

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

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Item 3 of the provisional agenda

Listing, classification and packing

Wearable airbag system

Submitted by the expert from Italy

I. Introduction

1. Currently there is no definition assigned in the *Model Regulations* for wearable airbag system (hereinafter the “System/s” or “Wearable Airbag System”, see examples in the pictures below). Riders’ safety equipment has improved considerably over the past few years especially thanks to standalone Wearable Airbag Systems and further advances will follow as the search continues to make such systems more and more protective: indeed, these are systems that use leading-edge technology that is constantly improving and advancing.

2. Wearable Airbag Systems are active safety systems for commuting, race and recreational motorcycling, which offer protection to users of any type of motorcycle or scooter, both as a rider or passenger. Depending in models, these systems can be worn either under or over a properly fitting outer garment. The systems offer comprehensive upper body protection, covering the rider’s chest, ribs, kidneys and full back. Depending in models, the protection extends to rider's shoulders and/or hips.

3. The systems are completely autonomous/standalone: they do not have any cable connection to the motorbike, and they come with an active electronic system that features several integrated sensors (gyroscopes and accelerometers) and a crash algorithm that leverages artificial intelligence (AI) to accurately monitor when to deploy the airbag in the event of crash.

4. As motorcycle accidents occur within milliseconds, airbag inflation needs to be very fast. The systems are provided with a protective airbag which - upon detection of a crash situation - is activated by canisters utilizing inert non-dangerous non-flammable compressed gas (helium and argon) and an internal pyrotechnic heating device which ensures faster airbag deployment because the pyrotechnic heating device results in thermal expansion of the gas and thus an increase in pressure of the same gas, which exits the canister faster than in stored gas inflators, CO₂ inflators and/or mechanically activated inflators. Systems are then able to provide protection to the rider with a maximum inflation time of few ten of milliseconds. Fast inflation means that the airbag is able to inflate before impact with an obstacle.

5. Wearable Airbag Systems operate using a series of triaxial sensors including accelerometers and gyroscopes which sense in three dimensions, across three axis X, Y and Z, for maximum reliability and effective performance. These sensors communicate with the ACU (Airbag Control Unit) electronics inside the back protector on a millisecond level, sending data inputs every millisecond. The systems are powered by small lithium batteries (3.65 V | 2,600 mAh nominal | 9.5 Wh – i.e. a battery smaller and less powerful than that of a latest generation mobile phones), very simple to recharge (thorough a magnetic USB charger) and will even work in the rain.

6. Such systems are on the market for a few years; they are sold in massive quantities, also online, in more than 50 countries of the world (EU, USA, Canada, South American countries, Far East and Middle East.). The use of such systems has already been extended to

sectors other than motorcycling (let's think of avalanche backpacks, airbags for skiers or cyclists, or those for horseback riding, or the recent airbags specially conceived for those who work at height).

7. It is also foreseeable that, in the next few years, the use of such systems will be further extended to sectors such as speed skating, hockey, acrobatic gymnastics, climbing, luge, alternative mobility (such as skateboard or scooter) and city mobility (such as to passengers on trains, subways or buses who are totally unprotected in case of an accident). In light of the above, it is highly likely that the product at stake is destined to become a widely consumed commodity due to the fact that it will reduce the extent of injuries or fatalities in such accidents.

II. Item description

8. These articles may be composed of more items belonging to different classes:
- (a) Small lithium battery (3.65 V – 9.5 Wh), powering the ACU which activates the pyrotechnic canister upon detection of a crash situation;
 - (b) One or two canisters containing non-dangerous and non-inflammable pressurized gas (argon or helium), for the airbag inflation;
 - (c) Pyrotechnic substances of Division 1.4 S (between 300 mg and 600 mg for each canister) necessary to activate the gas diffusion.

A typical composition of pyrotechnic material content (with classification 1.4S) may be as follows: 50 mg of ZPP (zirconium, potassium perchlorate) and 535 mg of THPP (Titanium Hydride Potassium Perchlorate)

9. A more complete description is available in the appendix, where some pictures of the assembled system and its components are shown. Instead, an explanation of the operation of this life-saving device is available at these links:

- (a) <https://www.youtube.com/watch?v=8ucUriFSk74>
- (b) <https://youtu.be/XI3LJnxWEpo>

III. Classification

10. The classification used for the transport of these items, lacking more precise indications, may be chosen between these two entries:

- (a) UN 2990, LIFE-SAVING APPLIANCES, SELF-INFLATING; or
- (b) UN 3268, SAFETY DEVICES, electrically initiated.

The first entries, by the special provision (SP) 296, may be full exempted by the regulations if shipped in strong outer package, of maximum 40 kg of mass weight. It may also contain items of different classes including lithium batteries (class 9); canisters containing power device (pyrotechnic contents) of Division 1.4 S, with a limit of 3.2 g; compressed or liquefied gases (class 2.2), with a limit of 120 ml.

For the second entry, SP289 allows a full exemption in the case it is installed as a safety device in a vehicle or if shipped as a completed component (doors, seats, steering columns).

For both cases the presence of substance of Division 1.4S is permitted, provided that a Test series 6(c) has been arranged.

UN No.	Name and description	Class or division	Subsidiary hazard	UN packing group	Special provisions	Limited and excepted quantities		Packaging and IBC'S	
						(7a)	(7b)	Packing instruction	Special packing provisions
(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)
-	3.1.2	2.0	2.0	2.0.1.3	3.3	3.4	3.5	4.1.4	4.1.4
2990	LIFE-SAVING APPLIANCES, SELF-INFLATING	9			296	0	E0	P905	
3268	SAFETY DEVICES, electrically initiated	9			280 289	0	E0	P902 LP902	

11. In a case of air transport, the technical instructions (TI) of ICAO, at section 8-1-1, which refers to the dangerous goods carried by passengers, allow the carriage of similar articles (avalanche rescue backpack) with a limit of 1 piece for each passenger. As for life-saving appliances, the avalanche it may contain:

- (a) Canisters of a compressed gas, of a class 2.2 and without a subsidiary hazard;
- (b) Lithium batteries; and
- (c) Pyrotechnic mechanism containing not more 200 mg of explosive of Division 1.4S.

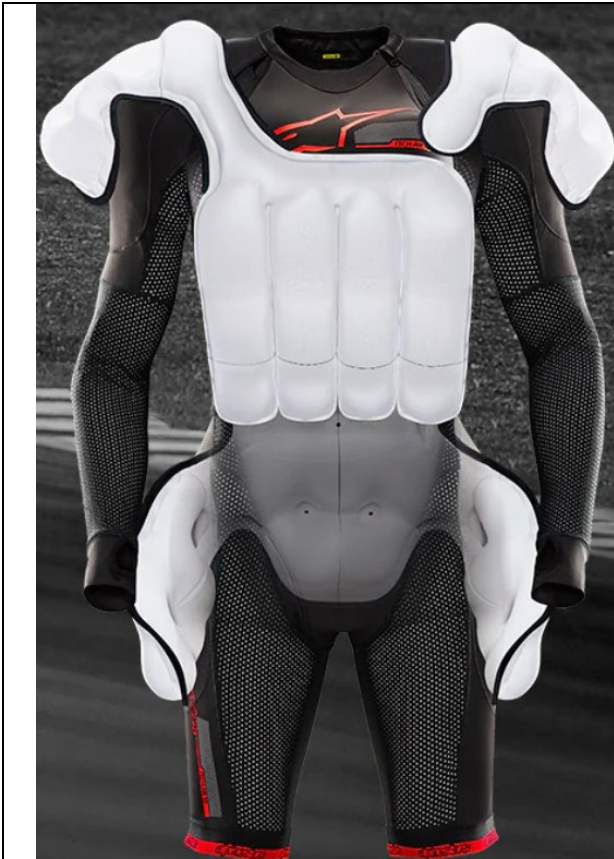
IV. Request

12. To have a shared and homogeneous international classification for these objects, the expert from Italy is interested to hear the opinions of the experts in the Sub-Committee on this subject.

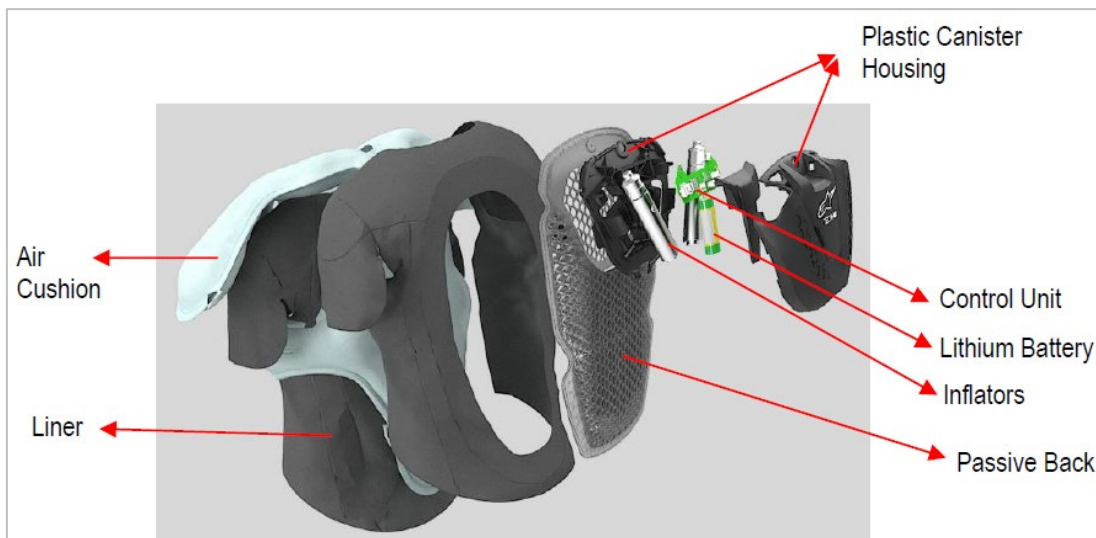
13. Should these items be classified as UN 2990, Life Saving Appliances, self-inflating or, as in our opinion, it would be considered more appropriately to use the entry UN 3268, Safety Devices?

14. The experts from Italy are available to prepare a formal proposal for the next session taking into account the comments from the experts of TDG Sub-Committee (see also “notional proposal” in the annex).

Wearable Airbag



Wearable Airbag assembly



Inflator drawings

<p>Inflator</p>	<p>INITIATOR</p>
<p>Chamber and Diffuser</p>	<p>Labels in the drawing:</p> <ul style="list-style-type: none"> BURST DISK TOPHAT DIFFUSER STORED GAS MIX (75%Ar_25%He) CHAMBER LASER WELDINGS
<p>Initiator Description</p>	<p>Labels in the drawing:</p> <ul style="list-style-type: none"> CRIMPING SHUNT RING IMI (Integrated Molded Initiator) LASER WELDING CHAMBER RESISTANCE WELDING PLUG DOMES IMI primary load 50 ±5g ZPP (Zirconium Potassium Perchlorate) IMI secondary load 535 ±16/-10g ZPP (Zirconium Potassium Perchlorate)

Annex I

(Notional Proposal)

Wearable airbag system

Submitted by the expert from Italy

I. Introduction

1. This document is related to the discussion on informal document INF.34 (63rd session) concerning the classification of these articles, and may be revised or withdrawn based on the conclusion of that discussion.
2. As explained in paragraphs 6 and 7 of the above document, wearable airbag systems are on the market for a few years but already in massive quantities. Today, these items are mainly shipped by road (for short distances) and by air in the case of international destinations.
3. For the air transports, ICAO Technical Instructions already recognizes an exemption for the packages of the avalanche rescue backpacks, which are very similar to these items. The only difference between these two articles is concerning the quantities of pyrotechnic substance that in a case of the wearable airbag system is not over than 1200 mg of explosive of 1.4 S.
4. Since the two entries UN 2990 and UN 3268 already provide a specific exemption, by special provisions SP296 and SP289 respectively, a partial amendment of these provisions would allow these new items to be considered as well.
5. These following proposals must be considered as alternatives.

II. Proposal 1

6. Insert a new paragraph at the end of Special Provision 296 as follows (new text is underlined):

“... Life-saving appliances packed in strong rigid outer packagings with a total maximum gross mass of 40 kg, containing no dangerous goods other than Division 2.2 compressed or liquefied gases with no subsidiary risk in receptacles with a capacity not exceeding 120 ml, installed solely for the purpose of the activation of the appliance, are not subject to these Regulations.

Wearable airbag system packed in outer strong packagings, with a total maximum gross weight of 25 kg, containing no dangerous goods other than:

 - Division 2.2 compressed or liquefied gases with no subsidiary risk in receptacles with a capacity not exceeding 120 ml, installed solely for the purpose of the activation of the appliance; and
 - Pyrotechnic substances classified 1.4 S, not exceeding the quantities of 600 mg for each canister, with a maximum of 2 canister for each article; are not subject to these Regulations.”

II. Proposal 2

7. Insert a new paragraph at the end of Special Provision 289 as follows (new text is underlined):

“Safety devices electrically initiated and safety devices, pyrotechnic installed in vehicles, vessels or aircraft or in completed components such as steering columns, door, panels, seats, etc. are not subject to these Regulations.

Wearable Airbag System packed in outer strong packagings, with a total maximum gross weight of 25 kg, containing no dangerous goods other than:

- Division 2.2 compressed or liquefied gases with no subsidiary risk in receptacles with a capacity not exceeding 120 ml, installed solely for the purpose of the activation of the appliance; and

- Pyrotechnic substances classified 1.4 S, not exceeding the quantities of 600 mg for each canister, with a maximum of 2 canister for each article;

are not subject to these Regulations.”
