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COMMITTEE OF EXPERTS ON THE TRANSPORT
OF DANGEROUS GOODS

REPORT OF THE COMMITTEE OF EXPERTS ON ITS FIFTEENTH SESSION
(5-14 December 1988)

Addendum 3

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Annex 4 - ADOPTED TEXT, PART 3: Amendments concerning organic peroxides

(a) Amendments to document ST/SG/AC.10/11

(b) Amendments to document ST/SG/AC.10/1/Rev.5

Annex 4

ADOPTED TEXT, PART 3: Amendments concerning organic peroxides^{1/}

Note by the secretariat

In accordance with the decisions of the Committee recorded in its report (document ST/SG/AC.10/15, paragraphs 53 and 56) the text of the above amendments was reviewed by the Editorial and Technical Group of the International Maritime Organization's Sub-Committee on the Carriage of Dangerous Goods in January 1989. Some further minor editorial changes were subsequently agreed between the Chairman and Secretary of the organic peroxides working group together with the IMO secretariat. The resultant text is reproduced in this annex.

^{1/} including certain amendments adopted as part of the package of proposals elaborated by the working group on organic peroxides.

(a) Amendments to document ST/SG/AC.10/11

PART III

(1) Amendments relating to chapter 11 paragraph renumbering

Replace "11.3.2" by "11.3.3" in 1.1.1, 1.2.1, 1.3.1 and 1.4.1.

Replace "11.2" by "11.3.3" in 1.3.2.

(2) Amendments relating to changes in the UN numbers

Delete the complete column headed "UN No." in all the "EXAMPLES OF RESULTS" tables given in 2.2.6.1, 2.2.6.2, 2.3.6.1, 2.4.6.1, 2.4.6.2, 2.5.6.1, 3.2.6, 4.2.6, 4.3.6, 5.2.6, 6.2.6, 6.3.6, 6.4.6, 6.5.6, 7.2.6, 7.3.6, 7.4.6, 7.5.6, 7.6.6, 8.2.6 and 8.3.6.

Delete footnote "a/" in 2.3.6.1 and reletter footnotes "b/" and "c/" as "a/" and "b/" respectively.

Delete footnote "a/" in 6.3.6 and reletter footnote "b/" as "a/".

Delete footnotes "a/" and "b/" in 2.5.6.1, 4.2.6, 6.4.6, 6.5.6, 7.2.6, 7.3.6 and 7.6.6.

Delete footnotes "a/" and "b/" in 2.4.6.1 and 7.5.6 and reletter footnote "c/" as "a/".

Delete footnotes "a/" and "b/" in 6.2.6 and reletter footnotes "c/" and "d/" as "a/" and "b/" respectively.

Delete footnote "b/" in 4.3.6 and 7.4.6.

Delete footnote "b/" in 2.4.6.2 and reletter footnote "c/" as "b/".

Delete footnote "c/" in 2.2.6.1 and reletter footnote "d/" as "c/".

(3) Amendments relating to changes in the packing method system

In 1.2.1 (b) delete "mentioned as a packing method Recommendations." and insert "given in the list of packagings in table 11.2 for the packing method for the specific organic peroxides in table 11.3 of the Recommendations."

In 3.2.6 replace "Pl6" by "1G".

Delete "Plb" three times in 5.2.6 and once in 8.2.6.

(4) Amendments relating to changes in the flow chart

For Fig.1.1 and Fig. A.3:

Align box A with box C

In box 7 bis, replace "bulk shipment" by "transport in IBCs or tanks"

In box A, replace "Peroxide should" by "Should"

In box B, replace "with spec.prov.181" by "with E-label (see 11.3.7.1(a))".

In box C, delete "with spec.prov.180".

In box F, replace existing text by "May be considered for transport in IBCs or tanks (see 11.3.3.3(f))".

In box G, replace existing text by "Should be considered for exemption (see 11.3.3.3.(g))".

(5) Amendments relating to changes in the classification scheme

In appendix 3 section 10 delete all but the heading and insert:

"Proper shipping name : ORGANIC PEROXIDE TYPE C, LIQUID
UN number : 3103
Division : 5.2
Technical name : tert-Butyl peroxybenzoate
Subsidiary risks : Not required
Packing group : II
Packing method : OP5A
Packaging : 6HG2
Control temperature : Not required
Emergency temperature: Not required"

(6) Amendments to the test methods

For test F.1, make the following amendments:

7.2.4.5 Insert "(rounded to the nearest whole number)" after "percentage"

7.2.5 Change "7.0 %" to "7 %" (twice)
Change "1.0 %" to "1 %" (twice)

7.2.6 In column headed "Mean % of Picric acid" change:

"8.1" to "8"
"6.4" to "6"
"1.9" to "2"
"13.1" to "13"
"8.1" to "8"
"4.0" to "4"
"0.5" to "1"
"1.3" to "1"
"7.7" to "8"
"16.7" to "17"
"0.6" to "1"
"0.6" to "1"

In column headed "Result", for Dilauroyl peroxide,
change "low" to "no".

In Fig. A.1 CAVITATED VERSION OF BAM 50/60 TUBE TEST, change the label
"Screw cap of malleable cast iron" to "Screw cap of steel St 35".

(b) Amendments to document ST/SG/AC.10/1/Rev.5

PREFACE

- Paragraph 7 Delete the last two sentences reading:
"For certain substances of Division 4.1, dangerous for
the eyes."
- Paragraph 11 Change "P" to "OP" in third line.
- Paragraph 12 Delete complete paragraph relating to control temperature.
- Paragraph 13 Delete complete paragraph relating to emergency temperature.
- Paragraph 14 Amend the second and third sentences to read:
"Special recommendations relating to Classes 1, 3, 4, 5, 6,
7 and 8 will be found in chapters 4, 5, 14, 11, 6, 7 and 8,
respectively. Special recommendations on packing for Class
1 and Divisions 4.1 and 5.2 are found in chapters 10, 14
and 11, respectively."
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CHAPTER 1

- 1.39 Renumber "1.39" as "1.39.1".
- 1.39.2 Add a new 1.39.2 to read:
"1.39.2 All organic peroxides accepted for transport under the provisions of Division 5.2 are assigned to one of twenty 'generic' entries in accordance with the classification principles and flow chart described in 11.3.3 and Figure 11.1."
- 1.40.1 Renumber "1.40.1" as "1.40" and delete "other than an organic peroxide".
- 1.40.2 Delete 1.40.2 entirely.
- Figure 1.1 In section 4.5 change "11.3.5.9*/" to "11.3.5*/" (twice).
-

CHAPTER 2

UN Numbers of entries to be deleted

2080 to 2085, 2087 to 2108, 2110 to 2116, 2118 to 2126, 2128 to 2180, 2182 to 2185, 2255, 2550, 2551, 2562, 2563, 2592 to 2598, 2755, 2756, 2883 to 2899, 2957 to 2964, 3044 to 3047, 3058 to 3063, 3067 to 3069, 3074, 3075 and 3081 (156 entries in all).

Amendments to existing entries

Delete the "E" mark from the Subsidiary Risks Column (b2) and add "181" to the Special Provisions column (b3) for the following UN Nos: 2952, 2956, 2972, 2973, 3042 and 3043.

Add "194" to the Special Provisions column (b3) for the following UN Nos: 2952, 2953, 2955, 3030, 3035, 3036, 3037, 3038 and 3039.

Delete the complete Control and Emergency Temperature columns (d1 and d2).

New entries

SUBSTANCE OR ARTICLE		HAZARDS			PACKING	
Number	Name and Description	Class or Di- vision	Subsi- diary Risks	Special Provi- sions	Group	Method
(a1)	(a2)	(b1)	(b2)	(b3)	(c1)	(c2)
3101	ORGANIC PEROXIDE TYPE B, LIQUID	5.2		122 181 195	II	OP1A-OP5A
3102	ORGANIC PEROXIDE TYPE B, SOLID	5.2		122 181 195	II	OP1B-OP5B
3103	ORGANIC PEROXIDE TYPE C, LIQUID	5.2		122 195	II	OP1A-OP6A
3104	ORGANIC PEROXIDE TYPE C, SOLID	5.2		122 195	II	OP1B-OP6B
3105	ORGANIC PEROXIDE TYPE D, LIQUID	5.2		122	II	OP1A-OP7A
3106	ORGANIC PEROXIDE TYPE D, SOLID	5.2		122	II	OP1B-OP7B
3107	ORGANIC PEROXIDE TYPE E, LIQUID	5.2		122	II	OP1A-OP8A
3108	ORGANIC PEROXIDE TYPE E, SOLID	5.2		122	II	OP1B-OP8B
3109	ORGANIC PEROXIDE TYPE F, LIQUID	5.2		122 160 165	II	OP1A-OP8A M
3110	ORGANIC PEROXIDE TYPE F, SOLID	5.2		122 160 165	II	OP1B-OP8B M
3111	ORGANIC PEROXIDE TYPE B, LIQUID, TEMPERATURE CONTROLLED	5.2		122 181 195	II	OP1A-OP5A
3112	ORGANIC PEROXIDE TYPE B, SOLID, TEMPERATURE CONTROLLED	5.2		122 181 195	II	OP1B-OP5B

New entries cont.

SUBSTANCE OR ARTICLE		HAZARDS			PACKING	
Number	Name and Description	Class or Di- vision	Subsi- diary Risks	Special Provi- sions	Group	Method
(a1)	(a2)	(b1)	(b2)	(b3)	(c1)	(c2)
3113	ORGANIC PEROXIDE TYPE C, LIQUID, TEMPERATURE CONTROLLED	5.2		122 195	II	OP1A-OP6A
3114	ORGANIC PEROXIDE TYPE C, SOLID, TEMPERATURE CONTROLLED	5.2		122 195	II	OP1B-OP6B
3115	ORGANIC PEROXIDE TYPE D, LIQUID, TEMPERATURE CONTROLLED	5.2		122	II	OP1A-OP7A
3116	ORGANIC PEROXIDE TYPE D, SOLID, TEMPERATURE CONTROLLED	5.2		122	II	OP1B-OP7B
3117	ORGANIC PEROXIDE TYPE E, LIQUID, TEMPERATURE CONTROLLED	5.2		122	II	OP1A-OP8A
3118	ORGANIC PEROXIDE TYPE E, SOLID, TEMPERATURE CONTROLLED	5.2		122	II	OP1B-OP8B
3119	ORGANIC PEROXIDE TYPE F, LIQUID, TEMPERATURE CONTROLLED	5.2		122 160 165	II	OP1A-OP8A M
3120	ORGANIC PEROXIDE TYPE F, SOLID, TEMPERATURE CONTROLLED	5.2		122 160 165	II	OP1B-OP8B M

CHAPTER 3

Numbers of the special provisions to be deleted

70 to 73, 77, 82, 84, 87, 91, 92, 94, 95, 97, 104, 121, 137, 139, 158, 159, 161, 166, 176 and 180.

Amendments to special provisions

Amend sp. 122 to read:

"The subsidiary risks, control and emergency temperatures if any, and the generic entry number for each of the currently assigned organic peroxide formulations are given in table 11.3."

Delete from sp. 133 the sentence:

"The explanation of the 'E' mark is given in 14.2.3.1 of chapter 14."

In sp. 154 for "table 14.1" read "table 14.2".

Amend sp. 160 to read:

"Organic peroxide formulations may be transported in tank-containers provided the requirements of chapter 12 are satisfied. Organic peroxide formulations suitable for transport in tank-containers are listed in table 11.5."

Amend sp. 165 to read:

"Organic peroxide formulations may be transported in Intermediate Bulk Containers(IBCs) provided the requirements of 11.3.12 and chapter 16 are satisfied. Organic peroxide formulations suitable for transport in IBCs are listed in table 11.4."

Amend sp. 181 to read:

"Packages containing this type of substance should bear the "EXPLOSIVE" subsidiary risk label unless the competent authority of the country of origin has permitted this label to be dispensed with for the specific packaging employed because test data have proved that the substance in this packaging does not exhibit explosive behaviour (see 13.6.1.4). The requirements of 11.3.11 and 14.2.3.6, as appropriate, should also be considered."

New special provisions

Add new sp. 194 to read:

"This substance requires temperature control. The control and emergency temperatures are derived from the self-accelerating decomposition temperature as described in 11.3.5. Temperature control requirements are given in 11.3.5 and the control and emergency temperatures are given in table 14.1."

Add new sp. 195 to read:

"For certain organic peroxides types B or C, a smaller packaging than that allowed by packing methods OP5A (or OP5B) or OP6A (or OP6B) respectively has to be used (see 11.3.9.3 and table 11.3)."

Add new sp. 196 to read:

"This formulation should fulfil the criteria given in 11.3.3.3(g).

Formulations not meeting these criteria should be transported under the provisions of Division 5.2; see table 11.3."

CHAPTER 9

9.1.3 Insert "5.2," after "2,".

9.1.5 Add to the end of 9.1.5:

"The packagings used for organic peroxides should comply with the requirements for the medium danger (Packing Group II) category mentioned in 9.1.3."

CHAPTER 11

Replace the current text for 11.3 with the following:

11.3 Division 5.2

11.3.1 Properties

11.3.1.1 Organic peroxides are liable to exothermic decomposition at normal or elevated temperatures. The decomposition can be initiated by heat, contact with impurities (e.g. acids, heavy-metal compounds, amines), friction or impact. The rate of decomposition increases with temperature and varies with the organic peroxide formulation. Decomposition may result in the evolution of harmful, or flammable, gases or vapours. For certain organic peroxides the transport temperature has to be controlled. Some organic peroxides may decompose explosively, particularly if confined. This characteristic may be modified by the addition of diluents or by the use of appropriate packagings. Many organic peroxides burn vigorously.

11.3.1.2 Contact of organic peroxides with the eyes should be avoided. Some organic peroxides will cause serious injury to the cornea, even after brief contact, or will be corrosive to the skin.

11.3.2 Assignment of organic peroxides to Division 5.2

11.3.2.1 Any organic peroxide should be considered for classification in Division 5.2, unless the organic peroxide formulation contains:

not more than 1.0% available oxygen from the organic peroxides when containing not more than 1.0% hydrogen peroxide; or

not more than 0.5% available oxygen from the organic peroxides when containing more than 1.0% but not more than 7.0% hydrogen peroxide.

Note: The available oxygen content (%) of an organic peroxide formulation is given by the formula $16 \times \Sigma (n_i \times c_i / m_i)$

where: n_i = number of peroxygen groups per molecule of organic peroxide i
 c_i = concentration (mass %) of organic peroxide i
 m_i = molecular mass of organic peroxide i .

11.3.2.2 Organic peroxides are classified as ORGANIC PEROXIDE TYPE A, B, C, D, E, F or G in accordance with the classification principles given in 11.3.3.3.

11.3.2.3 Organic peroxides, permitted for transport under the provisions of Division 5.2, are assigned to generic entries (UN Nos. 3101 to 3120) which are listed in chapter 2. The entries specify:

organic peroxide type (B to F) (see 11.3.3);

physical state (liquid/solid) (see 11.3.9.1);

temperature control (when required) (see 11.3.5).

11.3.2.4 Organic peroxide formulations currently assigned to a generic entry are shown in table 11.3 together with any relevant information.

11.3.2.5 Allocation of new organic peroxides or new formulations of currently assigned organic peroxides to a generic entry should be made by the competent authority of the country of origin and notification sent to the competent authority of the country of destination if so required by it. The notification should contain the relevant transport conditions and a report with the test results. Test methods and criteria and an example of a report are given in the current edition of the United Nations Recommendations, Tests and Criteria, Part III.

11.3.2.6 Samples of new organic peroxides or new formulations of currently assigned organic peroxides, for which complete test data are not available and which are to be transported for further testing or evaluation, may be assigned to one of the appropriate entries for ORGANIC PEROXIDE TYPE C provided the following conditions are met:

the available data indicates that the sample would be no more dangerous than ORGANIC PEROXIDE TYPE B;

the sample is packaged in accordance with packing method OP2A or OP2B and the quantity per transport unit is limited to 10 kg;

the available data indicate that the control temperature, if any, is sufficiently low to prevent any dangerous decomposition and sufficiently high to prevent any dangerous phase separation.

11.3.3 Classification of organic peroxides

11.3.3.1 Organic peroxides are classified into seven types according to the degree of hazard they present. The types of organic peroxide range from type A, which is not accepted for transport in the packaging in which it is tested, to type G, which is exempted from Division 5.2. The classification of types B to F is directly related to the maximum capacity allowed in one packaging.

11.3.3.2 An organic peroxide formulation should be regarded as possessing explosive properties when in laboratory testing the formulation is liable to detonate, to deflagrate rapidly or to show a violent effect when heated under confinement.

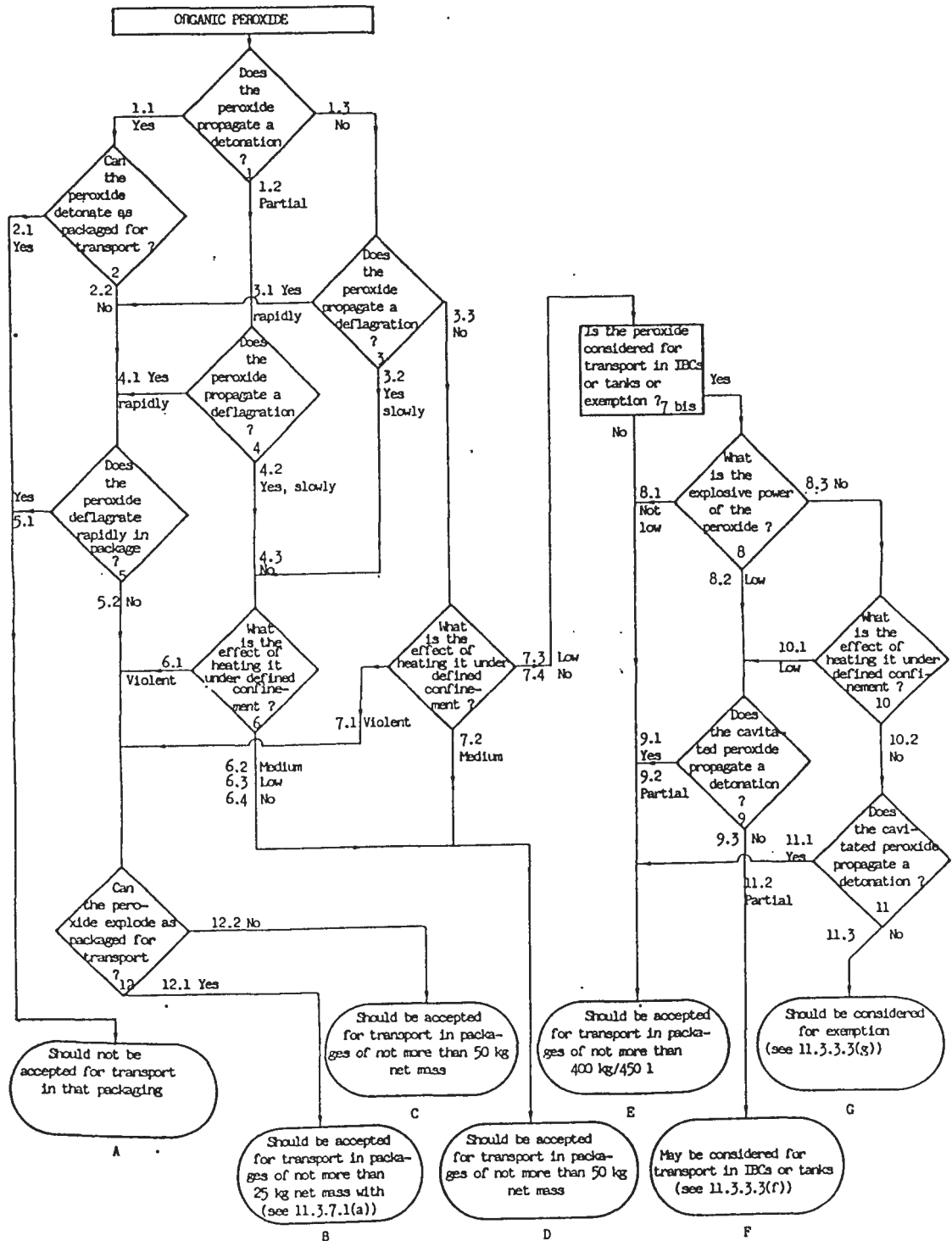
11.3.3.3 The following principles should be applied to the classification of organic peroxide formulations not listed in table 11.3:

- (a) Any organic peroxide formulation which can detonate or deflagrate rapidly, as packaged for transport, should be prohibited from transport in that packaging under Division 5.2 (defined as ORGANIC PEROXIDE TYPE A, exit box A of Figure 11.1).
- (b) Any organic peroxide formulation possessing explosive properties and which, as packaged for transport, does neither detonate nor deflagrate rapidly, but is liable to undergo a thermal explosion in that package, should bear an "EXPLOSIVE" subsidiary risk label. Such an organic peroxide may be packaged in amounts of up to 25 kg unless the maximum quantity has to be limited to a lower amount to preclude detonation or rapid deflagration in the package (defined as ORGANIC PEROXIDE TYPE B, exit box B of Figure 11.1).
- (c) Any organic peroxide formulation possessing explosive properties may be transported without an "EXPLOSIVE" subsidiary risk label when the substance as packaged (maximum 50 kg) for transport cannot detonate or rapidly deflagrate or undergo a thermal explosion (defined as ORGANIC PEROXIDE TYPE C, exit box C of Figure 11.1).
- (d) Any organic peroxide formulation which in laboratory testing:
 - detonates partially, does not deflagrate rapidly and shows no effect when heated under confinement; or
 - does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement; or
 - does not detonate or deflagrate at all and shows a medium effect when heated under confinement;is acceptable for transport in packages of not more than 50 kg net mass (defined as ORGANIC PEROXIDE TYPE D, exit box D of Figure 11.1).
- (e) Any organic peroxide formulation which, in laboratory testing, does neither detonate nor deflagrate at all and shows low or no effect when heated under confinement is acceptable for transport in packages of not more than 400 kg/450 litres (defined as ORGANIC PEROXIDE TYPE E, exit box E of Figure 11.1).
- (f) Any organic peroxide formulation which, in laboratory testing, does neither detonate in the cavitated state nor deflagrate at all and shows only a low or no effect when heated under confinement as well as low or no explosive power may be considered for transport in IBCs or tanks (defined as ORGANIC PEROXIDE TYPE F, exit box F of Figure 11.1); for additional requirements see 11.3.12 and 11.3.13.

- (g) Any organic peroxide formulation which, in laboratory testing, does neither detonate in the cavitated state nor deflagrate at all and shows no effect when heated under confinement as well as no explosive power should be exempted from Division 5.2, provided that the formulation is thermally stable (self-accelerating decomposition temperature is 60°C or higher for a 50 kg package) and for liquid formulations diluent type A is used for desensitization (defined as ORGANIC PEROXIDE TYPE G, exit box G of Figure 11.1).

11.3.3.4 In 11.3.3.3(a) to 11.3.3.3(g) only those properties of organic peroxides are referred to which are decisive for their classification. A flow chart, presenting the classification principles in the form of a graphically arranged scheme of questions concerning the decisive properties together with the possible answers, is given in Figure 11.1. These properties should be determined experimentally. Suitable test methods with pertinent evaluation criteria are given in the current edition of the United Nations Recommendations, Tests and Criteria, Part III.

FIGURE 11.1 - Classification and flow-chart scheme for organic peroxides



11.3.4 Desensitization of organic peroxides

11.3.4.1 In order to ensure safety during transport, organic peroxides are in many cases desensitized by organic liquids or solids, inorganic solids or water. Where a percentage of a substance is stipulated, this refers to the percentage by mass, rounded to the nearest whole number. In general, desensitization should be such that, in case of spillage, the organic peroxide will not concentrate to a dangerous extent.

11.3.4.2 Unless otherwise stated for the individual organic peroxide formulation, the following definitions should apply for diluents used for desensitization:

Diluents type A are organic liquids which are compatible with the organic peroxide and which have a boiling point of not less than 150°C. Type A diluents may be used for desensitizing all organic peroxides.

Diluents type B are organic liquids which are compatible with the organic peroxide and which have a boiling point of less than 150°C but not less than 60°C and a flashpoint of not less than 5°C. Type B diluents may only be used for desensitization of organic peroxides for which temperature control is required. The boiling point of the liquid should be at least 50°C higher than the control temperature of the organic peroxide.

11.3.4.3 Diluents, other than type A or type B, may be added to organic peroxide formulations as listed in table 11.3 provided that they are compatible. However, replacement of all or part of a type A or type B diluent by another diluent with differing properties requires that the organic peroxide formulation be re-assessed in accordance with the normal acceptance procedure for Division 5.2.

11.3.4.4 Water may only be used for the desensitization of organic peroxides which are shown in table 11.3 or in the notification according to 11.3.2.5 as being with water or as a stable dispersion in water.

11.3.4.5 Organic and inorganic solids may be used for desensitization of organic peroxides provided that they are compatible.

11.3.4.6 Compatible liquids and solids are those which have no detrimental influence on the thermal stability and hazard type of the organic peroxide formulation.

11.3.5 Temperature control requirements

11.3.5.1 All organic peroxides should be protected from direct sunlight, all sources of heat and placed in adequately ventilated areas. Certain organic peroxides may only be transported under conditions where the temperature is controlled.

11.3.5.2 The control temperature is the maximum temperature at which the organic peroxide can be safely transported during a prolonged period of time. It is assumed that the temperature of the immediate surroundings to the package is no more than 55°C during transport and, if it occurs, only during a relatively short time per 24 hours. When a journey is to take place under conditions where this assumption may not be correct then organic peroxides, not normally temperature controlled, may require control. In the event of loss of temperature control, it may be necessary to implement emergency procedures. The emergency temperature is the temperature at which such procedures should be implemented.

11.3.5.3 The control and emergency temperatures are derived using table 11.1 from the Self-Accelerating Decomposition Temperature (SADT) which is defined as the lowest temperature at which self-accelerating decomposition may occur with a substance in the packaging as used in transport. An SADT should be determined in order to decide if a substance should be subjected to temperature control during transport. Requirements for the determination of the SADT are given in 11.3.6.

11.3.5.4 All substances which exhibit violent self-accelerating decomposition when tested at 50°C should be subject to temperature control during transport and their SADTs should be determined. Substances requiring Special Provision 181 should be stable at 50°C for a least 168 hours under SADT test conditions to be acceptable for transport without temperature control. Otherwise, they should be subject to temperature control during transport according to their SADTs. All other substances, not requiring Special Provision 181, which show only mild self-accelerating decomposition at 50°C should be further tested at 45°C for a least 168 hours. Those which are unstable at this temperature should be subject to temperature control and their SADTs should be determined.

11.3.5.5 Control and emergency temperatures, where appropriate, for currently assigned organic peroxide formulations are given in table 11.3. The actual transport temperature may be lower than the control temperature but should be selected so as to avoid dangerous separation of phases.

TABLE 11.1 DERIVATION OF CONTROL AND EMERGENCY TEMPERATURES

SADT	Control temperature	Emergency temperature
20°C or less	20°C below SADT	10°C below SADT
over 20°C to 35°C	15°C below SADT	10°C below SADT
over 35°C	10°C below SADT	5°C below SADT

11.3.6 Determination of the Self-Accelerating Decomposition Temperature

11.3.6.1 Test methods for determining the SADT are given in the current edition of the Recommendations: Test and Criteria, Part II. The test selected should be conducted in a manner which is representative of the package, both in size and material, to be transported.

11.3.7 Labelling and marking

11.3.7.1 The Division 5.2 label should be affixed to packages containing organic peroxides classified as types B, C, D, E or F. This label also implies that the product may be flammable and hence no "FLAMMABLE LIQUID" subsidiary risk label is required. In addition, the following subsidiary risk labels should be applied:

- (a) An "EXPLOSIVE" subsidiary risk label for organic peroxides type B, unless the competent authority has permitted this label to be dispensed with for a specific packaging because test data have proved that the organic peroxide in such a packaging does not exhibit explosive behaviour (see 13.6.1.4).
- (b) A "CORROSIVE" subsidiary risk label is required when packing group I or II criteria of class 8 are met.

11.3.8 General packing requirements

11.3.8.1 To avoid unnecessary confinement, packagings meeting the test criteria of packing group I should not be used. Organic peroxides are assigned to packing group II (medium danger).

11.3.8.2 The packaging of an organic peroxide required to bear an "EXPLOSIVE" subsidiary risk label should comply with the provisions given in 10.1.1 and 10.1.3.

11.3.8.3 Packagings for organic peroxides should meet the requirements of chapter 9 and should be so constructed that none of the materials which are in contact with the contents will catalyse or otherwise dangerously affect the properties of their contents. For combination packagings, cushioning materials should not be readily combustible and should not cause decomposition of the organic peroxide if leakage occurs.

11.3.9 Packing methods for organic peroxides

11.3.9.1 The packing methods for organic peroxides are listed in table 11.2 and are assigned OP1A to OP8A for liquids and OP1B to OP8B for solids. The quantities specified for each packing method represent the maximum currently considered good practice. Viscous liquids should be treated as solids if the criterion given in 1.10 is met.

11.3.9.2 The packing methods appropriate for the individual currently assigned organic peroxides are listed in table 11.3. A packing method corresponding to a smaller package size (i.e. with a lower OP number) may be used but a packing method corresponding to a larger package size (i.e. with a higher OP number) should not be used.

11.3.9.3 For new organic peroxides or new formulations of currently assigned organic peroxides, the following procedure should be used to assign the appropriate packing method:

ORGANIC PEROXIDE TYPE B:

Packing method OP5A or OP5B should be assigned, provided that the organic peroxide satisfies the criteria of 11.3.3(b) in one of the packagings shown for the packing method. If the organic peroxide can only satisfy these criteria in a smaller packaging than those listed for packing method OP5A or OP5B (viz. one of the packagings listed for OP1A to OP4A or OP1B to OP4B), then the corresponding packing method with the lower OP number has to be assigned.

ORGANIC PEROXIDE TYPE C:

Packing method OP6A or OP6B should be assigned, provided that the organic peroxide satisfies the criteria of 11.3.3(c) in one of the packagings shown for the packing method. If the organic peroxide can only satisfy these criteria in a smaller packaging than those listed for packing method OP6A or OP6B then the corresponding packing method with the lower OP number has to be assigned.

ORGANIC PEROXIDE TYPE D:

Packing method OP7A or OP7B should be assigned to this type of organic peroxide.

ORGANIC PEROXIDE TYPE E:

Packing method OP8A or OP8B should be assigned to this type of organic peroxide.

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Annex 4

ORGANIC PEROXIDE TYPE F:

Packing method OP8A or OP8B should be assigned to this type of organic peroxide.

TABLE 11.2 (A) - LIST OF PACKAGINGS FOR LIQUID ORGANIC PEROXIDES

Type and Material	Packaging code (see 9.4.7)	OP1A 2/	Maximum capacity or net mass per packing method 1/ OP2A 2/	OP3A 2/	OP4A 2/	OP5A 2/	OP6A 2/	OP7A	OP8A
Steel drum	1A1	*	*	*	*	*	*	60 litres	225 litres
Steel drum 3/	1A2	*	*	*	*	*	*	50 kg	200 kg
Aluminium drum	1B1	*	*	*	*	*	*	60 litres	225 litres
Fibre drum 3/	1G	0.5 kg	0.5/10 kg	5 kg	5/25 kg	25 kg	50 kg	50 kg	200 kg
Plastics drum	1H1	0.5 litres	0.5 litres	5 litres	5 litres	30 litres	60 litres	60 litres	225 litres
Plastics jerrican	3H1	0.5 litres	0.5 litres	5 litres	5 litres	30 litres	60 litres	60 litres	60 litres
Wooden box 3/	4C1	0.5 kg	0.5/10 kg	5kg	5/25 kg	25 kg	50 kg	50 kg	100 kg
Plywood box 3/	4D	0.5 kg	0.5/10 kg	5kg	5/25 kg	25 kg	50 kg	50 kg	100 kg
Fibreboard box 3/	4G	0.5 kg	0.5/10 kg	5kg	5/25 kg	25 kg	50 kg	50 kg	100 kg
Plastics receptacle with outer steel drum	6HA1	*	*	*	*	*	*	60 litres	225 litres
Plastics receptacle with outer aluminium drum	6HB1	*	*	*	*	*	*	60 litres	225 litres
Plastics receptacle with outer fibre drum	6HG1	0.5 litres	0.5 litres	5 litres	5 litres	30 litres	60 litres	60 litres	225 litres
Plastics receptacle with outer fibreboard box	6HG2	0.5 litres	0.5 litres	5 litres	5 litres	30 litres	60 litres	60 litres	60 litres
Plastics receptacle with outer plastics drum	6HH1	0.5 litres	0.5 litres	5 litres	5 litres	30 litres	60 litres	60 litres	225 litres
Plastics receptacle with outer solid plastics box	6HH2	0.5 litres	0.5 litres	5 litres	5 litres	30 litres	60 litres	60 litres	60 litres

* = Prohibited for organic peroxide types B and C.

1/ = If two values are given, the first applies to the maximum net mass per inner receptacle and the second to the maximum net mass of the complete package.

2/ = For combination packagings containing organic peroxide type B or C, only plastics bottles, plastics jars, glass bottles or glass ampoules may be used as inner packagings. However, glass receptacles may only be used as inner receptacles for packing methods OP1A and OP2A.

3/ = Only allowed as part of a combination packaging. Inner receptacles should be suitable for liquids.

TABLE 11.2 (B) - LIST OF PACKAGINGS FOR SOLID ORGANIC PEROXIDES

Type and Material	Packaging code (see 9.4.7)	Maximum net mass per packing method 1/						OP7B	OP8B
		OP1B 2/	OP2B 2/ 3/	OP3B 2/	OP4B 2/	OP5B 2/	OP6B 2/		
Steel drum	1A2	*	*	*	*	*	*	50 kg	200 kg
Aluminium drum	1B2	*	*	*	*	*	*	50 kg	200 kg
Fibre drum	1G	0.5 kg	0.5/10 kg	5 kg	5/25 kg	25 kg	50 kg	50 kg	200 kg
Plastics drum	1H2	0.5 kg	0.5/10 kg	5 kg	5/25 kg	25 kg	50 kg	50 kg	200 kg
Wooden box	4C1	0.5 kg	0.5/10 kg	5 kg	5/25 kg	25 kg	50 kg	50 kg	100 kg
Plywood box	4D	0.5 kg	0.5/10 kg	5 kg	5/25 kg	25 kg	50 kg	50 kg	100 kg
Fibreboard box	4G	0.5 kg	0.5/10 kg	5 kg	5/25 kg	25 kg	50 kg	50 kg	100 kg
Plastics receptacle with outer steel drum	6HA1	*	*	*	*	*	*	50 kg	200 kg
Plastics receptacle with outer aluminium drum	6HB1	*	*	*	*	*	*	50 kg	200 kg
Plastics receptacle with outer fibre drum	6HG1	0.5 kg	0.5 kg	5 kg	5 kg	25 kg	50 kg	50 kg	200 kg
Plastics receptacle with outer fibreboard box	6HG2	0.5 kg	0.5 kg	5 kg	5 kg	25 kg	50 kg	50 kg	75 kg
Plastics receptacle with outer plastics drum	6HH1	0.5 kg	0.5 kg	5 kg	5 kg	25 kg	50 kg	50 kg	200 kg
Plastics receptacle with outer solid plastics box	6HH2	0.5 kg	0.5 kg	5 kg	5 kg	25 kg	50 kg	50 kg	75 kg

* = Prohibited for organic peroxide types B and C.

1/ = If two values are given, the first applies to the maximum net mass per inner receptacle and the second to the maximum net mass of the complete package.

2/ = For combination packagings containing organic peroxide type B or C, only non-metallic packagings allowed. However, glass receptacles may only be used as inner receptacles for packing methods OP1B and OP2B.

3/ = If fire retardant partitions are used, the maximum net mass of the complete package may be 25 kg.

TABLE 11.3 LIST OF CURRENTLY ASSIGNED ORGANIC PEROXIDES

ORGANIC PEROXIDE	Concen- tration (%)	Diluent type A (%)	Diluent type B (%) 1)	Inert solid (%)	Water (%)	Packing Method	Control Tempera- ture (°C)	Emergency Tempera- ture (°C)	Number (Generic entry)	Subsidiary risks and remarks
ACETYL ACETONE PEROXIDE	≤ 42	≥ 48			≥ 8	OP7A			3105	2)
"	≤ 32 as a paste					OP7B			3106	21)
ACETYL BENZOYL PEROXIDE	≤ 45	≥ 55				OP7A			3105	
ACETYL CYCLOHEXANESULPHONYL PEROXIDE	≤ 82				≥ 12	OP4B	- 10	0	3112	3)
"	≤ 32		≥ 68			OP7A	- 10	0	3115	
tert-AMYL HYDROPEROXIDE	≤ 88	≥ 6			≥ 6	OP8A			3107	
tert-AMYL PEROXYBENZOATE	≤ 96	≥ 4				OP7A			3105	
tert-AMYL PEROXY-2-ETHYLHEXANOATE	≤ 100					OP7A	+ 20	+ 25	3115	
tert-AMYL PEROXYNEODECANOATE	≤ 77		≥ 23			OP7A	0	+ 10	3115	
tert-AMYL PEROXYPIVALATE	≤ 77		≥ 23			OP5A	+ 10	+ 15	3113	
tert-AMYLPEROXY-3,5,5-TRIMETHYLHEXANOATE	≤ 100					OP5A			3101	3)
tert-BUTYL CUMYLPEROXIDE	≤ 100					OP7A			3105	
n-BUTYL-4,4-DI-(tert-BUTYLPEROXY)VALERATE	53 - 100					OP5A			3103	
"	≤ 52			≥ 48		OP7B			3106	
tert-BUTYL HYDROPEROXIDE	73 - 90				≥ 10	OP5A			3103	14)
"	≤ 80	≥ 20				OP7A			3105	4) 14)
"	≤ 72				≥ 28	OP8A, M			3109	14)
tert-BUTYL HYDROPEROXIDE + DI-tert-BUTYL PEROXIDE	≤ 82 + ≥ 9				≥ 7	OP5A			3103	14)
tert-BUTYL MONOPEROXYMALEATE	53 - 100					OP5B			3102	3)
"	≤ 52	≥ 48				OP6A			3103	
"	≤ 42 as a paste					OP8B			3108	21)
tert-BUTYL MONOPEROXYPHthalate	≤ 100					OP5B			3102	3)
tert-BUTYL PEROXYACETATE	53 - 77	≥ 23				OP5A			3101	3)
"	≤ 52	≥ 48				OP6A			3103	
tert-BUTYL PEROXYBENZOATE	78 - 100	≤ 22				OP5A			3103	
"	53 - 77	≥ 23				OP7A			3105	
"	≤ 52			≥ 48		OP7B			3106	
tert-BUTYL PEROXYCROTONATE	≤ 77	≥ 23				OP7A			3105	
tert-BUTYL PEROXYDIETHYLACETATE	≤ 100					OP5A	+ 20	+ 25	3113	
tert-BUTYL PEROXYDIETHYLACETATE + tert-BUTYL PEROXYBENZOATE	≤ 33 + ≤ 33	≥ 33				OP7A			3105	
tert-BUTYL PEROXY-2-ETHYLHEXANOATE	53 - 100					OP6A	+ 20	+ 25	3113	
"	≤ 52		≥ 48			OP8A	+ 20	+ 25	3117	
tert-BUTYL PEROXY-2-ETHYLHEXANOATE + 2,2-DI-(tert-BUTYLPEROXY)BUTANE	≤ 31 + ≤ 36	≥ 33				OP7A	+ 35	+ 40	3115	
"	≤ 12 + ≤ 14	≥ 14		≥ 60		OP7B			3106	

TABLE 11.3 (continued)

ORGANIC PEROXIDE	Concentration (%)	Diluent type A (%)	Diluent type B (%) 1)	Inert solid (%)	Water (%)	Packing Method	Control Temperature (°C)	Emergency Temperature (°C)	Number (Generic entry)	Subsidiary risks and remarks
tert-BUTYL PEROXYISOBUTYRATE	53 - 77		≥ 23			OP5A	+ 15	+ 20	3111	3)
"	≤ 52		≥ 48			OP7A	+ 15	+ 20	3115	
tert-BUTYLPEROXY ISOPROPYLCARBONATE	≤ 77	≥ 23				OP5A			3103	
tert-BUTYL PEROXYNEODECANOATE	78 - 100					OP7A	- 5	+ 5	3115	
"	≤ 77		≥ 23			OP7A	0	+ 10	3115	
3-tert-BUTYLPEROXY-3-PHENYLPHTHALIDE	≤ 100					OP7B			3106	
tert-BUTYL PEROXYPIVALATE	68 - 77	≥ 23				OP5A	0	+ 10	3113	
"	≤ 67		≥ 33			OP7A	0	+ 10	3115	
tert-BUTYLPEROXY STEARYLCARBONATE	≤ 100					OP7B			3106	
tert-BUTYL PEROXY-3,5,5-TRIMETHYLHEXANOATE	≤ 100					OP7A			3105	
3-CHLOROPEROXYBENZOIC ACID	58 - 86			≥ 14		OP1B			3102	3)
"	≤ 57			≥ 3	≥ 40	OP7B			3106	
CUMYL HYDROPEROXIDE	≤ 90	≥ 10				OP8A, M			3109	14) 19)
CUMYL PEROXYNEODECANOATE	≤ 77		≥ 23			OP7A	- 10	0	3115	
CUMYL PEROXYPIVALATE	≤ 77		≥ 23			OP7A	- 5	+ 5	3115	
CYCLOHEXANONE PEROXIDE(S)	≤ 91				≥ 9	OP6B			3104	14)
"	≤ 72 as a paste					OP7B			3106	5) 21)
"	≤ 72	≥ 28				OP7A			3105	5)
"	≤ 32			≥ 68					Exempt	
DIACETONE ALCOHOL PEROXIDES	≤ 57		≥ 26		≥ 8	OP7A	+ 30	+ 35	3115	7)
DIACETYL PEROXIDE	≤ 27		≥ 73			OP7A	+ 20	+ 25	3115	8) 14)
DI-tert-AMYL PEROXIDE	≤ 100					OP8A			3107	
DIBENZOYL PEROXIDE	52 - 100			≤ 48		OP2B			3102	3)
"	78 - 94				≥ 6	OP4B			3102	3)
"	≤ 77				≥ 23	OP6B			3104	
"	≤ 62			≥ 28	≥ 10	OP7B			3106	
"	53 - 62 as a paste					OP7B			3106	21)
"	≤ 52 as a paste					OP8B			3108	21)
"	36 - 52			≥ 48		OP7B			3106	
"	≤ 35			≥ 65					Exempt	
DIBENZYL PEROXYDICARBONATE	≤ 87				≥ 13	OP5B	+ 25	+ 30	3112	3)
DI-(4-tert-BUTYLCYCLOHEXYL) PEROXYDICARBONATE	≤ 100					OP6B	+ 30	+ 35	3114	
"	≤ 42 as a stable dispersion in water					OP8A, N	+ 30	+ 35	3119	
DI-tert-BUTYL PEROXIDE	≤ 100					OP8A			3107	
2,2-DI-(tert-BUTYLPEROXY)BUTANE	≤ 52	≥ 48				OP6A			3103	

TABLE 11.3 (continued)

ORGANIC PEROXIDE	Concentration (%)	Diluent type A (%)	Diluent type B (%) 1)	Inert solid (%)	Water (%)	Packing Method	Control Temperature (°C)	Emergency Temperature (°C)	Number (Generic entry)	Subsidiary risks and remarks
1,1-DI-(tert-BUTYLPEROXY)CYCLOHEXANE	81 - 100					OP5A			3101	3)
"	53 - 80	≥ 20				OP5A			3103	
"	≤ 52	≥ 48				OP7A			3105	
"	≤ 42	≥ 13		≥ 45		OP7B			3106	
"	≤ 27	≥ 36	≥ 36			OP8A			3107	
2,2-DI-(4,4-tert-BUTYLPEROXYCYCLOHEXYL)PROPANE	≤ 42			≥ 58		OP7B			3106	
DI-n-BUTYL PEROXYDICARBONATE	28 - 52		≥ 48			OP7A	- 15	- 5	3115	
"	≤ 27		≥ 73			OP8A	- 10	0	3117	
DI-sec-BUTYL PEROXYDICARBONATE	53 - 100					OP4A	- 20	- 10	3113	
"	≤ 52		≥ 48			OP7A	- 15	- 5	3115	
DI-(2-tert-BUTYLPEROXYISOPROPYL)BENZENE(S)	43 - 100			≤ 57		OP7B			3106	
"	≤ 42			≥ 58					Exempt	
DI-(tert-BUTYLPEROXY)PHTHALATE	43 - 52	≥ 48				OP7A			3105	
"	≤ 52 as a paste					OP7B			3106	21)
"	≤ 42	≥ 58				OP8A			3107	
2,2-DI-(tert-BUTYLPEROXY)PROPANE	≤ 52	≥ 48				OP7A			3105	
"	≤ 42	≥ 13		≥ 45		OP7B			3106	
1,1-DI-(tert-BUTYLPEROXY)-3,3,5-TRIMETHYLCYCLOHEXANE	58 - 100					OP5A			3101	3)
"	≤ 57			≥ 43		OP7B			3106	
"	≤ 57	≥ 43				OP8A			3107	
DICETYL PEROXYDICARBONATE	≤ 100					OP7B	+ 20	+ 25	3116	
"	≤ 42 as a stable dispersion in water					OP8A, N	+ 30	+ 35	3119	
DI-4-CHLOROBENZOYL PEROXIDE	≤ 77				≥ 23	OP5B			3102	3)
"	≤ 52 as a paste					OP7B			3106	21)
"	≤ 32			≥ 68					Exempt	
DICUMYL PEROXIDE	43 - 100			≤ 57		OP8B, M			3110	13)
"	≤ 42			≥ 58					Exempt	
DICYCLOHEXYL PEROXYDICARBONATE	92 - 100					OP5B	+ 5	+ 10	3112	3)
"	≤ 91				≥ 9	OP3B	+ 5	+ 10	3114	
DIDECANOYL PEROXIDE	≤ 100					OP6B	+ 15	+ 20	3114	
DI-2,4-DICHLOROBENZOYL PEROXIDE	≤ 77				≥ 23	OP5B			3102	3)
"	≤ 52 as a paste with silicon oil					OP7B			3106	
DI-(2-ETHYLHEXYL) PEROXYDICARBONATE	78 - 100					OP5A	- 20	- 10	3113	
"	≤ 77					OP7A	- 15	- 5	3115	
"	≤ 42 as a stable dispersion in water					OP8A	- 15	- 5	3117	
"	≤ 42 as a stable dispersion in water(frozen)					OP8B	- 15	- 5	3118	

TABLE 11.3 (continued)

ORGANIC PEROXIDE	Concen- tration (%)	Diluent type A (%)	Diluent type B (%) 1)	Inert solid (%)	Water (%)	Packing Method	Control Tempera- ture (°C)	Emergency Tempera- ture (°C)	Number (Generic entry)	Subsidiary risks and remarks
DIETHYL PEROXYDICARBONATE	≤ 27		≥ 73			OP7A	- 10	0	3115	
2,2-DIHYDROPEROXYPROPANE	≤ 27			≥ 73		OP5B			3102	3)
DI-(1-HYDROXYCYCLOHEXYL) PEROXIDE	≤ 100					OP7B			3106	
DIISOBUTYRYL PEROXIDE	33 - 52		≥ 48			OP5A	- 20	- 10	3111	3)
"	≤ 32		≥ 68			OP7A	- 20	- 10	3115	
DIISOPROPYL PEROXYDICARBONATE	53 - 100					OP2B	- 15	- 5	3112	3)
"	≤ 52		≥ 48			OP7A	- 10	0	3115	
DIISOTRIDECYL PEROXYDICARBONATE	≤ 100					OP7A	- 10	0	3115	
DILAURYL PEROXIDE	≤ 100					OP7B			3106	
"	≤ 42 as a stable dispersion in water					OP8A, N			3109	
DI-(2-METHYLBENZOYL) PEROXIDE	≤ 87				≥ 13	OP5B	+ 30	+ 35	3112	3)
2,5-DIMETHYL-2,5-DI-(BENZOYLPEROXY)HEXANE	83 - 100					OP5B			3102	3)
"	≤ 82			≥ 18		OP7B			3106	
"	≤ 82				≥ 18	OP5B			3104	
2,5-DIMETHYL-2,5-DI-(tert-BUTYLPEROXY)HEXANE	53 - 100					OP7A			3105	
"	≤ 52			≥ 48		OP7B			3106	
2,5-DIMETHYL-2,5-DI-(tert-BUTYLPEROXY)HEXYNE-3	53 - 100					OP5A			3103	
"	≤ 52			≥ 48		OP7B			3106	
2,5-DIMETHYL-2,5-DI-(2-ETHYLHEXANOYLPEROXY)HEXANE	≤ 100				≥ 18	OP7A	+ 20	+ 25	3115	
2,5-DIMETHYL-2,5-DIHYDROPEROXYHEXANE	≤ 82					OP6B			3104	
2,5-DIMETHYL-2,5-DI-(3,5,5-TRIMETHYLHEXANOYL- PEROXY)HEXANE	≤ 77	≥ 23				OP7A			3105	
DIMYRISTYL PEROXYDICARBONATE	≤ 100					OP7B	+ 20	+ 25	3116	
"	≤ 42 as a stable dispersion in water					OP8A, N	+ 20	+ 25	3119	
DI-n-NONANOYL PEROXIDE	≤ 100					OP7B	0	+ 10	3116	
DI-n-OCTANOYL PEROXIDE	≤ 100					OP5B	+ 10	+ 15	3114	
DIPEROXY AZELAIC ACID	≤ 27			≥ 73		OP7B	+ 35	+ 40	3116	
DIPEROXY DODECANE DIACID	14 - 42			≥ 58		OP7B	+ 40	+ 45	3116	
"	≤ 13			≥ 87					Exempt	
DI-(2-PHENOXYETHYL) PEROXYDICARBONATE	86 - 100					OP5B			3102	3)
"	≤ 85				≥ 15	OP7B			3106	
DIPROPIONYL PEROXIDE	≤ 27		≥ 73			OP8A	+ 15	+ 20	3117	
DI-n-PROPYL PEROXYDICARBONATE	≤ 100					OP4A	- 25	- 15	3113	
DISTEARYL PEROXYDICARBONATE	≤ 87			≥ 13		OP7B			3106	
DISUCCINIC ACID PEROXIDE	73 - 100					OP4B			3102	3)
"	≤ 72				≥ 28	OP7B	+ 10	+ 15	3116	18)

TABLE 11.3 (continued)

ORGANIC PEROXIDE	Concentration (%)	Diluent type A (%)	Diluent type B (%) 1)	Inert solid (%)	Water (%)	Packing Method	Control Temperature (°C)	Emergency Temperature (°C)	Number (Generic entry)	Subsidiary risks and remarks
DI-(3,5,5-TRIMETHYLHEXANOYL) PEROXIDE	≤ 82	≥ 18				OP7A	0	+ 10	3115	
DI-(3,5,5-TRIMETHYL-1,2-DIOXOLANYL-3) PEROXIDE	≤ 52 as a paste	≥ 33				OP7B	+ 30	+ 35	3116	21)
ETHYL 3,3-DI-(tert-AMYLPEROXY)BUTYRATE	≤ 67	≥ 33				OP7A			3105	
ETHYL 3,3-DI-(tert-BUTYLPEROXY)BUTYRATE	78 - 100					OP5A			3103	
"	≤ 77	≥ 23				OP7A			3105	
"	≤ 52			≥ 48		OP7B			3106	
3,3,6,6,9,9-HEXAMETHYL-1,2,4,5-TETRAOXACYCLONONANE	53 - 100					OP4B			3102	3)
"	≤ 52	≥ 48				OP7A			3105	
"	≤ 52			≥ 48		OP7B			3106	
ISOPROPYLCUMYL HYDROPEROXIDE	≤ 72	≥ 28				OP8A, M			3109	14)
p-MENTHYL HYDROPEROXIDE	56 - 100					OP7A			3105	14)
"	≤ 55	≥ 45				OP8A, M			3109	
METHYLCYCLOHEXANONE PEROXIDE(S)	≤ 67		≥ 33			OP7A	+ 35	+ 40	3115	
METHYL ETHYL KETONE PEROXIDE(S)	≤ 52	≥ 48				OP5A			3101	3) 9) 14)
"	≤ 45	≥ 55				OP7A			3105	10)
"	≤ 40	≥ 60				OP8A			3107	11)
"	≤ 62	≥ 19	≥ 19			OP7A			3105	
METHYL ISOBUTYL KETONE PEROXIDE(S)						OP2A			3103	12)
ORGANIC PEROXIDE, LIQUID, SAMPLE						OP2A			3113	12)
ORGANIC PEROXIDE, LIQUID, SAMPLE, TEMPERATURE CONTROLLED						OP2B			3104	12)
ORGANIC PEROXIDE, SOLID, SAMPLE						OP2B			3114	12)
ORGANIC PEROXIDE, SOLID, SAMPLE, TEMPERATURE CONTROLLED						OP7A			3105	14) 15) 20)
PEROXYACETIC ACID, TYPE D, stabilized	≤ 43					OP8A			3107	14) 16) 20)
PEROXYACETIC ACID, TYPE E, stabilized	≤ 43					OP8A			3109	14) 17) 20)
PEROXYACETIC ACID, TYPE F, stabilized	≤ 43					OP8A			3105	14)
PINANYL HYDROPEROXIDE	56 - 100					OP7A			3109	
"	≤ 55	≥ 45				OP8A, M			3106	
TETRAHYDRONAPHTHYL HYDROPEROXIDE	≤ 100					OP7B			3105	
1,1,3,3-TETRAMETHYLBUTYL HYDROPEROXIDE	≤ 100					OP7A	+ 20	+ 25	3115	
1,1,3,3-TETRAMETHYLBUTYL PEROXY-2 ETHYLHEXANOATE	≤ 100					OP7A	- 10	0	3115	
2,4,4-TRIMETHYLPENTYL-2-PEROXY PHENOXYACETATE	≤ 37		≥ 63			OP7A				

TABLE 11.3 (continued)

REMARKS

- 1) Diluent type B may always be replaced by diluent type A.
- 2) Available oxygen ≤ 4.7 %.
- 3) "EXPLOSIVE" subsidiary risk label required.
- 4) Diluent may be replaced by di-tert-butyl peroxide.
- 5) Available oxygen ≤ 9 %.
- 6) Available oxygen ≤ 7.5 %.
- 7) With ≤ 9 % hydrogen peroxide; available oxygen ≤ 10 %.
- 8) Only non-metallic packagings allowed.
- 9) Available oxygen > 10 %.
- 10) Available oxygen ≤ 10 %.
- 11) Available oxygen ≤ 8.2 %.
- 12) See 11.3.2.6.
- 13) Up to 2000 kg per receptacle assigned to ORGANIC PEROXIDE TYPE F on the basis of large scale trials.
- 14) "CORROSIVE" subsidiary risk label required.
- 15) Peroxyacetic acid formulations which fulfil the criteria of 11.3.3.3 (d)
- 16) Peroxyacetic acid formulations which fulfil the criteria of 11.3.3.3 (e)
- 17) Peroxyacetic acid formulations which fulfil the criteria of 11.3.3.3 (f)
- 18) Addition of water to this organic peroxide will decrease its thermal stability.
- 19) No "CORROSIVE" subsidiary risk label required for concentrations below 80%.
- 20) Mixtures with hydrogen peroxide, water and acid(s).
- 21) With diluent type A, with or without water.

11.3.10 Transport under temperature control

11.3.10.1 Since the circumstances to be taken into account differ for the various modes of transport, only general guidance is given in the following paragraphs.

11.3.10.2 Maintenance of the prescribed temperature is an essential feature of the safe transport of many organic peroxides. In general, there should be:

- thorough inspection of the transport unit prior to loading;

- instructions to the carrier about the operation of the refrigeration system;

- procedures to be followed in the event of loss of control;

- regular monitoring of operating temperatures;

- provision of a back-up refrigeration system or spare parts.

11.3.10.3 Any control and temperature sensing devices in the refrigeration system should be readily accessible and all electrical connections weather-proof. The temperature of air space within the transport unit should be measured by two independent sensors and the output should be so recorded that temperature changes are readily detectable. The temperature should be checked every four to six hours and logged. When substances having a control temperature of less than +25°C are carried, the transport unit should be equipped with visible and audible alarms, powered independently of the refrigeration system, set to operate at or below the control temperature.

11.3.10.4 If during transport the control temperature is exceeded, an alert procedure should be initiated involving any necessary repairs to the refrigeration equipment or an increase in the cooling capacity (e.g. by adding liquid or solid refrigerants). There should also be frequent checking of the temperature and preparations for implementation of the emergency procedures. If the emergency temperature is reached, the emergency procedures should be set in operation.

11.3.10.5 The suitability of a particular means of temperature control for transport depends on a number of factors. Amongst those to be considered are:

- the control temperature(s) of the substance(s) to be transported;

- the difference between the control temperature and the anticipated ambient temperature conditions;

- the effectiveness of the thermal insulation;

the duration of transport;

allowance of a safety margin for delays.

11.3.10.6 Suitable methods for preventing the control temperature being exceeded are, in order of increasing control capability:

(a) Thermal insulation; provided that the initial temperature of the organic peroxide(s) is sufficiently below the control temperature.

(b) Thermal insulation with coolant system; provided that:

an adequate quantity of coolant (e.g. liquid nitrogen or solid carbon dioxide), allowing a reasonable margin for delay, is carried;

liquid oxygen or air is not used as coolant;

there is a uniform cooling effect even when most of the coolant has been consumed;

the need to ventilate the unit before entering is clearly indicated by a warning on the door(s) of the unit.

(c) Single mechanical refrigeration; provided that flameproof fittings are used within the coolant compartment to prevent ignition of flammable vapours from the organic peroxides.

(d) Combined mechanical refrigeration system with coolant system; provided that:

the two systems are independent of one another;

the requirements in (b) and (c) are complied with.

(e) Dual mechanical refrigeration system; provided that:

apart from the integral power supply unit, the two systems are independent of one another;

each system alone is capable of maintaining adequate temperature control;

flameproof fittings are used within the coolant compartment to prevent ignition of flammable vapours from the organic peroxides.

11.3.11 Transport of packages in freight containers, closed road vehicles and unit loads

11.3.11.1 Where a number of packages are assembled in a freight container, closed road vehicle or unit load, the total quantity of organic peroxides, the type and number of packages and the stacking arrangement should not create an explosion hazard.

11.3.12 Transport of organic peroxides in IBCs

11.3.12.1 The following requirements apply to organic peroxides intended for the transport of organic peroxides in IBCs. Emergencies to be taken into account are the self-accelerating decomposition of the organic peroxide and fire-engulfment.

11.3.12.2 The currently assigned organic peroxides specifically listed in table 11.4 and indicated with the letter "N" in the "Packing Method" column of table 11.3 may be transported in the IBCs of the type shown. Other organic peroxides may be transported in IBCs under conditions established by the competent authority of the country of origin when, on the basis of the appropriate tests, this competent authority is satisfied that such transport may be safely conducted. The tests undertaken should include those necessary:

- to prove that the organic peroxide complies with the principles for classification given in 11.3.3.3(f), exit box F of Figure 11.1;

- to prove the compatibility of all materials normally in contact with the substance during the transport;

- to determine, when applicable, the control and emergency temperatures associated with the transport of the product in the IBC concerned as derived from the SADT;

- to design, when applicable, pressure and emergency relief devices;

- to determine if any special requirements are necessary for safe transport of the substance.

For the organic peroxides not listed in table 11.4, a notification, including the test data and approved transport conditions, should be sent to the competent authority of the country of destination.

11.3.12.3 To prevent explosive rupture of metal IBCs or composite IBCs with complete metal casing, the emergency devices should be designed to vent all the decomposition products and vapours evolved during a period of not less than one hour of complete fire-engulfment (heat load 11 W/cm²).

11.3.12.4 IBCs should be transported in a closed transport unit.

TABLE 11.4. CURRENTLY ASSIGNED ORGANIC PEROXIDES SUITABLE FOR
TRANSPORT IN IBCS

UN No.	Organic peroxide	Type of IBC <u>1/</u>	Maximum Capacity (litres)	Control Temperature	Emergency Temperature
3109	ORGANIC PEROXIDES, TYPE F, LIQUID Dilauroyl peroxide, not more than 42%, stable dispersion, in water	31HA1	1000		
3110	ORGANIC PEROXIDES, TYPE F, SOLID				
3119	ORGANIC PEROXIDES, TYPE F, LIQUID, TEMPERATURE CONTROLLED Di-(4-tert-butylcyclohexyl) peroxydicarbonate, not more than 42%, stable dispersion, in water	31HA1	1000	+30°C	+35°C
	Dicetyl peroxydicarbonate, not more than 42%, stable dispersion, in water	31HA1	1000	+30°C	+35°C
	Dimyristyl peroxydicarbonate, not more than 42%, stable dispersion, in water	31HA1	1000	+15°C	+25°C
3120	ORGANIC PEROXIDES, TYPE F, SOLID, TEMPERATURE CONTROLLED				

1/ See 16.5, bottom openings allowed.

11.3.13 Transport of organic peroxides in tank-containers

11.3.13.1 The requirements applicable to the transport of organic peroxides in tank-containers are given in chapter 12.

11.3.13.2 Table 11.5 lists, under the appropriate organic peroxide generic entry, those currently assigned organic peroxides that are allowed for transport in tank-containers. These organic peroxides are also indicated with the letter "M" in the column "Packing method" of table 11.3.

TABLE 11.5. CURRENTLY ASSIGNED ORGANIC PEROXIDES SUITABLE FOR
TRANSPORT IN TANK-CONTAINERS

UN No.	Organic peroxide	Control Temperature	Emergency Temperature
3109	ORGANIC PEROXIDES, TYPE F, LIQUID - tert-Butyl hydroperoxide <u>1</u> / not more than 72% with water - Cumyl hydroperoxide, not more than 90% in diluent type A - Isopropyl cumyl hydroperoxide, not more than 72% in diluent type A - p-Menthyl hydroperoxide, not more than 55% in diluent type A - Pinanyl hydroperoxide, not more than 55% in diluent type A		
3110	ORGANIC PEROXIDES TYPE F, SOLID - Dicumyl peroxide <u>2</u> /		
3119	ORGANIC PEROXIDES, TYPE F, LIQUID, TEMPERATURE CONTROLLED		
3120	ORGANIC PEROXIDES, TYPE F, SOLID, TEMPERATURE CONTROLLED		

1/ Provided that steps have been taken to achieve the safety equivalence of
65% tert-Butyl hydroperoxide and 35% water.

2/ Maximum quantity per receptacle 2000 kg

CHAPTER 12

Replace the text in 12.550 to 12.562 by the following:

12.550 Organic peroxides (Division 5.2)

12.551 Each organic peroxide should have been tested and a report submitted to the competent authority of the country of origin for approval and notification thereof should be sent to the competent authority of the country of destination. The notification should contain relevant transport information and the report with test results. The tests undertaken should include those necessary:

to prove the compatibility of all materials normally in contact with the substance during transport;

to provide data to enable the design of the pressure and emergency relief devices taking into account the design characteristics of the tank.

Any special requirements necessary for safe transport of the substance should be clearly described in the report.

12.552 The following requirements apply to tanks intended for the transport of organic peroxides (type F) with a Self-Accelerating Decomposition Temperature (SADT) of 55°C or more. In case of conflict these requirements prevail over 12.1 to 12.23. Emergencies to be taken into account are self-accelerating decomposition of the organic peroxide and fire-engulfment as described in 12.558.

12.553 The additional requirements for transport in tanks of organic peroxides with a SADT less than 55°C should be specified by the competent authority of the country of origin and notification thereof should be sent to the competent authority of the country of destination.

12.554 The tank should be designed for a test pressure of at least 0.4 MPa (4 bar).

12.555 Tanks should be fitted with temperature sensing devices.

12.556 Tanks should be fitted with pressure-relief devices and emergency-relief devices. Vacuum-relief devices may also be used. Pressure-relief devices should operate at pressures determined according to both the properties of the organic peroxide and the construction characteristics of the tank. Fusible elements are not allowed in the shell of the tank.

12.557 The pressure-relief devices should consist of spring-loaded valves fitted to prevent significant build-up within the tank of the decomposition products and vapours released at a temperature of 50°C. The capacity and start-to-discharge pressure of the relief valves should be based on the results of the tests specified in 12.551. The start-to-discharge pressure should however in no case be such that liquid would escape from the valve(s) if the tank were overturned.

12.558 The emergency-relief devices may be of the spring-loaded or frangible types designed to vent all the decomposition products and vapours evolved during a period of not less than one hour of complete fire-engulfment (heat load 11 W/cm²). The start-to discharge pressure of the emergency-relief device(s) should be higher than that specified in 12.557 and based on the results of the tests referred to in 12.551. The emergency-relief devices should be dimensioned in such a way that the maximum pressure in the tank never exceeds the test pressure of the tank.

12.559 For insulated tanks the capacity and setting of emergency-relief device(s) should be determined assuming a loss of insulation from 1% of the surface area.

12.560 Vacuum-relief devices and spring-loaded valves should be provided with flame arresters. Due attention should be paid to the reduction of the relief capacity caused by the flame arrester.

12.561 Service equipment such as valves and external piping should be so arranged that no organic peroxide remains in them after filling of the tank.

12.562 Bottom openings are not allowed.

12.563 Tanks may either be insulated or protected by a sun shield. If the SADT of the organic peroxide in the tank is 55°C or less, or the tank is constructed of aluminium, the tank should be completely insulated. The outer surface should be finished in white or bright metal.

12.564 The degree of filling should not exceed 90% at 15°C.

12.565 The marking as required in 12.20.2 should include the UN number and the technical name with the approved concentration of the organic peroxide concerned.

Amendments to table 12.2

Delete the entries for UN Nos. 2093, 2102, 2116, 2125, 2162 and 2171 in table 12.2.

Insert entries for new UN Nos. 3109, 3110, 3119, 3120 and 3149 in table 12.2 as follows:

1	2	3	4	5	6	7	8	9
3109	Organic peroxide, type F, liquid ⁵	5.2/II	-	4	12.5.2	N.A.	12.9.2 12.556 12.557 12.558	12.564
3110	Organic peroxide, type F, solid ⁵	5.2/II	-	4	12.5.2	N.A.	12.9.2 12.556 12.557 12.558	12.564
3119	Organic peroxide, type F, liquid, temperature controlled ⁵	5.2/II	-	4	12.5.2	N.A.	12.9.2 12.556 12.557 12.558	12.564
3120	Organic peroxide, type F, solid, temperature controlled ⁵	5.2/II	-	4	12.5.2	N.A.	12.9.2 12.556 12.557 12.558	12.564
3149	Hydrogen peroxide and peroxyacetic acid mixtures, with acid(s), water and not more than 5% peroxyacetic acid, stabilized	5.1/II	8	4	12.5.2	A/12.7.3	12.9.3	12.22.3

Amend in section (b) of the introduction to table 12.2 footnote 5 to read:

"Currently assigned organic peroxides allowed for transport in tanks are listed in table 11.5."

CHAPTER 13

- 13.4.3 Add to the end of 13.4.3 the following text:
"The Division 1.1, 1.2 or 1.3 label, without the class or division number or compatibility group letter, should be used as the "EXPLOSIVE" subsidiary risk label."
- 13.6.1.3 Add a new paragraph 13.6.1.3 to read:
" 13.6.1.3 For self-reactive substances of Division 4.1 and for organic peroxides that require temperature control during transport, the control and emergency temperature have to be included in the transport document."
- 13.6.1.4 Add a new paragraph 13.6.1.4 to read:
" 13.6.1.4 For certain flammable solids of Division 4.1 and organic peroxides of Division 5.2 for which the competent authority has permitted the "EXPLOSIVE" subsidiary risk label to be dispensed with for the specific package, a statement in this respect should be included in the transport document."
- 13.8.4 Delete the entries in the table with UN Nos. 2255, 2756 and 2899.
Insert the following entry in the table:
"3101-3120 ORGANIC PEROXIDES TYPES B, C, D, E or F"
-

CHAPTER 14

- 14.2.1.2 Insert after "This sub-division comprises" the following text:
", for example, some".
- 14.2.3.1 Replace the existing text of 14.2.3.1 by:
" 14.2.3.1 All self-reactive substances of Division 4.1 should be protected from direct sunlight, all sources of heat and placed in adequately ventilated areas. Certain self-reactive substances may only be transported under conditions where the temperature is controlled. The assignment of special provision 181 to an entry in chapter 2 indicates that the self-reactive substance may exhibit explosive behaviour under certain conditions. Packagings containing this type of substance should bear the "EXPLOSIVE" subsidiary risk label unless the competent authority of the country of origin has permitted this label to be dispensed with for the specific packaging employed because test data have proved that the substance in this packaging does not exhibit explosive behaviour (see 13.6.1.4)."

14.2.3.2 Replace the text "should bear an E mark." in 14.2.3.2 (d) and (e) by: " should be assigned special provision 181. "

14.2.3.3 Renumber "11.3.4" as "11.3.5".

Add the following text to the end of 14.2.3.3:
"The control and emergency temperatures for currently listed self-reactive substances requiring temperature control are given in table 14.1."

Insert the following new table 14.1 after 14.2.3.3:

TABLE 14.1 CONTROL AND EMERGENCY TEMPERATURES FOR CERTAIN SELF-REACTIVE SUBSTANCES

UN NUMBER	SUBSTANCE NAME AND DESCRIPTION	CONTROL TEMPERATURE	EMERGENCY TEMPERATURE
2952	AZODIISOBUTYRONITRILE	+ 40°C	+ 45°C
2953	2,2'-AZODI-(2,4-DIMETHYL VALERO- NITRILE)	+ 10°C	+ 15°C
2955	2,2'-AZODI-(2,4-DIMETHYL-4-METHOXY- VALERONITRILE)	- 5°C	+ 5°C
3030	2,2'-AZODI-(2-METHYLBUTYRONITRILE)	+ 40°C	+ 45°C
3035	3-(2-HYDROXYETHOXY)-4-PYRROLIDIN-1- YLBENZENEDIAZONIUM ZINC CHLORIDE	+ 40°C	+ 45°C
3036	2,5-DIETHOXY-4-MORPHOLINOBENZENE- DIAZONIUM ZINC CHLORIDE	+ 35°C	+ 40°C
3037	4-[BENZYL(ETHYL)AMINO]-3-ETHOXY- BENZENEDIAZONIUM ZINC CHLORIDE ..	+ 40°C	+ 45°C
3038	4-[BENZYL(METHYL)AMINO]-3-ETHOXY- BENZENEDIAZONIUM ZINC CHLORIDE ..	+ 40°C	+ 45°C
3039	4-DIMETHYLAMINO-6-(2-DIMETHYLAMINO- ETHOXY)TOLUENE-2-DIAZONIUM ZINC CHLORIDE	+ 40°C	+ 45°C

Table 14.1 Renumber the existing table 14.1 to table 14.2.

- 14.2.3.4 Delete the existing text and replace with:
"The recommendations for the determination of the Self-Accelerating Decomposition Temperature (SADT) given in 11.3.6 and for the derivation of the control and emergency temperature from the SADT given in 11.3.5 should be applied to self-reactive substances."

INDEX

Delete all current index entries with "5.2" in the "Class" column

Insert the following new entries into the index:

<u>Substance or Article</u>	<u>Class</u>	<u>Number</u>
HYDROGEN PEROXIDE AND PEROXYACETIC ACID MIXTURES, with acid(s), water and not more 5% peroxyacetic acid, stabilized	5.1	3149

Organic peroxides, see table 11.3 for an alphabetical list of currently assigned organic peroxides	5.2	3101-3120
ORGANIC PEROXIDE TYPE B, LIQUID	5.2	3101
ORGANIC PEROXIDE TYPE B, LIQUID, TEMPERATURE CONTROLLED	5.2	3111
ORGANIC PEROXIDE TYPE B, SOLID	5.2	3102
ORGANIC PEROXIDE TYPE B, SOLID, TEMPERATURE CONTROLLED .	5.2	3112
ORGANIC PEROXIDE TYPE C, LIQUID	5.2	3103
ORGANIC PEROXIDE TYPE C, LIQUID, TEMPERATURE CONTROLLED	5.2	3113
ORGANIC PEROXIDE TYPE C, SOLID	5.2	3104
ORGANIC PEROXIDE TYPE C, SOLID, TEMPERATURE CONTROLLED .	5.2	3114
ORGANIC PEROXIDE TYPE D, LIQUID	5.2	3105
ORGANIC PEROXIDE TYPE D, LIQUID, TEMPERATURE CONTROLLED	5.2	3115
ORGANIC PEROXIDE TYPE D, SOLID	5.2	3106
ORGANIC PEROXIDE TYPE D, SOLID, TEMPERATURE CONTROLLED .	5.2	3116

<u>Substance or Article</u>	<u>Class</u>	<u>Number</u>
ORGANIC PEROXIDE TYPE E, LIQUID	5.2	3107
ORGANIC PEROXIDE TYPE E, LIQUID, TEMPERATURE CONTROLLED	5.2	3117
ORGANIC PEROXIDE TYPE E, SOLID	5.2	3108
ORGANIC PEROXIDE TYPE E, SOLID, TEMPERATURE CONTROLLED .	5.2	3118
ORGANIC PEROXIDE TYPE F, LIQUID	5.2	3109
ORGANIC PEROXIDE TYPE F, LIQUID, TEMPERATURE CONTROLLED	5.2	3119
ORGANIC PEROXIDE TYPE F, SOLID	5.2	3110
ORGANIC PEROXIDE TYPE F, SOLID, TEMPERATURE CONTROLLED .	5.2	3120
