

JUSTIFICATION OF THE USAGE OF THE APPROVED PACKAGING IN THE TRANSPORT OF DANGEROUS GOODS¹

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Abstract

Every day a dilemma appears in the transport of dangerous goods: whether particular cargo should be transported by ADR rules or in accordance with the exceptions of ADR. The dilemma is reduced to economic justification of packing cargo in approved type packaging or in the auxiliary packaging. For a sender it is preferable to pack dangerous materials in handy packaging, but in accordance with the provisions that allow us to pack in limited quantities. Dangerous materials packed in limited quantities are not subject to the provisions of ADR, except in some cases. For each UN number it is stipulated which amount an individual package shall not exceed so that the package would be marked as limited quantity and therefore acquitted of the provisions of ADR. This paper discusses the topic whether this packed cargo meets all requirements for safe transport, both for humans and the environment and whether possible savings in transport performed in that way are profitable.

***Keywords*—dangerous goods; emballage; packaging; safety**

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INTRODUCTION

The transport of dangerous materials by road is defined by the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR). Packaging for dangerous materials means one or more receptacles and any other components or materials necessary to fulfill the function of reservoir and a security function for accepting and safe storage of the contents [1].

Dangerous goods must be packed in packaging, including IBC and large packaging of a good quality. Packaging must be strong enough to withstand the shocks and stresses, which may occur under normal conditions of carriage, including transshipment between transport units and handling of pallets and packaging units[2]. Packaging for dangerous goods shall be so constructed and closed to prevent any release of the contents from the packaging under normal conditions of carriage. Also, it must be closed in accordance with the instructions provided by the manufacturer.

APPROVED PACKAGING

A participant in the transport of dangerous goods is required to use the type of packaging that meets the requirements prescribed by ADR, or the approved packaging (Fig. 1). Packaging for dangerous goods can be produced only by a company or other legal entity that has the approval for the type of packaging. The approval code for the type of packaging must be included on each individual packaging that a manufacturer places on the market.



Fig.1.Approved packaging [3]

The packaging for dangerous goods must have a UN number, a label and a packaging code (Fig. 2). Packaging code contains a letter that indicates the packaging group whose structural type is successfully tested. These are the letters X, Y and Z:

- X - for packaging groups I, II and III;
- Y - for packaging groups II and III;
- Z - for packaging group III.



Fig.2.Types of packaging

Dangerous goods are classified in three packaging groups according to the degree of danger:

- a) Packaging group I: Substances of great danger,
- b) Packaging group II: Substances of medium danger and
- c) Packaging group III: Substances of minor danger.

Depending on the type and dimensions of the packaging the price changes as well, especially if it is talked about the approved packaging for the transport of dangerous goods. The price of this package is significantly higher than ordinary so the shippers often opt to inadequately packaged goods and thus carry out transport improperly.

According to the Law on transport of dangerous goods, criminal provisions in Serbia range from 600,000 to 3,000,000 RSD for economic offense if a participant in the transport of dangerous goods uses the packaging that has not been approved or does not have a valid Test Report [4]. Danger that may arise in this case is classified as a Category I risk and in this case there may be imposed the prohibition of carrying out an economic activity from six months to three years. Such penalties should certainly

compel all participants in the transport of dangerous goods to comply with all legal requirements.

The type of packaging categorizes a packaging for test purposes according to the kind of packaging and its material characteristics (Table 1).

Table 1. Tests required for packaging types[1]

Type of packaging ^a			Tests required					Stack
Rigid outer packaging	Primary receptacle		Water spray	Cold conditioning	Drop	Additional drop	Puncture	
	Plastics	Other	No. of samples	No. of samples	No. of samples	No. of samples	No. of samples	No. of samples
Fibreboard box	x		5	5	10	Required on one sample when the packaging is intended to contain dry ice.	2	Required on three samples when testing a „U”-marked packaging as defined in 6.3.5.1.6 for specific provisions.
		x	5	0	5		2	
Fibreboard drum	x		3	3	6		2	
		x	3	0	3		2	
Plastics box	x		0	5	5		2	
		x	0	5	5		2	
Plastics drum/jerrycan	x		0	3	3		2	
		x	0	3	3		2	
Boxes of other material	x		0	5	5		2	
		x	0	0	5		2	
Drum/jerrycans of other material	x		0	3	3	2		
		x	0	0	3	2		

^a „Type of packaging” categorizes packagings for test purposes according to the kind of packaging and its material characteristics.

Tests are carried out on the package ready for shipment and in the case of combination of packagings on the used inner packaging.

There are several types of tests: drop testing, leakproof testing, internal pressure testing, stacking testing and the like. When cardboard is tested it must be kept in climate conditions of regulated temperature and relative humidity for at least 24 hours.

Concerning the IBC packaging the testing is performed depending on the type of material from which it is made (Table 2).

IBC containers shall be subjected to the testing of construction type and possibly the first and periodical inspection and testing. All rigid plastic IBC containers must be checked before putting into operation and then at intervals not longer than five years.

All of the above tests raise the cost of packaging for a certain percentage.

Table 2. Following information which may appear on a corrosion-resistant plate permanently attached in a place readily accessible for inspection [1]

Additional marking	Category of IBC				
	Metal	Rigid plastics	Composite	Fibreboard	Wooden
Capacity in litres ^a at 20 °C	x	x	x		
Tare mass in kg ^a	x	x	x	x	x
Test (gauge) pressure, in kPa or bar ^a , if applicable		x	x		
Maximum filling / discharge pressure in kPa or bar ^a , if applicable	x	x	x		
Body material and its minimum thickness in mm	x				
Date of last leakproofness test, if applicable (month and year)	x	x	x		
Date of last inspection (month and year)	x	x	x		
Serial number of the manufacturer	x				
Maximum permitted stacking load ^b	x	x	x	x	x

^a The unit used shall be indicated.

^b This additional marking shall apply to all IBCs manufactured, repaired or remanufactured as from 1 January 2011.

CASE STUDY

Dangerous goods are transported on Euro pallets measuring $1200 \times 800 \times 2000$ mm (Fig. 3) in boxes sized $275 \times 195 \times 300$ mm [5]. There could be 96 boxes on a pallet in total. 33 Euro pallets are loaded on a semitrailer of standard dimensions $13.6 \times 2.45 \times 2.70$ m, which makes 3,168 boxes in total. A tested and approved box for packaging of dangerous goods costs 1.97 euros [3], which makes the total cost of 6,241 euros where transport costs, import customs duties and warehousing costs are not included.



Fig. 3. The packaging of dangerous goods on a pallet

If a tested and approved IBC container measuring $1200 \times 1000 \times 1150$ mm (Fig. 4) is used for transport of dangerous goods, 52 items can be loaded on a semitrailer of standard dimensions $13.6 \times 2.45 \times 2.70$ m. The price of one item is 170.5 euros [6]. The total price of an IBC container is 8,866 euros, where transport costs, import customs duties and warehousing costs are not included.



Fig. 4.IBC container

If a packaging that has not been tested and approved for packing of dangerous goods is used, the calculation for the same vehicle and the same amount of goods would be as follows.

A classical Euro pallet measuring $1200 \times 800 \times 2000$ mm and classical boxes sized $305 \times 210 \times 91$ mm are used for transport, which gives a total of 331 boxes per pallet. The box of above dimensions has been considered because there are no standard boxes of the same size as the used certified box for dangerous goods. There could be 33 euro pallets loaded on a semitrailer of standard dimensions, or the total of 10,923 boxes. One box costs 0.92 euros, which gives the total price of 10,049 euros where transport costs, import customs duties and warehousing costs are not included.

If an IBC container sized $1200 \times 1000 \times 1150$ mm is used for transport, 52 items could be loaded on the semitrailer of standard dimensions $13.6 \times 2.45 \times 2.70$ m. The price of an IBC container is 164.5 euros, so that the total price is 8,554 euros, where transport costs, import customs duties and warehousing costs are not included.

There is a difference in price between the approved packaging for the transport of dangerous goods and ordinary packaging because certain tests have to be carried in order to approve the packaging.

CONCLUSION

Analysis of the situation with regard to the transport of dangerous goods indicates the need for compliance with the provisions of ADR and the Law on Transport of Dangerous Goods. In order to put the transport of dangerous goods completely under control it is necessary to take all measures to secure

transport, as well as preventive measures for testing the quality of packaging by accredited laboratories, if already certified packaging for certain substances are not bought. In this way, the cost of transport is increased as presented in this paper, but the danger to humans and the environment is minimized. The paper presents that the cost of a classic box is 10,049 euros and the cost of the tested and approved boxes for dangerous goods is 6,214 euros, except that there are three times as many classic boxes as the latter ones due to differences in dimensions. When packaging dangerous goods in IBC containers it is easier to compare the costs of classic and certified packaging, since the used IBC is of the same size. The costs of packaging of dangerous goods in the tested and approved IBC container are higher for 312 euros per semitrailer.

Transport of dangerous goods in certified containers should not be called into question only because of the increase in costs, because if an accident happens the consequences are far greater than the "money saved". One of the measures for increasing the use of certified packaging is stricter control of application of existing regulations.

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