

OFFICIAL MEXICAN STANDARD
NOM-027-SCT2-1994
GENERAL PROVISIONS FOR THE PACKING,
PACKAGING AND TRANSPORT OF HAZARDOUS
SUBSTANCES, MATERIALS AND WASTES OF
DIVISION 5.2, ORGANIC PEROXIDES.

1. PURPOSE.

The purpose of this standard is to set forth the general provisions for the packing and packaging, as well as the transport, of hazardous substances in Division 5.2 Organic Peroxides. To this end we include the provisions regarding classification; the manner in which said packing and packaging must be effected; desensitization; in the case of those substances which must be transported at a set temperature, the control of said temperature; and the type of transportation.

2. APPLICABILITY.

This Official Mexican Standard applies compulsorily to the shippers and carriers of hazardous substances, materials and wastes of Division 5.2, Organic Peroxides, which are transported over the general lines of communication.

3. REFERENCES.

For the correct implementation of this standard, the following Official Mexican Standards must be consulted:

NOM-002-SCT2/1994	LISTING OF THE MOST COMMONLY TRANSPORTED HAZARDOUS SUBSTANCES AND MATERIALS.
NOM-003-SCT2/1994	CHARACTERISTICS OF THE LABELS OF PACKAGES AND PACKAGINGS INTENDED FOR THE TRANSPORT OF HAZARDOUS SUBSTANCES AND WASTES.
NOM-007-SCT2/1994	MARKING OF PACKAGES AND PACKAGINGS INTENDED FOR THE TRANSPORT OF HAZARDOUS SUBSTANCES AND WASTES.

NOM-024-SCT2/1994

**SPECIFICATIONS AND CHARACTERISTICS FOR THE
CONSTRUCTION AND RECONSTRUCTION OF
PACKAGES AND PACKAGINGS.**

4. DEFINITIONS.

Organic peroxides: Organic substances which contain the bivalent -O-O structure and may be considered derivatives of hydrogen peroxide, where one of hydrogen atoms, or both, have been replaced by organic radicals.

Peroxides are thermally unstable substances which may undergo an exothermic self-accelerating decomposition. In addition, they may have one or several of the following properties:

- a) Be liable to explosive decomposition;
- b) Burn rapidly;
- c) Be sensitive to impact or friction;
- d) React dangerously upon coming into contact with other substances;
- e) Cause damage to the eyes; and
- f) [Be] corrosive for the skin and respiratory system.

Deflagrate.- To burn rapidly with flame and sparks, but without explosion.

Tank-container.- This means a tank of at least 450 liters capacity whose shell is fitted with all the items of service and structural equipment necessary for the transport of hazardous liquids. The tank-container must be capable of being loaded and discharged without the need for removal of its items of structural equipment, must possess stabilizing members external to the shell, and must be capable of being lifted when full.

Package and packaging.- A receptacle and all the other components or materials necessary for the receptacle to perform its containment and transport function.

Receptacle.- A vessel intended to contain substances, including any closure device.

Inner package and packaging.- A package and packaging which must be fitted with an outer package and packaging for transport.

Outer package and packaging.- The outer protection of a composite package and packaging or of a combination of packages and packages, together with the absorbent materials, the cushioning materials and all other components necessary to contain and protect inner receptacles or inner packages and packagings.

Desensitize.- Treatment [sic] which is given to a peroxide to make it less sensitive to explosibility or deflagrability.

Detonate.- To produce a sound like that of a gunshot or thunderclap. To explode.

5. PROPERTIES, ASSIGNMENT AND CLASSIFICATION OF ORGANIC PEROXIDES.

5.1 Properties

5.1.1 Organic peroxides can undergo an exothermic decomposition at normal or elevated temperatures, which is liable to be initiated by heat, by contact with impurities (heavy-metal compounded acids,[sic] amines, etc.), by friction, or by impact.

The rate of decomposition increases with temperature and varies with the organic peroxide composition.

Decomposition of this organic peroxide may result in the evolution of harmful, or flammable, gases or vapors. For certain organic peroxides, temperature must be controlled during transport. Some organic peroxides may decompose explosively, above all in a confined space. This characteristic may be modified by the addition of diluents or by the use of appropriate packages and packagings. Many of these burn very easily.

5.2 Assignment

5.2.1 Any organic peroxide and its mixtures must be included in Division 5.2 of the classification used in the list of most commonly transported substances and materials (NOM-002-SCT2), and is subject to being regulated by this standard, except if the preparation in question contains:

- a) No more than 1.0% of active [sic] oxygen from the organic peroxides when the hydrogen peroxide contents does not exceed 1.0%, or
- b) Not more than 0.5% active oxygen from the organic peroxides when the hydrogen peroxide contents is greater than 1.0% but less than 7.0%.

NOTE: The active oxygen content (%) of an organic peroxide preparation [is] given by the formula $16x \left(\frac{ni}{mi} \right)$ where:

ni = Peroxy group number by molecule of organic peroxide i;

ci = Concentration (% in mass) of organic peroxide i; and

mi = Molecular mass of organic peroxide i

5.3 Classification

5.3.1 Organic peroxides are, according to their degree of danger, classified into seven types which are: A, B, C, D, E, F, and G.

5.3.2 An organic peroxide preparation is regarded as possessing explosive properties, if in laboratory testing, upon being heated under confinement, it detonates or undergoes a rapid deflagration or a violent reaction.

5.3.3 The classification of Organic Peroxide preparations not included in Table 2 List of Organic Peroxides cataloged as of this date must comply with the following principles:

- a) Type "A": Any organic peroxide exhibiting the proper characteristics of explosives must, in order to be transported, meet the requirements for the packing and packaging of explosives indicated in NOM-009-SCT2/1994 rather than those of Division 5.2.
- b) Type "B": An organic peroxide which exhibits the proper characteristics of explosives as packed and packaged for transport, which does not deflagrate rapidly, but which may not undergo a thermal explosion. The corresponding package or packaging must bear an "explosive" subsidiary risk label. Its package or packaging shall be up to 25 Kg (net mass).
- c) Type "C": Any organic peroxide which, while exhibiting the proper characteristics of explosives as packed or packaged for transport, does not deflagrate rapidly nor may undergo a thermal explosion. Its package or packaging shall be up to 50 Kg (net mass).
- d) Any organic peroxide preparation which in laboratory testing:

- Detonates partially, does not deflagrate rapidly and does not react to heating under confinement; or
- Does not detonate at all, deflagrates slowly and does not react violently to heating under confinement; or
- Does not detonate or deflagrate at all and reacts moderately to heating under confinement.

An organic peroxide preparation is acceptable for transport in packages and packagings when its net mass does not exceed 50 kg. This type of organic is classified as organic peroxides of Type "D".

- e) Type "E": Any organic [peroxide] which, in laboratory testing, does not detonate at all, reacts weakly or does not react to heating under confinement. For purposes of transport, its package or packaging shall not exceed 400 Kg/450 liters.
- f) Type "F": Any organic peroxide which, in laboratory testing, does not detonate or deflagrate at all, which does not react to heating under confinement, and whose explosive power is nil. It may be transported in a tank-container.
- g) Any organic peroxide preparation which, in laboratory testing, does not detonate or deflagrate at all, does not react to heating under confinement and whose explosive power is nil, shall be exempted from the provisions regarding Division 5.2, provided that it is thermally stable. This type of organic peroxide [is] classified [as] organic peroxides of Type "G".
- h) Type "H": Any organic peroxide which, in laboratory testing, does not detonate or deflagrate at all, [and] whose explosive power is nil. Its transport may be exempt from the provisions pertaining to Division 5.2 provided that it is thermally stable.

5.3.4 Figure 1 shows the flow chart of the organic peroxide classification.

6. SPECIAL PROVISIONS FOR THE PACKING AND PACKAGING OF DIVISION 5.2 ORGANIC PEROXIDES.

6.1 Organic peroxides shall not be confined, even in small quantities, in metal packages or in tank-containers since these materials can, upon coming into contact with the content, act as catalysts or affect the product properties, thus presenting a potential explosion hazard.

They must not be handled in pressurized or closed vessels, unless being fitted with the necessary safety devices.

- 6.2 The package and packaging of an organic peroxide for which an "EXPLOSIVE" secondary risk label is prescribed, shall comply with the following provisions:
- a) Nails, staples and other closure devices made of metal having no protective covering shall not penetrate inside the outer package and packaging unless the inner package and packaging adequately protects the peroxides against contact with the metal.
 - b) Inner packages and packagings, fastening devices and cushioning materials, as well as the placing of peroxides in the packages and packagings, must be such that no movement may occur within the package and packaging during transport.
- 6.3 Packages and packagings intended for the transport of organic peroxides must comply with the provisions of Standard NOM-024-SCT2-1994 as regards the construction and reconstruction of packages and packagings.
- 6.4 The methods of packing and packaging of organic peroxides are set forth in Table 1, in which symbols OP1A through OP8A correspond to liquids, and symbols OP1B through OP8B correspond to solids.
- 6.5 Table 2 indicates the method of packing and packaging for each of the organic peroxides cataloged as of this date.
- 6.6 To determine the appropriate method of packing and packaging for new organic peroxides or new preparations of organic peroxides already cataloged, the following procedure shall be applied:
- 6.6.1 Packing and Packaging Method OP5A or OP5B shall be assigned to organic peroxide Type "B", provided that the organic peroxide meets the following criteria:
- a) Any organic peroxide preparation having explosive properties and which, as contained and packaged for transport, does not detonate or deflagrate rapidly, but which may undergo a thermal explosion in the corresponding package and packaging, must display an "EXPLOSIVE" secondary risk label.
 - b) Such organic peroxide may be transported in packages and packagings in amounts not greater than 25 kg unless, to avoid detonation or rapid deflagration in the package and packaging, the maximum authorized amount must be limited.

- c) If the organic peroxide only meets said criteria in packages and packagings smaller than those indicated for Package and Packaging Method OP5A or OP4B (that is, one of the packages and packagings indicated for Methods OP1A or OP1B through OP4B), it will be assigned the packing and packaging method corresponding to the lowest OP number.

6.6.2 Organic peroxide Type "C" shall be assigned to Packing and Packaging Method OP6A or OP6B provided that the organic peroxide meets the following criterion:

- a) Any organic peroxide preparation having explosive properties may be transported without an "EXPLOSIVE" secondary risk label if, as contained and packaged for transport (50 kg as a maximum), it does not detonate and it does not undergo a rapid deflagration or a thermal explosion.
- b) If the organic peroxide only meets said criteria in a package and packaging smaller than those indicated for Packing and Packaging Method OP6A or OP6B, it will be assigned to the packing and packaging method corresponding to the lowest OP number.

6.6.3 Organic peroxide Type "D" shall be assigned to Packing and Packaging Method OP7A or OP7B.

6.6.4 Organic peroxide Type "E" shall be assigned to Packing and Packaging Method OP8A or OP8B.

6.6.5 Organic peroxide Type "F" shall be assigned to Packing and Packaging Method OP8A or OP8B.

6.7 NEW ORGANIC PEROXIDES.

6.7.1 [As regards s]amples of new organic peroxides or new preparations of organic peroxides [for which] all test results are not available and which are transported, in order to carry out new tests and evaluations, they may be assigned as organic peroxide Type C, provided that they meet the following conditions:

- a) That the sample is not, according to available data, more hazardous than an organic peroxide [of] Type B.

- b) That the sample is contained or packaged in accordance with packing and packaging methods OP2A or OP2B, and that the amount is limited to 10 kg per unit of transport, and
- c) That according to available data, the control temperature is low enough to avoid any dangerous decomposition, and high enough to avoid any dangerous separation in [sic] phases.

7. CONTROL OF TEMPERATURE OF ORGANIC PEROXIDES IN TRANSPORT.

- 7.1 Organic peroxides must be protected from direct sunlight and from any source of heat, in a sufficiently ventilated area. Some peroxides may only be transported under conditions where the temperature is controlled.
- 7.2 The control temperature is the maximum temperature at which the organic peroxide can be transported without risk. During transport, the temperature shall never be higher than 55EC in the immediate surroundings of the package and packaging, and this temperature shall only be maintained for a short time during each period of 24 hours.
- 7.3 Whenever difficulties arise during transport regarding the control of temperature, emergency measures will have to be adopted. The emergency temperature is the temperature determined by the necessity to implement such measures.
- 7.4 The control temperature and the emergency temperature are determined in the manner indicated in Table 3, which is detailed in the margin of this paragraph, taking as reference the Self-Accelerating Decomposition Temperature (SADC), which is defined as the lowest temperature at which rapid decomposition of a substance in its package and packaging may occur. The SADC must be determined in order to decide if an organic peroxide must be subjected to temperature control during transport.

TABLE 3: COMPUTATION OF THE CONTROL AND EMERGENCY TEMPERATURES.

SADT	Control Temperature	Emergency Temperature
20EC (68EF) or less	SADT minus 20EC (68EF)	SADT minus 10EC (50EF)
over 20EC to 35EC (68EF - 95EF)	SADT minus 15EC (59EF)	SADT minus 10EC (50EF)
over 35EC (95EF)	SADT minus 10EC (50EF)	SADT minus 5EC (41EF)

- 7.5 Any organic peroxide which, in the course of the test, undergoes a violent self-accelerating decomposition at 50Ec, must be subject to a temperature control system during transport, and its SADT must be determined.
- 7.6 Organic peroxides which, judging from the results of the tests conducted, do not undergo reactions similar to explosives in the relevant package and packaging, as a result of which said package and packaging is exempt from the "EXPLOSIVE" secondary risk label[,] may be transported without a temperature control system when the SADT determination test shows them to remain stable at 50EC for 168 hours. In the reverse case, they must be subject to a temperature control system during transport.
- 7.7 Any other organic peroxide which does not fall under a case provided for in the previous paragraph and which only undergoes a slight self-accelerating decomposition at 50EC must be analyzed again at 45EC for 168 hours as a minimum. If said organic peroxide turns out to be unstable at 45EC, it must be subject to a temperature control system during transport, and its SADT must be determined.
- 7.8 Table 4 indicates, if applicable, the control and emergency temperature of the preparations of organic peroxide of Type "F" classification as of this date. The effective temperature under conditions of transport may be lower than the control temperature, but it must be selected such as to avoid any dangerous separation in [sic] phases.

8. DESENSITIZATION OF ORGANIC PEROXIDES.

- 8.1 In order to ensure safety during transport, organic peroxides shall be desensitized, with organic liquids or solids, inorganic solids, or water. When a percentage of a substance is stipulated, said proportion shall be understood as referring to the mass, rounding off the decimal figure to the nearest whole number. In general, the degree of desensitization must be such that in case of leakage, the peroxide does not concentrate up to a dangerous extent.
- 8.2 Unless otherwise stated with respect to a particular organic peroxide preparation, diluents which are used for the desensitization must meet the following definitions:
- a) Diluent of Type A: Organic liquids compatible with the organic peroxide in question and having a boiling point of not less than 150EC. Diluents of Type "A" may be used to desensitize any organic peroxide.
 - b) Diluent of Type B: Organic liquids compatible with the organic peroxide in question and having a boiling point of less than 150EC but not less than 60EC, and a flash point of not less than 5EC. Diluents of Type B may only be used for desensitization of organic peroxides for which temperature control is stipulated. The boiling point of the diluent shall be at least 50EC higher than the control temperature of the peroxide.
- 8.3 For preparations of organic peroxides cataloged as of this date, various diluent salts of Type "A" or "B" may be added, provided that they are compatible (see Table 2). However, replacement of all or part of a Type "A" or "B" diluent by another diluent with differing properties, will make it necessary to requalify the preparation in question in accordance with the normal acceptance procedure for organic peroxides.
- 8.4 Water may only be used to desensitize those organic peroxides which are indicated in Table 2.
- 8.5 For the desensitization of organic peroxides, organic and inorganic solids may be used, provided that they are compatible with them.
- 8.6 Liquids and solids which do not influence negatively the thermal stability and type of risk of an organic peroxide are compatible.

9. TYPE OF TRANSPORT FOR DIVISION 5.2 ORGANIC PEROXIDES.

9.1 Transport of packages and packagings in freight containers, closed road vehicles and load units.

9.1.1 When various packages and packagings are grouped together in a freight container, in a closed road vehicle or in a load unit, the total amount of organic peroxide, the type and number of packages and packagings and their packing mode must be effected so as to avoid explosion risks.

9.2 Transport of organic peroxides in Intermediate Bulk Containers (IBCs).

9.2.1 Organic peroxides which are included in Table 4 and which are designated in Table 2 with Letter "N" in the "Package and Packaging" column in Table 2, may be transported in IBCs.

9.2.2 To avoid explosion of metal IBCs or IBCs fitted with a complete metal casing, the emergency devices must be designed so that they release all the decomposition products and vapors evolved upon being engulfed in flames for one hour as a minimum (heat load: 11 w/cm²).

9.2.3 IBCs must be transported in a closed transport unit.

9.3 Transport of organic peroxides in tank-containers.

9.3.1 Organic peroxides which may be transported in tank-containers or rail tank-wagons are indicated with the letter "M" in the "packing and packaging method" column in Table 2. They are distributed by generic entries, and are shown in Table 5 with their United Nations numbers.

TABLE 4: ORGANIC PEROXIDES CATALOGED UNTIL THE TIME WHEN THEY CAN
BE
TRANSPORTED IN INTERMEDIATE BULK CONTAINERS (IBC's)

UN No.	Organic Peroxide	Type of IBC	Maximum Quantity (liters)	Control Tempera- ture (EC)	Emergency Tempera- ture (EC)
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3109	LIQUID ORGANIC PEROXIDES, TYPE F Dilauroyl peroxide, at a maximum concentration of 42%, as a stable dispersion in water.	31HA1	1,000		
3110	SOLID ORGANIC PEROXIDES, TYPE F				
3119	LIQUID ORGANIC PEROXIDES, TYPE F, TEMPERATURE CONTROLLED				
	Di-(5-tert-butylcyclohexyl) peroxydicarbonate, at a maximum concentration of 42%, as a stable dispersion in water	31HA1	1,000	+30	+35
	Dicetyl peroxydicarbonate, at a maximum concentration of 42%, as a stable dispersion in water	31HA1	1,000	+30	+35
	Dimyristyl peroxydicarbonate, at a maximum concentration of 42%, as a stable dispersion in water	31HA1	1,000	+15	+25
3120	SOLID ORGANIC PEROXIDES, TYPE F, TEMPERATURE CONTROLLED	31HA1	1,000	+30	+35

TABLE 5: ORGANIC PEROXIDES CATALOGED UNTIL THE TIME WHEN THEY CAN BE TRANSPORTED IN TANK-CONTAINERS OR TANK CARS.

UN No.	Organic Peroxide	Control Temperature	Emergency Temperature
3109	LIQUID ORGANIC PEROXIDES, TYPE F tert-Butyl hydroperoxide, ^{1/} at a maximum concentration of 72%, in water. Cumyl hydroperoxide, at a maximum concentration of 90%, in Type A diluent. Isopropyl cumyl hydroperoxide, at a maximum concentration of 72%, in Type A diluent. p-Menthyl hydroperoxide, at a maximum concentration of 55%, in Type A diluent. Pinanyl hydroperoxide, at a maximum concentration of 55%, in Type A diluent.		
3110	SOLID ORGANIC PEROXIDES, TYPE F Dicumyl peroxide ^{2/}		
3119	LIQUID ORGANIC PEROXIDES, TYPE F, TEMPERATURE CONTROLLED		
3120	SOLID ORGANIC PEROXIDES, TYPE F, TEMPERATURE CONTROLLED		

^{1/} Provided that steps have been taken to achieve a degree of safety equivalent to that of 655 [sic] of tert-Butyl hydroperoxide and 35% water.

^{2/} Maximum quantity per receptacle, 2,000 kg.