAM). This is provided in the annex to this document.

Proposal

4. Special provision SP 653 has been in the ADR since 2007 and has worked well for transport within Europe and other countries that are signatory to the multilateral treaty (49 contracting parties so far). It is proposed that the following new special provision be included in the Model Regulations for UN 1013:

In 3.2, in the Dangerous Goods List apply SP XYZ to the entry for UN1013, Carbon Dioxide.

In 3.3 include a new special provision XYZ as follows:

“XYZ Except when transported by air, gas cylinders having a test pressure capacity product of a maximum **15.2 MPa.litre (152 bar.litre)** containing Carbon Dioxide, UN 1013 are not subject to the other provisions of these Model Regulations if the following conditions are met:

(a) The provisions for construction and testing of cylinders are met;

(b) The special packing provisions for goods of Class 2 in 4.1.6 are met;

- (c) The cylinders are inspected prior to filling and are filled in accordance with the filling limits in P200 and are leak tested after filling before being offered for transport;
- (d) The cylinders are contained in outer packagings which meet the general provisions of packing of 4.1.1.1, 4.1.1.2 and 4.1.1.5 to 4.1.1.7;
- (e) The outer package must include instructions for closing the package to ensure that the general packaging requirements are met;
- (f) The cylinders are not packed together with other dangerous goods;
- (g) The total gross mass of a package does not exceed 30 kg; and
- (h) Each package is clearly and durably marked as follows:

Carbon dioxide, Division 2.2



Note: The mark illustrated above must be displayed as a square-on-point, surrounded by a line that measures at least 100 mm by 100 mm on each side.

- (i) Persons preparing and transporting shipments according to this special provision shall be knowledgeable about the applicable requirements of this special provision.

Annex

History of ADR/RID/ADN Special Provision 653

Introduction

1. In 2001, the Government of Austria initiated a multilateral agreement M114 intended to allow the carriage of carbon dioxide in conditions less stringent than those of ADR in order to simplify the carriage of small cylinders with a capacity up to 0.5 litre for the preparation of soda water, and to allow carriage in packagings suitable for delivery services to private persons and organizers of small events. For the conditions for derogation, see the text of M114 or the text reproduced under section A below since the same text was introduced in ADR in 2007.
2. The agreement was signed by Austria, Czech Republic, Germany and Norway, with a date of expiration of 1 January 2006. A corresponding agreement was concluded for rail transport (RID 2002/3).
3. For inland waterways, ADN, concluded in 2000 but entered into force in 2009 only, so no special agreement could be legally envisaged at that time for this mode of transport.
4. As M114 was due to expire on 1 January 2006, Germany prepared a proposal submitted to the ADR/RID/ADN Joint Meeting in 2005 to get this derogation embodied in ADR and RID, see below for the following events.

A 2007 version

5. The first version of special provision SP 653 was introduced in ADR/RID 2007 and read as follows:

“653 The carriage of this gas in cylinders **with a maximum capacity of 0.5 litres**, is not subject to the other provisions of ADR if the following conditions are met:

- The provisions for construction and testing of cylinders are observed;
- The cylinders are contained in outer packagings which at least meet the requirements of Part 4 for combination packagings. The general provisions of packing of 4.1.1.1, 4.1.1.2 and 4.1.1.5 to 4.1.1.7 shall be observed;
- The cylinders are not packed together with other dangerous goods;
- The total gross mass of a package does not exceed 30 kg; and
- Each package is clearly and durably marked with "UN 1013". This marking is displayed within a diamond-shaped area surrounded by a line that measures at least 100 mm by 100 mm.”

6. The proposal was made by Germany in document TRANS/WP.15/AC.1/2005/53 to reflect the derogations that had been proposed in multilateral agreement M114, initiated by Austria.

7. The justification provided was that, according to 1.1.3.2 of ADR (corresponding to 2.2.2.3 of the UN Model Regulations, except that at that time the reference temperature - now aligned with the Model Regulations - was 15 °C instead of 20 °C), carbon dioxide carried at a pressure less than 200 kPa at 20 °C, and which not liquefied or refrigerated liquefied gas (i.e. completely gaseous), is not subject to the Model Regulations whatever the size of the receptacle or tank is.

8. In such a case, e.g. carbon dioxide contained in gaseous form only at a pressure of less than 2 bar in a 50 litre water capacity cylinder, exempted from the Model Regulations by 1.1.3.2 (UN 2.2.2.3), it could not be excluded that 100 litres of carbon dioxide be released if the valve was not airtight or was improperly closed and consequently could spread rapidly throughout the cargo space of the wagon/vehicle.

9. If such an event was considered as not likely to endanger the health of the participants in the transport operation, i.e. as a risk sufficiently acceptable from the safety point of view to justify the exemption, Germany considered that the effective risk presented by small cylinders of CO₂ should also be assessed by comparison. Germany stated that small cylinders of carbon dioxide of 0.5 litres contained 200 litres of gas at 15 °C each, and that it had been estimated whether, if the gas were released in the cargo space of any wagon/vehicle, there would be any reason to fear that the health of the participants would be endangered. It had been concluded that, even under adverse conditions, no concentrations of carbon dioxide would be produced in the cargo spaces of wagons/vehicles that could endanger the health of the driver or the participants in the transport operation.

10. Moreover, in the opinion of the *Bundesanstalt für Materialforschung und Prüfung* (BAM) (Federal Institute for Materials Research and Testing), it could be assumed, depending on the type of valves tested for these carbon dioxide cylinders, that there was an infinitely small probability of a valve ceasing to be airtight during carriage. If the valve of a small carbon dioxide cylinder were not airtight, this would become apparent directly after filling at the filling facility - the filled cylinder would already be empty at the start of carriage - or the airtightness deficiency would be so slight that the quantities of carbon dioxide released over time into the wagon/vehicle would not cause an appreciable increase in the atmospheric concentration of carbon dioxide.

11. Following these explanations, the German proposal was adopted at the autumn 2005 session of the RID/ADR/ADN Joint Meeting, as reflected in paragraph 89 of the session report ECE/TRANS/WP.15/AC.1/100 as reproduced below:

“Carriage of UN No. 1013 in cylinders up to 0.5 litre

Document: TRANS/WP.15/AC.1/2005/53 (Germany)

89. The proposal to transfer the provisions of the special multilateral agreement M114 and RID 3/2002 to the text of RID/ADR was adopted. The provisions adopted, however, were not included in 1.1.3.2 (g), nor in section 3.4.6 as proposed orally by certain delegations, but in a special 6xx provision in Chapter 3.3 (see annex 2).”

B. 2011 version

12. The text (RID, ADR and ADN) of SP 653 was amended in 2011:

“653 The carriage of this gas in cylinders **having a test pressure capacity product of maximum 15 MPa.litre (150 bar.litre)** is not subject to the other provisions of ADR if the following conditions are met:

- The provisions for construction and testing of cylinders are observed;
- The cylinders are contained in outer packagings which at least meet the requirements of Part 4 for combination packagings. The general provisions of packing of 4.1.1.1, 4.1.1.2 and 4.1.1.5 to 4.1.1.7 shall be observed;
- The cylinders are not packed together with other dangerous goods;
- The total gross mass of a package does not exceed 30 kg; and
- Each package is clearly and durably marked with "UN 1013" for carbon dioxide or "UN 1066" for nitrogen, compressed. This marking is displayed within a diamond-shaped area surrounded by a line that measures at least 100 mm by 100 mm”

13. The proposal was submitted by the European Industrial Gases Association (EIGA) and was intended to extend the concept of derogation to small cylinders of compressed nitrogen used in the context of preventive activation of avalanches. The proposal was submitted as document ECE/TRANS/WP.15/AC.1/2007/40 to the Autumn 2007 session of the Joint Meeting but was not discussed at that session. The arguments put forward by EIGA were that, if the small CO₂ cylinders were mainly used for carbonating of tap water in private households, for avalanche-airbags small nitrogen cylinders of 0.22 litres, 300 bars were used.

14. According to EIGA, both these gases, CO₂ and nitrogen, were listed as gases of Class 2 under code 1A (asphyxiant compressed gases), in table A of Chapter 3.2 of RID/ADR/ADN (i.e. UN Division 2.2, asphyxiant compressed gas, no subsidiary hazard). (In fact only nitrogen, compressed is listed as 1A, as CO₂ is listed as 2A, i.e. liquefied, asphyxiant)

15. EIGA noted that cylinders above 0.5 litre for CO₂ were commonly used. As the size of the small cylinders could vary, it was proposed to exempt small cylinders for gases of Class 2, code 1A, based on the **product of size and test pressure** of the cylinders rather than on the basis of the **capacity** only.

16. The maximum product-litre volume would be 250 bar-litres. For CO₂, this would mean a size of cylinders of up to 1 litre (250 bar-litre for a 250 bar test pressure). For nitrogen it would mean a size of the cylinders up to 0.55 litre (300 bar-litre for a 450 bar test pressure). [The document indicates 300 bar-litre, but 450 X 0.55 results in 247.5, which would be in line with the proposed 250.]

17. In the same document, EIGA proposed also that the maximum mass of each delivery should not exceed 300 kg.

18. The proposal was discussed at the March 2008 session of the Joint Meeting, but EIGA came up with a new proposal in informal document INF.34, abandoning the principle of maximum product of size and test pressure and proposing to keep SP 653 as it was (i.e. only receptacle size limit of 0.5 litre but application of the special provision to compressed nitrogen). The reason is not explained in the report, but as the informal document was issued during the session, it is likely that there was no agreement on the proposed product of 250 litres.bar and that EIGA could live with the 0.5 litre size limit for nitrogen, which was not far from 0.55.

19. The conclusion in paragraph 50 of the report ECE/TRANS/WP.15/AC.1/110 reads as follows:

“Amendment of special provision 653

Document: ECE/TRANS/WP.15/AC.1/2007/40 (EIGA)

Informal document: INF.34 (EIGA)

50. The Joint Meeting adopted the amendments to special provision 653 to extend its scope to include small nitrogen cylinders for avalanche airbags (see annex II).”

20. In fact the text adopted was not as proposed in any of the two EIGA proposals, since the Joint Meeting at the end agreed to use the concept of the product of size and test pressure, for both CO₂ and nitrogen, but to allow only a product of 150 bar.litre instead of 250. This seems to be closer to a product of size.test pressure of 0.5 X 250 and may be this is the reason. No condition on the maximum mass of the delivery was included.

NOTE: Since this text was adopted in March 2008 but could not become applicable before 1 January 2011 because of the legal procedures of amendments to RID, ADR and ADN, this text was made applicable on the territories of Germany, France and Czech Republic in the interim period through multilateral agreement M195 (ADR)

C. 2013 version

21. The text (RID, ADR and ADN) was amended once again in 2013 to read:

“653 The carriage of this gas in cylinders having a test pressure capacity product of **maximum 15.2 MPa.litre (152 bar.litre)** is not subject to the other provisions of ADR if the following conditions are met:

- The provisions for construction and testing of cylinders are observed;
- The cylinders are contained in outer packagings which at least meet the requirements of Part 4 for combination packagings. The general provisions of packing of 4.1.1.1, 4.1.1.2 and 4.1.1.5 to 4.1.1.7 shall be observed;
- The cylinders are not packed together with other dangerous goods;

- The total gross mass of a package does not exceed 30 kg; and
- Each package is clearly and durably marked with "UN 1006" for argon compressed, "UN 1013" for carbon dioxide, "UN 1046" for helium compressed or "UN 1066" for nitrogen compressed. This marking is displayed within a diamond-shaped area surrounded by a line that measures at least 100 mm by 100 mm."

22. This minor change was proposed by Sweden in 2011 (based on document ECE/TRANS/WP.15/AC.1/2011/12).

23. The reason was that the water capacity indicated on many CO₂ small cylinders used in Europe was (according to Chapter 6.2) 0.605 litre (water capacity measured without the safety valve). For these cylinders, the product of the test pressure and the capacity (250 X 0.605) is 151.25 bar.litre, i.e. a little more than the required value of 150 bar.litre. Nevertheless, in practice, once the safety valve is fitted, the water capacity is only 0.595 litre, which leads to a product of 250 X 0.595=148.75 bar.litre, i.e. below the 150 bar.litre limit.

24. This was discussed at the March 2011 session of the Joint Meeting. There was no objection to this proposal. However EIGA had proposed in parallel in informal document INF.15; (i) to extend the scope of special provision 653 to argon and other compressed gases, and (ii) to raise the 150 bar.litre limit to 187.5 in order to allow a more practicable larger capacity of 0.75 litres. Therefore, Sweden and EIGA were invited to consult themselves and to come back with a new proposal at the next session. This was recorded in paragraph 50 of the report ECE/TRANS/WP.15/AC.1/122, as follows:

“Modification of special provision 653

Document: ECE/TRANS/WP.15/AC.1/2011/12 (Sweden)

Informal document: INF.15 (EIGA)

50. In principle there was no objection to the proposal to increase the test pressure capacity product to 15.2 MPa.litre (from 15 MPa.litre) so as to exempt certain cylinders containing carbon dioxide or nitrogen. However, as EIGA proposed extending the exemption to compressed argon, and as other inert gases could eventually be concerned, the authors of the proposal were invited to hold consultations to prepare a more complete proposal for the next session.”

25. Subsequently, at the Autumn 2011 session of the Joint Meeting, EIGA submitted a new proposal ECE/TRANS/WP.15/AC.1/2011/34. It dropped the proposal to increase the limit to 187.5 bar but carried forward the Swedish proposal to raise it to 152 bar for the reasons explained by Sweden, and proposed to extend the scope of SP 653 to argon, compressed and helium, compressed, noting in particular that both gases are inert. This proposal was adopted, as reflected in paragraph 68 of the session report ECE/TRANS/WP.15/AC.1/124, as follows:

“Special provision 653

Document: ECE/TRANS/WP.15/AC.1/2011/34 (EIGA)

68. The proposals by EIGA to apply special provision 653 also to ARGON, COMPRESSED and HELIUM, COMPRESSED and to increase the test pressure capacity product were adopted (see annex 1). The view was expressed, however, that EIGA might usefully consider dealing with such issues in a more systematic and comprehensive manner in order to avoid having to deal with specific cases on the basis of commercial requirements.”

NOTE: Since the new text for SP 653 text was adopted in September 2011 but could not become applicable before 1 January 2013 because of the legal procedures of amendments to RID, ADR and ADN, this text was made applicable, for CO₂ and nitrogen only, on the territories of Austria, Denmark, Germany, Finland, France, Netherlands, Norway, Sweden, Switzerland and the United Kingdom in the interim period through multilateral agreement M244 (ADR).

26. So far, no new proposal for addressing the issue in a more systematic way has been submitted and the current text of SP 653 remains as adopted for the 2013 versions of ADR/RID/ADN.

Summary

27. The derogations contained in SP 653 of ADR, RID and ADR were originally intended to apply to small cylinders of CO₂ with a capacity of not more than 0.5 litre used for the preparation of soda water by individuals in a private context or during events such as receptions. The main justification for the derogation was that the receptacles used were small and had to meet the construction and testing requirements applicable to pressure receptacles containing CO₂ and therefore the probability for bursting was very low. The probability for leakage was considered also very low and in any case was considered not to lead to the release of quantities of gas that could endanger drivers or other participants in a transport chain, compared with quantities that could be released from larger cylinders or tanks exempted under the conditions of 2.2.2.3 of the UN Model Regulations.

28. The derogation took in a first stage the form of an ADR multilateral agreement initiated by Austria in 2001 and signed by three more countries. It was then introduced with the same derogation conditions in ADR and RID as special provision 653 of their 2007 version.

29. The derogation was later extended to compressed nitrogen (in 2011), compressed argon and compressed helium (in 2013). These extensions led to the replacement of the 0.5 litre maximum capacity of the CO₂ cylinders by a limit (152 bar.litre) on the product of the water capacity of the cylinder by the test pressure required for the cylinder depending on the gas contained, corresponding to the product test pressure multiplied by the capacity for CO₂ cylinders of a 0.605 litre water capacity which were widely used in Europe.
