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Proposals of amendments to the packing containers of CALCIUM CARBIDE and its safety measures

Transmitted by the expert from China

Background

Calcium carbide (UN No.1402) is a substance classified as (4.3), PG I or PG II. Calcium is a solid substance which emits flammable gas in contact with water. The distinction between Packing Group I and Packing Group II depends upon the quantity of flammable gas emitted when calcium carbide contacts water or moisture.

According to paragraph 2.4.4.3.1 of the Model Regulations, "Packing group I shall be assigned to any substance, which reacts vigorously with water at ambient temperatures and demonstrates generally a tendency for the gas produced to ignite spontaneously, or which reacts readily with water at ambient temperatures such that the rate of evolution of flammable gas is equal to or greater than 10 litres per kilogram of substance over any one minute." The assignment of Packing Group II is determined by sub-paragraph 2.4.4.3.2 which states: "Packing group II shall be assigned to any substance which reacts readily with water at ambient temperatures such that the maximum rate of evolution of flammable gas is equal to or greater than 20 litres per kilogram of substance per hour, and which does not meet the criteria for packing group I."

When the packing or handling of calcium carbide is not appropriate for the transport process, generation of acetylene can occur and combustion or explosion of acetylene can easily take place.. For safety in transportation, the packing requirements of calcium carbide and its relevant safety measures have been prescribed concretely in the fourteenth revised edition of the United Nations "Model Regulations on the Transport of Dangerous Goods" ("Model Regulations").

The relevant provisions concerning packing requirements of calcium carbide in Model Regulations are as follows:

UN No.	Name and description	Class or division	Subsidiary risk	UN packing group	Special provisions	Limited quantities	Packagings and IBCs		Portable tanks and Bulk containers	
							Packing instruction	Special packing provisions	Instructions	Special provisions
1402	CALCIUM CARBIDE	4.3		I		NONE	P403 IBC04	B1	T9	TP7 TP33
		4.3		II		500g	P410 IBC07	B2	T3	TP33

According to Special Provision TP7 of section 4.2.5.3 of Model Regulations, which is applicable to shipment of calcium carbide classified in packing group I: "After calcium carbide is encased in a portable tank or a bulk container, "Air shall be eliminated from the vapour space by nitrogen or other means." The purpose of eliminating air is to eliminate the oxygen contained inside the container that may react with acetylene generated by the reaction of calcium carbide and water. In practice, excluding air from inside the container results in a complicated packing operation and significant costs for the packing of calcium carbide.

It is well known that the three elements of combustion and explosion for packed calcium carbide after its packing are acetylene, oxygen and the source of ignition which exist simultaneously, and each element's quantity reaches or is above the lower scope of the critical value. By eliminating any one of the three elements or controlling its quantity out of the scope of the critical value, the combustion and explosion would not take place. In fact, it is difficult to control the source of ignition, because any quake and shock in the transport process of calcium carbide may create sparks. But controlling the oxygen would make the operation and costs of packing of calcium carbide complicated and increase them simultaneously. After many tests for a metal intermediate bulk container (IBC) of one cubic meter filled with calcium carbide, Chinese suppliers have found a useful method which could prevent the combustion and explosion through controlling the acetylene contents in a packing container of calcium carbide from the 1990s. The method is to check the acetylene contents in the packing container of calcium carbide and make sure that the acetylene content is less than 1% (by volume) before sealing up the container without filling it with nitrogen. Controlling the concentration of acetylene below 1% (40% of the lower flammable limit of acetylene) the flammability and explosive potential, can be guarantee safety. With more than 10 years' practice of the method's application in Chinese local railway transport and export shipping abroad, there has been no accident of combustion and explosion.

Because controlling the concentration of acetylene generated by the reaction of calcium carbide with water is concrete and clear, this method offers an alternative to purging air from the container. The proposed method to accurately measure by an acetylene test gauge, is simple and fast in operation, resulting in lower costs of packing of calcium carbide but also ensuring the transport safety.

Proposals:

Revise and expand the requirements of TP7 by adding a phrase allowing the control of acetylene in the container. TP7 should be revised to read: "For UN1402, air shall be eliminated from the vapour space by nitrogen or other means, or the acetylene contents in the container should be controlled to be less than <1% (by volume) ".

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