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**COMMITTEE OF EXPERTS ON THE TRANSPORT OF
DANGEROUS GOODS AND ON THE GLOBALLY
HARMONIZED SYSTEM OF CLASSIFICATION
AND LABELLING OF CHEMICALS**

**Sub-Committee of Experts on the
Transport of Dangerous Goods**
(Twenty-first session, 1-10 July 2002,
agenda item 3 (d))

EXPLOSIVES, SELF-REACTIVE SUBSTANCES AND ORGANIC PEROXIDES

Miscellaneous proposals

Proposal for a rationalized list of currently assigned organic peroxide table 2.5.3.2.4

Transmitted by the International Council of Chemical Associations (ICCA)

1. Introduction

1.1 Earlier proposal ST/SG/AC.10/C.3/2002/47

During the twentieth session of the Sub-Committee in December 2001, the proposal ST/SG/AC.10/C.3/2001/47 of ICCA was adopted in principle. However, some delegates wanted to have more time to review the proposal in more detail. ICCA agreed to this and offered to submit an amended proposal for the July 2002 session which should include relevant comments on details (not on principles) brought to the attention of the expert of ICCA in time.

This proposal contains the original proposal ST/SG/AC.10/C.3/2002/47 including the comments as presented in UN/SCETDG/20/Inf.10/Rev.1 and comments received from various delegations.

1.2 Introduction to the current proposal (based on ST/SG/AC.10/C.3/2002/47)

For many years, the detailed lists of organic peroxides (OP) and self-reactive substances (SR) have been included in the Model Regulations on the Transport of Dangerous Goods. During the July 1999 session, the expert from the United Kingdom questioned the necessity of the lists (ST/SG/AC.10/C.3/32, paragraph 104). Industry and some delegates argued that the lists are indispensable. The following arguments (amongst others) serve to show why it is preferable (essential) to retain the lists in the Model Regulations.

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The generic entries for OP's and SR's are not N.O.S entries. With the generic UN entries reserved for OP's and SR's, the required transport conditions for an individual product are not given, in contrast to the N.O.S entries. Assigned packing method (OP), control-, and emergency temperatures, special remarks on concentration, subsidiary risk label, special diluent, etc., are given in the tables (currently 30 remarks for OP's are in use). The classification flow chart cannot cover all of these aspects. These transport conditions for individual substances have to be approved by the independent UN Committee of Experts, and incorporated into world-wide transport regulations as well as storage regulations. Deletion of the tables implies a) no list to which reference can be made, which may imply re-testing and classification and (re) issuing of competent authority approvals, b) no publicly available and approved reference for inspectors, c) problems for shippers accepting OP's or SR's, d) no updated list for those (world-wide) regulations which already incorporate the existing lists.

The table for organic peroxides has grown over the years and Industry (ICCA/CEFIC) offered to rationalize this list and to reduce the number of listed products as much as possible. This proposal contains the outcome of this action. The draft proposal has been presented again to OECD-IGUS EOS (Paris, March 2002), and relevant Organic peroxide Producers Associations in United States of America, Europe and Japan.

For convenience the table will be made (electronically) available in the IMDG/DOT/ADR/RID format.

2. Principle proposals on rationalising Organic Peroxide table 2.5.3.2.4

The following principles are proposed to rationalise the table:

Principle proposal 1

Delete from the list all organic peroxides which are allowed in IBCs (indicated by packing method N) and tanks (indicated by packing method M).

***Justification:** as a consequence of the introduction of IBC and portable tank instructions in the Model Regulations, organic peroxides allowed in an IBCs and/or Tanks are listed in IBC520 and/or T23. This is a simplification. Repetition of listing these organic peroxides in the table 2.5.3.2.4 may even lead to confusion, because the control temperature for the product in IBC or tank, may differ from the one to be applied for packagings.*

Relevant references are proposed to be incorporated in 2.5.3 (Division 5.2- Organic peroxides) and 4.1.7.2.1 (transport in IBCs). For transport in portable tanks the reference is already included in 4.2.1.13.15.

To be consistent, the same relevant references are proposed for self-reactive substances of Division 4.1.

Principle proposal 2

Delete from the list entries no longer used.

Any deleted organic peroxide can be reintroduced as soon as this is required, with the classification as given in the 12th Model Regulations, without classification testing. Moreover test results of the deleted entries are collected and distributed via DATATOP, a database on organic peroxides test results as compiled by TNO-PML, The Netherlands.

***Justification:** in the early days, a number of products were listed, whilst the product was under development. After consulting all industries involved world-wide, many of them are proposed for deletion.*

Principle proposal 3

Combine in the lists all entries with covering/overlapping concentrations and/or classifications, update the classification based on (new) test results and insert some new entries.

***Justification:** a number of listed products can be combined due to the fact that the listed concentrations show an overlap, the classification (type B to type G) show possible combinations based on test results and/or the listed diluent can be combined. Some new products are currently transported and not listed.*

For convenience, an extra column with number has been added to each organic peroxide formulation in table 2.5.3.2.4 in Annex 1 and the proposed changes are indicated. The justification of each proposed change is given in section 3.3, with reference to the organic peroxide of concern.

3. Proposals

3.1 Proposals based on principle proposal 1

A) Delete all organic peroxides with packaging method N and/or M from the table 2.5.3.2.4, as indicated in ANNEX 1.

B) Delete the *NOTE* to table 2.5.3.2.4 and amend the title of table 2.5.3.2.4 to read:

List of currently assigned organic peroxides in packages. In the column “Packing Method” codes “OP1” to “OP8” refer to packing methods in Packing instruction P520. Peroxides to be transported should fulfil the classification and the control and emergency temperatures (derived from the SADT) as listed. For substances permitted in IBCs see IBC 520, and in tanks see T23.

Delete the *NOTE 2* to table 2.4.2.3.2.3 and amend title of table 2.4.2.3.2.3 to read:

List of currently assigned self-reactive substances in packages. In the column “Packing Method” codes “OP1” to “OP8” refer to packing methods in Packing instruction P520. Self-reactive substances to be transported should fulfil the classification and the control and emergency temperatures (derived from the SADT) as listed.

C) Amend the first two sentences of 2.5.3.2.3 to read:

Organic peroxides permitted for transport in packagings are listed in 2.5.3.2.4, those permitted for transport in IBCs are listed in IBC 520 and those permitted for transport in portable tanks are listed in T23. For each permitted substance listed, the generic entry of the Dangerous Goods List (UN 3101 to 3120) is assigned, appropriate subsidiary risks and remarks providing relevant transport information are given.

Amend the first two sentences of 2.4.2.3.2.2 to read:

Self-reactive substances permitted for transport in packagings are listed in 2.4.2.3.2.3, those permitted for transport in IBCs are listed in IBC 520 and those permitted for transport in portable tanks are listed in T23. For each permitted substance listed, the appropriate generic entry of the Dangerous Goods List (UN 3221 to 3240) is assigned, and appropriate subsidiary risks and remarks providing relevant transport information are given.

D) Amend the first part of the first sentence of 2.5.3.2.5 to read:

Classification of organic peroxides not listed in 2.5.3.2.4, IBC 520 or T23 and assignment to

Amend the first part of the first sentence of 2.4.2.3.2.4 to read:

Classification of self-reactive substances not listed in 2.4.2.3.2.3, IBC 520 or T23 and assignment to

E) Amend 4.1.7.2.1 to be read:

The currently assigned organic peroxides specifically listed in Packing Instruction IBC 520 may be transported in IBCs in accordance with this Packing Instruction.

3.2 Proposals based on principle proposal 2

Delete the entries from table 2.5.3.2.4, as indicated in ANNEX 1.

3.3 Proposals based on principle proposal 3

A) Amend individual entries of table 2.5.3.2.4, as indicated in ANNEX 1.

New table amended table 2.5.3.2.4 should be read as given in ANNEX 2.

Justification:

Number 7: has to be reclassified to 3105 because of the Koenen test result of 1.5 mm (UN test E.1).

Number 14/15: test results show OP8/3107 is correct; detonation No, , Deflagration No, Heating under confinement Low (see also Datatop); consequently number 15 should be assigned to OP8/3108 (approval NL IVW-IMO/01-17, July 2001).

Number 15: test results show that the concentration can be increased to 52% with for the same classification (DPVT < 1.0 mm, Koenen < 1.0 mm, Deflagration < 0.35 mm/s, Time Pressure test < 2070 kPa)

Number 17/18 can be combined; test results show that concentration of 52% can be classified as UN 3108, OP8.

Number 31/33 can be combined; 32% is already OP8, and in tank table T23, diluent type B is allowed; type B may always be replaced by diluent type A, see note 1 on the table. Remark 25 (number 33) is obsolete, because the change in the definition of a diluent type B (several years ago) covers this remark for this specific peroxide (type B diluent Boiling point: > SADT (50 kg) + 60 °C).

Number 34: to bring in line with other entries; up to 100% allowed implies no diluent type to be mentioned

Number 47/50/51: bring "≤", "<" and "≥" in line with other listings

Number 58: test results show that this formulation can be classified to 3119 (see also Datatop).

Number 71: change diluent type to B, because in tank table T23, diluent type B is allowed; type B may always be replaced by diluent type A, see note 1 on the table.

Number 97/98: can be combined since 97 covers 98.

Number 106: concentration can be increased to 52% since number 107 is already OP8/3109 at 52% concentration.

Number 114: concentration of diluent type A can be reduced to 25% without change of classification; peroxide concentration remain the same; rephrase note 21 as indicated because this covers the formulation transported and the classification.

Number 131: According to new test results, OP5/3103 should be assigned to this product (Koenen test result 2 mm).

Number 132: According to test results (Datatop), OP8/3110 should be assigned to this solid formulation (No detonation, no deflagration, low heating under confinement and no explosive power).

Number 142/143: SADT of product is 25 °C and Tc and Te are amended accordingly.

Number 153: same formulation as number 154 (only frozen under transport conditions): formulation can be classified to 3120 since test results will be the same as number 154. Rearrange 153/153 (first 3119 than 3120)

Number 175/176: can be combined, 77% is already assigned to OP8/3108 and detonation test is "No" for 77% whilst the 52% show partial result which is believed to be incorrect.

Numbers 225-227: given concentrations are not realistic. For this type of peroxide (mix of isomers) concentration is expressed as active oxygen content. Upper limit of 224, for safety reasons, should be limited to max. 10.7% active oxygen. It is proposed in column "Concentration" to refer to amended remark 8 and 9. In the remark 8, 9 and 10, the specification "with or without water" is added which makes number 225 obsolete.

Number 228: rephrase note 22, as indicated because this covers the formulation transported and the classification.

Number 236/237: bring " \leq ", " $<$ " and " \geq " in line with other listings.

Number 238: to be deleted; however erroneously not listed in 12th edition but listed in 11th edition (already included in IMDG 2000 edition and ADR/RID)!

Number 239: Erroneously not listed in 12th edition but listed in 11th edition: to be reintroduced (already included in IMDG 2000 edition and ADR/RID)

Number 240: new SADT data show lower SADT and consequently the listed temperatures should be lowered with 5 °C; erroneously not listed in 12th edition but listed in 11th edition: to be reintroduced (already included in IMDG 2000 edition and ADR/RID)

New peroxides indicated as "New": new peroxides are approved by competent authority and test results are given in ANNEX 3.

- B)** Change in T23 under UN 3109, the concentration of Pinanyl hydroperoxide from "not more than 50% in diluent type A" to "not more than 56% in diluent type A".

Justification:

Correction in T23 of concentration is needed because a typing error crept in during the change to tank instruction T23; from ninth to tenth edition.

- C)** Add in IBC 520 the following entry at UN no: 3119; Organic peroxide: Dicyclohexylperoxydicarbonate, not more than 42% as a stable dispersion, in water; Type of IBC: 31A; Max. quantity: 1250 l, Control temperature: 10 °C, Emergency temperature: 15 °C.

Justification:

New peroxide entry for transport in IBCs, see ANNEX 3 for data.

- D)** Insert in IBC 520 the following rows:.

UN No	Organic peroxide	Type of IBC <u>1/</u>	Maximum quantity (kg)	Control temperature <u>2/</u>	Emergency temperature
3110	ORGANIC PEROXIDE, TYPE F, SOLID Dicumyl peroxide	31A	2000		
3120	ORGANIC PEROXIDE, TYPE F, SOLID, TEMPERATURE CONTROLLED				

Justification:

Before transport of organic peroxides in IBCs was generally permitted, Dicumyl peroxide was, for many years, allowed to be transported in small "tanks" (max. 2000 kg), and listed in the organic peroxide table. With the introduction of tables for organic peroxide permitted for transport in tanks, this peroxide was listed in this table, with the same quantity limitation. At that time tables for IBCs were not present in the recommendations. Actual transport takes place in IBCs. In the 30th amendment of the IMDG code this is recognized and transport in IBCs is allowed (see fourth set of errata and corrigenda to the IMDG Code, Amendment 30-00).

ANNEX 1: Changes are indicated in “bold”

2.5.3.2.4 List of currently assigned organic peroxides in packages. In the column “Packing Method” codes “OP1” to “OP8” refer to packing methods in **Packing instruction P520**. Peroxides to be transported should fulfil the classification and the control and emergency temperatures (derived from the SADT) as listed.

For substances permitted in IBCs see IBC 520, and in tanks see T23.

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
ACETYL ACETONE PEROXIDE	≤ 42	≥ 48			≥ 8	OP7			3105	2)
"	≤ 32 as a paste	≥ 55				OP7			3106	20)
ACETYL BENZOYL PEROXIDE	≤ 45					OP7			3105	3)
ACETYL CYCLOHEXANESULPHONYL PEROXIDE	≤ 82		≥ 68		≥ 12	OP4	-10	0	3112	
"	≤ 32					OP7	-10	0	3115	
tert-AMYL HYDROPEROXIDE	≤ 88	≥ 6			≥ 6	OP8			3107	
tert-AMYL PEROXYACETATE	≤ 62	≥ 38				OP8 OP7			3107 3105	
tert-AMYL PEROXYBENZOATE	≤ 100					OP5			3103	
tert-AMYL PEROXY-2-ETHYLHEXANOATE	≤ 100					OP7	+20	+25	3115	
tert-AMYL PEROXY 2-ETHYLHEXYL CARBONATE	≤ 100					OP7			3105	
tert-AMYL PEROXY ISOPROPYL CARBONATE	≤ 77	≥ 23				OP5			3103	NEW
tert-AMYL PEROXYNEODECANOATE	≤ 77		≥ 23			OP7	0	+10	3115	
tert-AMYL PEROXYPIVALATE	≤ 77		≥ 23			OP5	+10	+15	3113	
tert-AMYL PEROXY-3,5,5-TRIMETHYLHEXANOATE	≤ 100					OP5			3101	3)
tert-BUTYL CUMYL PEROXIDE	> 42 - 100					OP7 OP8			3105 3107	
"	≤ 42 ≤ 52	≥ 58 48				OP7 OP8			3106 3108	
n-BUTYL-4,4-DI-(tert-BUTYLPEROXY)VALERATE	> 52 - 100					OP5			3103	
"	≤ 52	≥ 48				OP7			3106	
"	≤ 42 52	≥ 58 48				OP8 → combine			3108	
tert-BUTYL HYDROPEROXIDE	> 79 - 90	≥ 20			≥ 10	OP5			3103	13)
"	≤ 80					OP7			3105	4) 13)
"	≤ 79				> 14	OP8			3107	13) 23)
"	≤ 72				≥ 28	OP8-NA			3109	13)
tert-BUTYL HYDROPEROXIDE + DI-tert-BUTYL PEROXIDE	< 82 + > 9				≥ 7	OP5			3103	13)

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 MONOPEROXYMALEATE	> 52 - 100	≥ 48				OP5			3102	3)	24
"	≤ 52			≥ 48		OP6			3103		25
"	≤ 52					OP8			3108		26
"	≤ 52 as a paste					OP8			3108		27
tert-BUTYL MONOPEROXYPHTHALATE	≤ 100	≥ 23				OP5			3102	3)	28
tert-BUTYL PEROXYACETATE	> 52 - 77	≥ 23				OP5			3101	3)	29
"	> 32 - 52	≥ 48				OP6			3103		30
"	≤ 32	≥ 68	≥ 68			OP8;N			3109		31
"	≤ 32		≥ 68			M	+30	+35	3119		32
"	(in tanks) ≤ 22		≥ 78			OP8			3109	25)	33
tert-BUTYL PEROXYBENZOATE	> 77 - 100	≤ 22				OP5			3103		34
"	> 52 - 77	≥ 23				OP7			3105		35
"	≤ 52			≥ 48		OP7			3106		36
tert-BUTYL PEROXYBUTYL FUMARATE	≤ 52	≥ 48				OP7			3105		37
tert-BUTYL PEROXYCROTONATE	≤ 77	≥ 23				OP7			3105		38
tert-BUTYL PEROXYDIETHYLACETATE	≤ 100					OP5	+20	+25	3113		39
tert-BUTYL PEROXYDIETHYLACETATE+											
tert-BUTYL PEROXYBENZOATE	≤ 33+≤ 33	≥ 33				OP7			3105		40
tert-BUTYL PEROXY-2-ETHYLHEXANOATE	> 32 - 100		≥ 48			OP6	+20	+25	3113		41
"	≤ 52			≥ 48		OP8	+30	+35	3117		42
"	≤ 52				≥ 48	OP8	+20	+25	3118		43
"	≤ 32		≥ 68			OP8	+40	+45	3119		44
"	(in HBCs) ≤ 32		≥ 68			N	+30	+35	3119		45
"	(in tanks) ≤ 32		≥ 68			M	+15	+20	3119		46
tert-BUTYL PEROXY-2-ETHYLHEXANOATE+	≤ 12+≤ 14	≥ 14		≥ 60		OP7			3106		47
2,2-Di-(tert-BUTYLPEROXY)BUTANE	≤ 31+≤ 36		≥ 33			OP7	+35	+40	3115		48
"	≤ 100					OP7			3105		49
tert-BUTYLPEROXY-2-ETHYLHEXYLCARBONATE	≤ 100					OP7			3105		49
tert-BUTYL PEROXYISOBUTYRATE	> 52 - 77	≥ 23				OP5	+15	+20	3111	3)	50
"	≤ 52		≥ 48			OP7	+15	+20	3115		51
tert-BUTYLPEROXY ISOPROPYL CARBONATE	≤ 77	≥ 23				OP5			3103		52
1-(2-tert-BUTYLPEROXY ISOPROPYL)-3-ISOPROPENYLBENZENE	≤ 77	≥ 23				OP7			3105		53
"	≤ 42			≥ 58		OP8			3108		54
tert-BUTYL PEROXY-2-METHYLBENZOATE	≤ 100					OP5			3103		55

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
tet-BUTYL PEROXYNEODECANOATE	> 77 - 100		≥ 23			OP7	-5	+5	3115	
"	≤ 77					OP7	0	+10	3115	
"	≤ 52 as a stable dispersion in water					OP8	0	+10	3117, 3119	
"	≤ 42 as a stable dispersion in water (frozen)					OP8	0	+10	3118	
"	≤ 32		≥ 68			OP8, N	0	+10	3119	
"	(in IBCs) ≤ 42 as a stable dispersion in water					N	5	+5	3119	
tet-BUTYL PEROXYNEOHEPTANOATE	≤ 77		≥ 23			OP7	0	+10	3115	
"	≤ 42 as a stable dispersion in water					OP8	0	+10	3117	NEW
3-tet-BUTYLPEROXY-3-PHENYLPHTHALIDE	≤ 100					OP7			3106	
tet-BUTYL PEROXYPIVALATE	> 67 - 77	≥ 23				OP5	0	+10	3113	
"	> 27 - 67		≥ 33			OP7	0	+10	3115	
"	≤ 27		≥ 73			OP8	+30	+35	3119	
"	(in IBCs) ≤ 27		≥ 73			N	+10	+15	3119	
"	(in tanks) ≤ 27		≥ 73			M	+5	+10	3119	
tet-BUTYLPEROXY STEARYL CARBONATE	≤ 100					OP7			3106	
tet-BUTYL PEROXY-3,5-TRIMETHYLHEXANOATE	> 32 - 100					OP7			3105	
"	≤ 32	≥ 68	≥ 68			OP8, N			3109	
"	(in tanks) ≤ 32		≥ 68			M	+35	+40	3119	
3-CHLOROPEROXYBENZOIC ACID	> 57 - 86			≥ 14		OP1			3102	3)
"	≤ 57			≥ 3	≥ 40	OP7			3106	
"	≤ 77			≥ 6	≥ 17	OP7			3106	
CUMYL HYDROPEROXIDE	> 90 - 98	≤ 10				OP8			3107	13)
"	≤ 90	≥ 10				OP8, M			3109	13) 18)
CUMYL PEROXYNEODECANOATE	≤ 77		≥ 23			OP7	-10	0	3115	
"	≤ 52 as a stable dispersion in water					OP8	-10	0	3119	
"	(in IBCs) ≤ 52 as a stable dispersion in water					N	15	5	3119	
CUMYL PEROXYNEOHEPTANOATE	≤ 77	≥ 23				OP7	-10	0	3115	
CUMYL PEROXYPIVALATE	≤ 77		≥ 23			OP7	-5	+5	3115	
CYCLOHEXANONE PEROXIDE(S)	≤ 91			≥ 9		OP6			3104	13)
"	≤ 72	≥ 28				OP7			3105	5)
"	≤ 72 as a paste					OP7			3106	5) 20)
"	≤ 32			≥ 68					Exempt	29)
DIACETONE ALCOHOL PEROXIDES	≤ 57		≥ 26		≥ 8	OP7	+40	+45	3115	6)
DIACETYL PEROXIDE	≤ 27		≥ 73			OP7	+20	+25	3115	7) 13)

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-tert-AMYL PEROXIDE	≤ 100	≥ 18				OP8			3107	
1,1-DI-(tert-AMYL)PEROXYCYCLOHEXANE	≤ 82	≥ 18				OP6			3103	
DIBENZOYL PEROXIDE	> 51 - 100			≤ 48	≥ 6	OP2			3102	3)
"	> 77 - 94				≥ 6	OP4			3102	3)
"	≤ 77				≥ 23	OP6			3104	
"	≤ 62			≥ 28	≥ 10	OP7			3106	
"	> 52 - 62 as a paste					OP7			3106	20)
"	> 35 - 52			≥ 48		OP7			3106	
"	> 36 - 42	≥ 18			≤ 40	OP8			3107	
"	> 36 - 42	≥ 18				OP8			3107	
"	> 36 - 42	≥ 58				OP8			3107	
"	≤ 56,5 as a paste				≥ 15	OP8			3108	
"	≤ 52 as a paste					OP8			3108	20)
"	≤ 42 as a stable dispersion in water					OP8-N			3109	
"	≤ 35			≥ 65		OP8-N			Exempt	29)
DIBENZYL PEROXYDICARBONATE	≤ 87				≥ 13	OP5	+25	+30	3112	3)
DI-(4-tert-BUTYL)CYCLOHEXYL) PEROXYDICARBONATE	≤ 100					OP6	+30	+35	3114	
"	≤ 42 as a stable dispersion in water					OP8-N	+30	+35	3119	
DI-tert-BUTYL PEROXIDE	↗ 32 ↘ 52 - 100			≥ 48		OP8			3107	
"	≤ 52					OP8-N			3109	25)
DI-tert-BUTYL PEROXYAZELATE	≤ 52	≥ 48				OP7			3105	
2,2-DI-(tert-BUTYL)PEROXYBUTANE	≤ 52	≥ 48				OP6			3103	
1,6-DI-(tert-BUTYL)PEROXYCARBONYLOXY) HEXANE	≤ 72	≥ 28				OP5			3103	
1,1-DI-(tert-BUTYL)PEROXY) CYCLOHEXANE	> 80 - 100					OP5			3101	3)
"	> 52 - 80	≥ 20				OP5			3103	
"	> 42 - 52	≥ 48				OP7			3105	
"	≤ 42	≥ 13				OP7			3106	
"	≤ 27	≥ 36-25		≥ 45		OP8			3107	21)
"	≤ 42	≥ 58				OP8-N			3109	
"	≤ 13	≥ 13				OP8			3109	
DI-n-BUTYL PEROXYDICARBONATE	> 27 - 52	≥ 48				OP7	-15	-5	3115	
"	≤ 27	≥ 73				OP8	-10	0	3117	
DI-sec-BUTYL PEROXYDICARBONATE	≤ 42 as a stable dispersion in water (frozen)					OP8	-15	-5	3118	
"	> 52 - 100					OP4	-20	-10	3113	
"	≤ 52	≥ 48				OP7	-15	-5	3115	

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-(2-tert-BUTYLPEROXYISOPROPYL)BENZENE(S)	> 42 - 100			≤ 57		OP7			3106	
"	≤ 42			≥ 58					Exempt	29)
DI-(tert-BUTYLPEROXY) PHTHALATE	> 42 - 52	≥ 48				OP7			3105	
"	≤ 52 as a paste					OP7			3106	20)
"	≤ 42	≥ 58				OP8			3107	
2,2-DI-(tert-BUTYLPEROXY)PROPANE	≤ 52	≥ 48				OP7			3105	
"	≤ 42	≥ 13		≥ 45		OP7			3106	
1,1-DI-(tert-BUTYLPEROXY)-3,3,5-TRIMETHYLCYCLOHEXANE	> 90 - 100					OP5			3101	3)
"	> 57 - 90	≥ 10				OP5			3103	
"	≤ 77		≥ 23			OP7 OP5			3105 3103	
"	≤ 57			≥ 43		OP7 OP8			3107 3110	
"	≤ 57	≥ 43				OP8			3107	
"	≤ 32	≥ 26	≥ 42			OP8			3107	
DICETYL PEROXYDICARBONATE	≤ 100					OP7	+30	+35	3116	
"	≤ 42 as a stable dispersion in water					OP8-N	+30	+35	3119	
DI-4-CHLOROBENZOYL PEROXIDE	≤ 77				≥ 23	OP5			3102	3)
"	≤ 52 as a paste			≥ 68		OP7			3106	20)
"	≤ 32			≥ 48					Exempt	29)
DICUMYL PEROXIDE	> 42- 52 - 100			≥ 48		OP8-M			3110	12)
"	≤ 52								Exempt	29)
DICYCLOHEXYL PEROXYDICARBONATE	> 91 - 100					OP3	+5 +10	+10 +15	3112	3)
"	≤ 91				≥ 9	OP5	+5 +10	+10 +15	3114	
"	≤ 42 as a stable dispersion in water					OP8	+15	+20	3119	
DIDECANOYL PEROXIDE	≤ 100					OP6	+30	+35	3114	
2,2-DI(4,4-DI(tert-BUTYLPEROXY)CYCLOHEXYL)PROPANE	≤ 42			≥ 58		OP7			3106	
"	≤ 22		≥ 78			OP8			3107	
DI-2,4-DICHLOROBENZOYL PEROXIDE	≤ 77				≥ 23	OP5			3102	3)
"	≤ 52 as a paste with silicon oil					OP7			3106	
DI-(2-ETHOXYETHYL) PEROXYDICARBONATE	≤ 52		≥ 48			OP7	-10	0	3115	

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-(2-ETHYLHEXYL) PEROXYDICARBONATE	> 77 - 100		≥ 23			OP5	-20	-10	3113	
"	≤ 77					OP7	-15	-5	3115	150
"	≤ 62 as a stable dispersion in water					OP8	-15	-5	3117	151
"	≤ 42 ≤ 52 as a stable dispersion in water (frozen)					OP8	-15	-5	3118-3120	152
"	≤ 52 as a stable dispersion in water					OP8	-15	-5	3119	153
"	≤ 52 as a stable dispersion in water					OP8	-15	-5	3119	154
"	≤ 52 as a stable dispersion in water					N	20	10	3119	155
DIETHYL PEROXYDICARBONATE	≤ 27		≥ 73			OP7	10	0	3115	156
2,2-DIHYDROPEROXYPROPANE	≤ 27			≥ 73		OP5			3102	3) 157
DI-(1-HYDROXYCYCLOHEXYL) PEROXIDE	≤ 100					OP7			3106	158
DIISOBUTYRYL PEROXIDE	> 32 - 52		≥ 48			OP5	-20	-10	3111	3) 159
"	≤ 32		≥ 68			OP7	-20	-10	3115	160
DI-ISOPROPYLBENZENE DIHYDROPEROXIDE	≤ 82	≥ 5			≥ 5	OP7	-15	-5	3106	24) 161
DIISOPROPYL PEROXYDICARBONATE	> 52 - 100					OP2	-15	-5	3112	3) 162
"	≤ 52		≥ 48			OP7	-20	-10	3115	163
"	≤ 28	≥ 72				OP7	-15	-5	3115	164
DHSOTRIDECYL PEROXYDICARBONATE	≤ 100					OP7	10	0	3115	164
DILAURYL PEROXIDE	≤ 100					OP7			3106	165
"	≤ 42 as a stable dispersion in water					OP8-N			3109	166
DI-(3-METHOXYBUTYL) PEROXYDICARBONATE	≤ 52		≥ 48			OP7	-5	+5	3115	167
DI-(2-METHYLBENZOYL) PEROXIDE	≤ 87				≥ 13	OP5	+30	+35	3112	3) 168
DI-(4-METHYLBENZOYL) PEROXIDE	≤ 52 as a paste with silicon oil					OP7			3106	169
DI-(3-METHYLBENZOYL) PEROXIDE	≤ 20 + ≤ 18 + ≤ 4		≥ 58			OP7	+30	+35	3115	170
+ BENZOYL (3-METHYLBENZOYL) PEROXIDE										
+ DIBENZOYL PEROXIDE										
2,5-DIMETHYL-2,5-DI-(BENZOYLPEROXY)HEXANE	> 82 - 100					OP5			3102	3) 171
"	≤ 82			≥ 18		OP7			3106	172
"	≤ 82				≥ 18	OP5			3104	173

	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	
ORGANIC PEROXIDE											
2,5-DIMETHYL-2,5-DI-(tert-BUTYLPEROXY)HEXANE	> 52 - 100			≥ 48		OP7			3105		174
"	≤ 52			≥ 23		OP7			3106		175
"	≤ 77		combine			OP8			3108		176
"	≤ 47 as a paste					OP8			3108		177
"	≤ 52		≥ 48			OP8			3109		178
2,5-DIMETHYL-2,5-DI-(tert-BUTYLPEROXY)HEXANE-3	> 86 - 100					OP5			3101	3)	179
"	> 52 - 86		≥ 14			OP5			3103	26)	180
"	≤ 52			≥ 48		OP7			3106		181
2,5-DIMETHYL-2,5-DI-(2-ETHYLHEXANOYLPEROXY)HEXANE	≤ 100					OP5	+20	+25	3113		182
2,5-DIMETHYL-2,5-DIHYDROPEROXYHEXANE	≤ 82				≥ 18	OP6			3104		183
2,5-DIMETHYL-2,5-DI-(3,5,5-TRIMETHYLHEXANOYLPEROXY)HEXANE	≤ 77		≥ 23			OP7			3105		184
1,1-DIMETHYL-3-HYDROXYBUTYLPEROXYNEOHEPTANOATE	≤ 52		≥ 48			OP8	0	+10	3117		185
DIMYRISTYL PEROXYDICARBONATE	≤ 100					OP7	+20	+25	3116		186
"	≤ 42 as a stable dispersion in water					OP8	+20	+25	3119		187
" (in-IBCs)	≤ 42 as a stable dispersion in water					N	+15	+20	3119		188
DI-(2-NEODECANOYLPEROXYISOPROPYL)BENZENE	≤ 52		≥ 48			OP7	-10	0	3115		189
DI-n-NONANOYL PEROXIDE	≤ 100					OP7	0	+10	3116		190
DI-n-OCTANOYL PEROXIDE	≤ 100					OP5	+10	+15	3114		191
DIPEROXY AZELAIC ACID	≤ 27			≥ 73		OP7	+35	+40	3116		192
DIPEROXY DODECANEDIACID	> 13 - 42			≥ 58		OP7	+40	+45	3116		193
"	≤ 13			≥ 87					Exempt 29)		194
DI-(2-PHENOXYETHYL) PEROXYDICARBONATE	> 85 - 100					OP5			3102	3)	195
"	≤ 85				≥ 15	OP7			3106		196
DIPROPIONYL PEROXIDE	≤ 27		≥ 73			OP8	+15	+20	3117		197
DI-n-PROPYL PEROXYDICARBONATE	≤ 100					OP3	-25	-15	3113		198
"	≤ 77		≥ 23			OP5	-20	-10	3113		199
DISTEARYL PEROXYDICARBONATE	≤ 87			≥ 13		OP7			3106		200

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
DISUCCINIC ACID PEROXIDE	> 72 - 100				≥ 28	OP4	+10	+15	3102	3) 17)
"	≤ 72					OP7	0	+10	3116	
DI-(3,5,5-TRIMETHYLHEXANOYL) PEROXIDE	> 38 - 82	≥ 18				OP7	0	+10	3115	
"	≤ 52 as a stable dispersion in water					OP8-N	+10	+15	3119	
"	≤ 38	≥ 62				OP8	+20	+25	3119	
"	(in H ₂ O)	≥ 62				N	+10	+15	3119	
"	(in tanks)	≥ 38	≥ 62			M	0	+5	3119	
DI-(3,5,5-TRIMETHYL-1,2-DIOXOLANYL-3)-PEROXIDE	≤ 52 as a paste					OP7	+30	+35	3116	20)
ETHYL 3,3-DI-(tert-AMYLPEROXY)BUTYRATE	≤ 67	≥ 33				OP7			3105	
ETHYL 3,3-DI-(tert-BUTYLPEROXY)BUTYRATE	> 77 - 100					OP5			3103	
"	≤ 77	≥ 23				OP7			3105	
"	≤ 52			≥ 48		OP7			3106	
1-(2-ETHYLHEXANOYLPEROXY)-1,3-DIMETHYL-BUTYL PEROXYPIVALATE	≤ 52	≥ 45	≥ 10			OP7	-20	-10	3115	NEW
3,3,6,6,9,9-HEXAMETHYL-1,2,4,5-TETRAOXYACETONE	> 52 - 100					OP4			3102	3)
"	≤ 52	≥ 48				OP7			3105	
"	≤ 52			≥ 48		OP7			3106	
tert-HEXYL PEROXYNEODECANOATE	≤ 71	≥ 29				OP7	0	+10	3115	
tert-HEXYL PEROXYPIVALATE	≤ 72					OP7	+10	+15	3115	
ISOPROPYL sec-BUTYL PEROXYDICARBONATE						OP7	-20	-10	3115	
+ DI-sec-BUTYL PEROXYDICARBONATE	32 + ≤ 15 - 18	≥ 38								
+ DI-ISOPROPYL PEROXYDICARBONATE	+ ≤ 12 - 15									
ISOPROPYL sec-BUTYL PEROXYDICARBONATE										
+ DI-sec-BUTYL PEROXYDICARBONATE	≤ 52 + ≤ 28 + ≤ 22					OP5	-20	-10	3111	3)
ISOPROPYL CUMYL HYDROPEROXIDE	≤ 72	≥ 28				OP8-M			3109	13)
p-MENTHYL HYDROPEROXIDE	> 72 - 100					OP7			3105	13)
"	≤ 72	≥ 28				OP8-M			3109	27)
METHYLCYCLOHEXANONE PEROXIDE(S)	≤ 67		≥ 33			OP7	+35	+40	3115	
METHYL ETHYL KETONE PEROXIDE(S)	≤ 52 see remark 8	≥ 48				OP5			3101	3) 8) 13)
"	≤ 37 see remark 9	≥ 55			≥ 8	OP7			3105	9)
"	≤ 45 see remark 9	≥ 55				OP7			3105	9)
"	≤ 40 see remark 10	≥ 60				OP8			3107	10)

	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
ORGANIC PEROXIDE										
METHYL ISOBUTYL KETONE PEROXIDES)	≤ 62	≥ 19				OP7			3105	22)
ORGANIC PEROXIDE, LIQUID, SAMPLE						OP2			3103	11)
ORGANIC PEROXIDE, LIQUID, SAMPLE, TEMPERATURE CONTROLLED						OP2			3113	11)
ORGANIC PEROXIDE, SOLID, SAMPLE						OP2			3104	11)
ORGANIC PEROXIDE, SOLID, SAMPLE, TEMPERATURE CONTROLLED						OP2			3114	11)
PEROXYACETIC ACID, TYPE D, stabilized	≤ 43					OP7			3105	13) 14) 19)
PEROXYACETIC ACID, TYPE E, stabilized	≤ 43					OP8			3107	13) 15) 19)
PEROXYACETIC ACID, TYPE F, stabilized	≤ 43					OP8, N			3109	13) 16) 19)
PEROXYACETIC ACID, TYPE F, stabilized	≤ 41					M	+30	+45	3119	13) 30)
PEROXYLAURIC ACID	≤ 100					OP8	+35	+40	3118	
PINANYL HYDROPEROXIDE	> 56 - 100	≥ 44				OP7			3105	13)
"	≤ 56					OP8, M			3109	
POLYETHER POLY-tert-BUTYL PEROXYCARBONATE	≤ 52		≥ 23			OP8			3107	NEW
TETRAHYDRONAPHTHYL HYDROPEROXIDE	≤ 100					OP7			3106	238
1,1,3,3-TETRAMETHYLBUTYL HYDROPEROXIDE	≤ 100					OP7			3105	239
1,1,3,3-TETRAMETHYLBUTYL PEROXY-2 ETHYLHEXANOATE	≤ 100					OP7	+20 +15	+25 +20	3115	240
1,1,3,3-TETRAMETHYLBUTYL PEROXYNEODECANOATE	≤ 72		≥ 28			OP7	-5	+5	3115	241
"	≤ 52 as a stable dispersion in water					OP8, N	-5	+5	3119	242
1,1,3,3-TETRAMETHYLBUTYL PEROXY										
PHENOXYACETATE	≤ 37		≥ 63			OP7	10	0	3115	243
1,1,3,3-TETRAMETHYLBUTYL PEROXYPIVALATE	≤ 77	≥ 23				OP7	0	+10	3115	NEW
3,6,9-TRIEHTYL-3,6,9-TRIMETHYL-1,4,7-TRIPEROXONANE	≤ 42	≥ 58				OP7			3105	28)
										245

Notes on 2.5.3.2.4:

- 1) Diluent type B may always be replaced by diluent type A. **Boiling point diluent type B should be at least 60 °C higher than the SADT of the organic peroxide.**
- 2) Available oxygen ≤ 4.7%.
- 3) "EXPLOSIVE" subsidiary risk label required (Model No. 01, see 5.2.2.2.2).
- 4) Diluent may be replaced by di-tert-butyl peroxide.
- 5) Available oxygen ≤ 9%.
- 6) With ≤ 9% hydrogen peroxide; available oxygen ≤ 10%.
- 7) Only non-metallic packagings allowed.
- 8) **Available oxygen > 10% and ≤ 10.7%, with or without water**
- 9) **Available oxygen ≤ 10%, with or without water**
- 10) Available oxygen ≤ 8.2%, with or without water
- 11) See 2.5.3.2.5.1.
- 12) Up to 2000 kg per receptacle assigned to ORGANIC PEROXIDE TYPE F on the basis of large scale trials.
- 13) "CORROSIVE" subsidiary risk label required (Model No. 08, see 5.2.2.2.2).
- 14) Peroxyacetic acid formulations which fulfill the criteria of 2.5.3.3.2 (d).
- 15) Peroxyacetic acid formulations which fulfill the criteria of 2.5.3.3.2 (e).
- 16) Peroxyacetic acid formulations which fulfill the criteria of 2.5.3.3.2 (f).
- 17) Addition of water to this organic peroxide will decrease its thermal stability.
- 18) No "CORROSIVE" subsidiary risk label required for concentrations below 80%.
- 19) Mixtures with hydrogen peroxide, water and acid(s).
- 20) With diluent type A, with or without water.
- 21) **With ≥ 36 25% diluent type A by mass, and in addition ethylbenzene in addition to diluent type A.**
- 22) **With ≥ 19% diluent type A by mass, and in addition methyl isobutyl ketone in addition to diluent type A.**
- 23) With < 6% di-tert-butyl peroxide.
- 24) With ≤ 8% 1-isopropylhydroperoxy-4-isopropylhydroxybenzene.
- 25) Diluent type B with boiling point > 110 °C.
- 26) With < 0.5% hydroperoxides content.
- 27) For concentrations more than 56%, "CORROSIVE" subsidiary risk label required (Model No. 08, see 5.2.2.2.2).
- 28) Available active oxygen ≤ 7.6 % in diluent type A, having a boil-off point in the range of 220 - 260 °C.
- 29) Not subject to the requirements of these Model Regulations for Division 5.2.
- 30) ~~Formulations derived from distillation of peroxyacetic acid originating from peroxyacetic acid in concentrations of not more than 41% with water, total active oxygen (Peroxyacetic acid + H₂O₂)~~
~~≤ 9.5%, which fulfills the criteria of 2.5.3.3.2 (f).~~

ANNEX 2: Organic peroxide table, as amended by the proposed changes

2.5.3.2.4 List of currently assigned organic peroxides in packages. In the column “Packing Method” codes “OP1” to “OP8” refer to packing methods in Packing instruction P520. Peroxides to be transported should fulfil the classification and the control and emergency temperatures (derived from the SADT) as listed. For substances permitted in IBCs see IBC 520, and in tanks see T23.

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
ACETYL ACETONE PEROXIDE	≤ 42	≥ 48			≥ 8	OP7			3105	2)
"	≤ 32 as a paste					OP7			3106	20)
ACETYL CYCLOHEXANESULPHONYL PEROXIDE	≤ 82		≥ 68		≥ 12	OP4	-10	0	3112	3)
"	≤ 32					OP7	-10	0	3115	
tert-AMYL HYDROPEROXIDE	≤ 88	≥ 6			≥ 6	OP8			3107	
tert-AMYL PEROXYACETATE	≤ 62	≥ 38				OP7			3105	
tert-AMYL PEROXYBENZOATE	≤ 100					OP5			3103	
tert-AMYL PEROXY-2-ETHYLHEXANOATE	≤ 100					OP7	+20	+25	3115	
tert-AMYL PEROXY 2-ETHYLHEXYL CARBONATE	≤ 100					OP7			3105	
tert-AMYL PEROXY ISOPROPYL CARBONATE	≤ 77	≥ 23				OP5			3103	
tert-AMYL PEROXYNEODECANOATE	≤ 77		≥ 23			OP7	0	+10	3115	
tert-AMYL PEROXYPIVALATE	≤ 77		≥ 23			OP5	+10	+15	3113	
tert-AMYL PEROXY-3,5-TRIMETHYLHEXANOATE	≤ 100			≥ 23		OP5			3101	3)
tert-BUTYL CUMYL PEROXIDE	> 42 - 100			≥ 48		OP8			3107	
"	≤ 52					OP8			3108	
n-BUTYL-4,4-DI-(tert-BUTYLPEROXY)VALERATE	> 52 - 100			≥ 48		OP5			3103	
"	≤ 52					OP8			3108	
tert-BUTYL HYDROPEROXIDE	> 79 - 90			≥ 10		OP5			3103	13)
"	≤ 80	≥ 20				OP7			3105	4) 13)
"	≤ 79				≥ 14	OP8			3107	13) 23)
"	≤ 72				≥ 28	OP8			3109	13)
tert-BUTYL HYDROPEROXIDE + DI-tert-BUTYL PEROXIDE	< 82 + > 9				≥ 7	OP5			3103	13)
tert-BUTYL MONOPEROXYMALLEATE	> 52 - 100	≥ 48				OP5			3102	3)
"	≤ 52					OP6			3103	
"	≤ 52			≥ 48		OP8			3108	
"	≤ 52 as a paste					OP8			3108	

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 PEROXYACETATE	> 52 - 77	≥ 23				OP5			3101	3)
"	> 32 - 52	≥ 48				OP6			3103	
"	≤ 32		≥ 68			OP8			3109	
tert-BUTYL PEROXYBENZOATE	> 77 - 100	≥ 23				OP5			3103	
"	> 52 - 77			≥ 48		OP7			3105	
"	≤ 52					OP7			3106	
tert-BUTYL PEROXYBUTYL FUMARATE	≤ 52	≥ 48				OP7			3105	
tert-BUTYL PEROXYCROTONATE	≤ 77	≥ 23				OP7			3105	
tert-BUTYL PEROXYDIETHYLACETATE	≤ 100					OP5	+20	+25	3113	
tert-BUTYL PEROXY-2-ETHYLHEXANOATE	> 52 - 100		≥ 48			OP6	+20	+25	3113	
"	> 32 - 52		≥ 48			OP8	+30	+35	3117	
"	≤ 52			≥ 48		OP8	+20	+25	3118	
"	≤ 32		≥ 68			OP8	+40	+45	3119	
tert-BUTYL PEROXY-2-ETHYLHEXANOATE + 2,2-DI-(tert-BUTYLPEROXY)BUTANE	≤ 12 + ≤ 14	≥ 14		≥ 60		OP7			3106	
"	≤ 31 + ≤ 36		≥ 33			OP7	+35	+40	3115	
tert-BUTYL PEROXY 2-ETHYLHEXYL CARBONATE	≤ 100		≥ 23			OP7			3105	
tert-BUTYL PEROXYISOBUTYRATE	> 52 - 77		≥ 23			OP5	+15	+20	3111	
"	≤ 52		≥ 48			OP7	+15		3115	
tert-BUTYLPEROXY ISOPROPYL CARBONATE	≤ 77	≥ 23				OP5			3103	
1-(2-tert-BUTYLPEROXY ISOPROPYL)-3-ISOPROPENYLBENZENE	≤ 77	≥ 23				OP7			3105	
"	≤ 42			≥ 58		OP8			3108	
tert-BUTYL PEROXY-2-METHYLBENZOATE	≤ 100					OP5			3103	
tert-BUTYL PEROXYNEODECANOATE	> 77 - 100		≥ 23			OP7	-5	+5	3115	
"	≤ 77					OP7	0	+10	3115	
"	≤ 52 as a stable dispersion in water					OP8	0	+10	3119	
"	≤ 42 as a stable dispersion in water (frozen)					OP8	0	+10	3118	
"	≤ 32	≥ 68				OP8	0	+10	3119	
tert-BUTYL PEROXYNEOHEPTANOATE	≤ 77	≥ 23				OP7	0	+10	3115	
"	≤ 42 as a stable dispersion in water					OP8	0	+10	3117	
tert-BUTYL PEROXYPIVALATE	> 67 - 77	≥ 23				OP5	0	+10	3113	
"	> 27 - 67		≥ 33			OP7	0	+10	3115	
"	≤ 27		≥ 73			OP8	+30	+35	3119	

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
tert-BUTYLPEROXY STEARYL CARBONATE	≤ 100					OP7			3106	
tert-BUTYL PEROXY-3,5,5-TRIMETHYLHEXANOATE	> 32 - 100		≥ 68			OP7 OP8			3105 3109	
"	≤ 32					OP8			3109	
3-CHLOROPEROXYBENZOIC ACID	> 57 - 86			≥ 14		OP1			3102	3)
"	≤ 57			≥ 3	≥ 40	OP7			3106	
"	≤ 77			≥ 6	≥ 17	OP7			3106	
CUMYL HYDROPEROXIDE	> 90 - 98					OP8			3107	13)
"	≤ 90	≥ 10				OP8			3109	13) 18)
CUMYL PEROXYNEODECANOATE	≤ 77		≥ 23			OP7	-10	0	3115	
"	≤ 52 as a stable dispersion in water					OP7	-10	0	3119	
CUMYL PEROXYNEOHEPTANOATE	≤ 77	≥ 23				OP8	-10	0	3119	
CUMYL PEROXYPIVALATE	≤ 77		≥ 23			OP7	-10	0	3115	
CYCLOHEXANONE PEROXIDE(S)	≤ 91				≥ 9	OP7	-5	+5	3115	
"	≤ 72	≥ 28				OP6			3104	13)
"	≤ 72 as a paste					OP7			3105	5)
"	≤ 32			≥ 68		OP7			3106	5) 20)
DIACETONE ALCOHOL PEROXIDES	≤ 57		≥ 26		≥ 8	OP7	+40	+45	3115	Exempt 29)
DIACETYL PEROXIDE	≤ 27		≥ 73			OP7	+20	+25	3115	6)
DH-tert-AMYL PEROXIDE	≤ 100					OP8			3107	7) 13)
1,1-DI-(tert-AMYL)PEROXYCYCLOHEXANE	≤ 82	≥ 18				OP6			3103	
DIBENZOYL PEROXIDE	> 51 - 100			≤ 48		OP2			3102	3)
"	> 77 - 94			≥ 6	≥ 6	OP4			3102	3)
"	≤ 77			≥ 23	≥ 23	OP6			3104	
"	≤ 62			≥ 28	≥ 10	OP7			3106	
"	> 52 - 62 as a paste					OP7			3106	20)
"	> 35 - 52			≥ 48		OP7			3106	
"	> 36 - 42	≥ 18			≤ 40	OP8			3107	
"	≤ 56.5 as a paste				≥ 15	OP8			3108	20)
"	≤ 52 as a paste					OP8			3108	
"	≤ 42 as a stable dispersion in water					OP8			3109	
"	≤ 35			≥ 65		OP8			Exempt	29)

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
D-(4-tert-BUTYL)CYCLOHEXYL) PEROXYDICARBONATE	≤ 100					OP6	+30	+35	3114	
"	≤ 42 as a stable dispersion in water					OP8	+30	+35	3119	
D-(tert-BUTYL) PEROXIDE	> 52 - 100					OP8			3107	
"	≤ 52		≥ 48			OP8			3109	25)
D-(tert-BUTYL) PEROXYAZELATE	≤ 52	≥ 48				OP7			3105	
2,2-DI-(tert-BUTYLPEROXY)BUTANE	≤ 52	≥ 48				OP6			3103	
1,6-DI-(tert-BUTYLPEROXYCARBONYLOXY) HEXANE	≤ 72	≥ 28				OP5			3103	
1,1-DI-(tert-BUTYLPEROXY) CYCLOHEXANE	> 80 - 100					OP5			3101	3)
"	> 52 - 80	≥ 20				OP5			3103	
"	> 42 - 52	≥ 48				OP7			3105	
"	≤ 42	≥ 13		≥ 45		OP7			3106	
"	≤ 27	≥ 25				OP8			3107	21)
"	≤ 42	≥ 58				OP8			3109	
"	≤ 13	≥ 13	≥ 74			OP8			3109	
D-n-BUTYL PEROXYDICARBONATE	> 27 - 52		≥ 48			OP7	-15	-5	3115	
"	≤ 27		≥ 73			OP8	-10	0	3117	
"	≤ 42 as a stable dispersion in water (frozen)					OP8	-15	-5	3118	
D-sec-BUTYL PEROXYDICARBONATE	> 52 - 100		≥ 48			OP4	-20	-10	3113	
"	≤ 52					OP7	-15	-5	3115	
D-(2-tert-BUTYLPEROXYISOPROPYL)BENZENE(S)	> 42 - 100			≤ 57		OP7			3106	
"	≤ 42			≥ 58		OP7			Exempt	29)
D-(tert-BUTYLPEROXY) PHTHALATE	> 42 - 52	≥ 48				OP7			3105	
"	≤ 52 as a paste					OP7			3106	20)
"	≤ 42	≥ 58				OP8			3107	
2,2-DI-(tert-BUTYLPEROXY)PROPANE	≤ 52	≥ 48				OP7			3105	
"	≤ 42	≥ 13		≥ 45		OP7			3106	
1,1-DI-(tert-BUTYLPEROXY)-3,3,5-TRIMETHYLCYCLOHEXANE	> 90 - 100					OP5			3101	3)
"	> 57 - 90	≥ 10				OP5			3103	
"	≤ 77		≥ 23			OP5			3103	
"	≤ 57			≥ 43		OP8			3110	
"	≤ 57	≥ 43				OP8			3107	
"	≤ 32	≥ 26				OP8			3107	
DICETYL PEROXYDICARBONATE	≤ 100		≥ 42			OP7	+30	+35	3116	
"	≤ 42 as a stable dispersion in water					OP8	+30	+35	3119	

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
DI-4-CHLOROBENZOYL PEROXIDE	≤ 77				≥ 23	OP5			3102	3)
"	≤ 52 as a paste					OP7			3106	20)
"	≤ 32			≥ 68					Exempt	29)
DICUMYL PEROXIDE	> 52 - 100			≤ 48		OP8			3110	12)
"	≤ 52			≥ 48					Exempt	29)
DICYCLOHEXYL PEROXYDICARBONATE	> 91 - 100				≥ 9	OP3	+10	+15	3112	3)
"	≤ 91					OP5	+10	+15	3114	
"	≤ 42 as a stable dispersion in water					OP8	+15	+20	3119	
DIDECANOYL PEROXIDE	≤ 100					OP6	+30	+35	3114	
2,2-DI(4,4-DI (tert-BUTYLPEROXY) CYCLOHEXYL)-PROPANE		≤ 42		≥ 58		OP7			3106	
"		≤ 22	≥ 78			OP8			3107	
DI-2,4-DICHLOROBENZOYL PEROXIDE		≤ 77			≥ 23	OP5			3102	3)
"	≤ 52 as a paste with silicon oil					OP7			3106	
DI-(2-ETHOXYETHYL) PEROXYDICARBONATE	≤ 52		≥ 48			OP7	-10	0	3115	
DI-(2-ETHYLHEXYL) PEROXYDICARBONATE	> 77 - 100		≥ 23			OP5	-20	-10	3113	
"	≤ 77					OP7	-15	-5	3115	
"	≤ 62 as a stable dispersion in water					OP8	-15	-5	3117	
"	≤ 52 as a stable dispersion in water (frozen)					OP8	-15	-5	3120	
"	≤ 52 as a stable dispersion in water					OP8	-15	-5	3119	
2,2-DIHYDROPEROXYPROPANE	≤ 27			≥ 73		OP5			3102	3)
DI-(1-HYDROXYCYCLOHEXYL) PEROXIDE	≤ 100		≥ 48			OP7	-20	-10	3106	
DIISOBUTYRYL PEROXIDE	> 32 - 52		≥ 68			OP5	-20	-10	3111	3)
"	≤ 32					OP7	-20	-10	3115	
DI-ISOPROPYL BENZENE DIHYDROPEROXIDE	≤ 82	≥ 5			≥ 5	OP7			3106	24)
DIISOPROPYL PEROXYDICARBONATE	> 52 - 100		≥ 48			OP2	-15	-5	3112	3)
"	≤ 52					OP7	-20	-10	3115	
"	≤ 28	≥ 72				OP7	-15	-5	3115	
DILAUROYL PEROXIDE	≤ 100					OP7			3106	
"	≤ 42 as a stable dispersion in water					OP8			3109	
DI-(3-METHOXYBUTYL) PEROXYDICARBONATE	≤ 52		≥ 48			OP7	-5	+5	3115	
DI-(2-METHYLBENZOYL) PEROXIDE	≤ 87				≥ 13	OP5	+30	+35	3112	3)

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-(4-METHYLBENZOYL) PEROXIDE	≤ 52 as a paste with silicon oil		≥ 58			OP7	+30	+35	3106	
DI-(3-METHYLBENZOYL) PEROXIDE	≤ 20 + ≤ 18 + ≤ 4					OP7			3115	
+ BENZOYL (3-METHYLBENZOYL) PEROXIDE										
+ DIBENZOYL PEROXIDE										
2,5-DIMETHYL-2,5-DI-(BENZOYL)PEROXY)HEXANE	> 82 - 100			≥ 18	≥ 18	OP5			3102	3)
"	≤ 82					OP7			3106	
"	≤ 82					OP5			3104	
2,5-DIMETHYL-2,5-DI-(tert-BUTYL)PEROXY)HEXANE	> 52 - 100			≥ 23		OP7			3105	
"	≤ 77					OP8			3108	
"	≤ 47 as a paste					OP8			3108	
"	≤ 52					OP8			3109	
2,5-DIMETHYL-2,5-DI-(tert-BUTYL)PEROXY)HEXANE-3	> 86 - 100		≥ 14			OP5			3101	3)
"	> 52 - 86					OP5			3103	26)
"	≤ 52			≥ 48		OP7			3106	
2,5-DIMETHYL-2,5-DI-(2-ETHYLHEXANOYL)PEROXY)HEXANE	≤ 100					OP5	+20	+25	3113	
2,5-DIMETHYL-2,5-DIHYDROPEROXY)HEXANE	≤ 82			≥ 18		OP6			3104	
2,5-DIMETHYL-2,5-DI-(3,5,5-TRIMETHYLHEXANOYL)PEROXY)HEXANE	≤ 77		≥ 23			OP7			3105	
1,1-DIMETHYL-3-HYDROXYBUTYL PEROXYNEOHEPTANOATE	≤ 52		≥ 48			OP8	0	+10	3117	
DIMYRISTYL PEROXYDICARBONATE	≤ 100					OP7	+20	+25	3116	
"	≤ 42 as a stable dispersion in water					OP8	+20	+25	3119	
DI-(2-NEODECANOYL)PEROXYISOPROPYL) BENZENE	≤ 52	≥ 48				OP7	-10	0	3115	
DI-n-NONANOYL PEROXIDE	≤ 100					OP7	0	+10	3116	
DI-n-OCTANOYL PEROXIDE	≤ 100					OP5	+10	+15	3114	
DI-(2-PHENOXYPETHYL) PEROXYDICARBONATE	> 85 - 100					OP5			3102	3)
"	≤ 85		≥ 73		≥ 15	OP7			3106	
DIPROPIONYL PEROXIDE	≤ 27					OP8	+15	+20	3117	
DI-n-PROPYL PEROXYDICARBONATE	≤ 100		≥ 23			OP3	-25	-15	3113	
"	≤ 77					OP5	-20	-10	3113	

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
DISUCCINIC ACID PEROXIDE	> 72 - 100					OP4			3102	3) 17)
"	≤ 72				≥ 28	OP7	+10	+15	3116	
DI-(3,5,-TRIMETHYLHEXANOYL) PEROXIDE	> 38 - 82	≥ 18				OP7	0	+10	3115	
"	≤ 52 as a stable dispersion in water					OP8	+10	+15	3119	
"	≤ 38	≥ 62				OP8	+20	+25	3119	
ETHYL 3,3-DI-(tert-AMYLPEROXY)BUTYRATE	≤ 67	≥ 33				OP7			3105	
ETHYL 3,3-DI-(tert-BUTYLPEROXY)BUTYRATE	> 77 - 100					OP5			3103	
"	≤ 77	≥ 23				OP7			3105	
"	≤ 52			≥ 48		OP7			3106	
1-(2-ETHYLHEXANOYLPEROXY)-1,3-DIMETHYL- BUTYL PEROXYPIVALATE	≤ 52	≥ 45	≥ 10			OP7	-20	-10	3115	
tert-HEXYL PEROXYNEODECANOATE	≤ 71	≥ 29				OP7	0	+10	3115	
tert-HEXYL PEROXYPIVALATE	≤ 72		≥ 28			OP7	+10	+15	3115	
ISOPROPYL sec-BUTYL PEROXYDICARBONATE										
+ DI-sec-BUTYL PEROXYDICARBONATE	32 + ≤ 15 - 18	≥ 38				OP7	-20	-10	3115	
+ DI-ISOPROPYL PEROXYDICARBONATE	+ ≤ 12 - 15									
ISOPROPYL sec-BUTYL PEROXYDICARBONATE										
+ DI-sec-BUTYL PEROXYDICARBONATE	≤ 52 + ≤ 28 + ≤ 22					OP5	-20	-10	3111	3)
+ DI-ISOPROPYL PEROXYDICARBONATE	≤ 72	≥ 28				OP8			3109	13)
ISOPROPYL CUMYL HYDROPEROXIDE	> 72 - 100					OP7			3105	13)
p-MENTHYL HYDROPEROXIDE	≤ 72	≥ 28				OP8			3109	27)
"	≤ 67		≥ 33			OP7	+35	+40	3115	
METHYL CYCLOHEXANONE PEROXIDE(S)	see remark 8	≥ 48				OP5			3101	3) 8) 13)
METHYL ETHYL KETONE PEROXIDE(S)	see remark 9	≥ 55				OP7			3105	9)
"	see remark 10	≥ 60				OP8			3107	10)
METHYL ISOBUTYL KETONE PEROXIDE(S)	≤ 62	≥ 19				OP7			3105	22)
ORGANIC PEROXIDE, LIQUID, SAMPLE						OP2			3103	11)
ORGANIC PEROXIDE, LIQUID, SAMPLE,										
TEMPERATURE CONTROLLED						OP2			3113	11)
ORGANIC PEROXIDE, SOLID, SAMPLE						OP2			3104	11)
ORGANIC PEROXIDE, SOLID, SAMPLE,										
TEMPERATURE CONTROLLED						OP2			3114	11)

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
PEROXYACETIC ACID, TYPE D, stabilized	≤ 43					OP7			3105	13) 14) 19)
PEROXYACETIC ACID, TYPE E, stabilized	≤ 43					OP8			3107	13) 15) 19)
PEROXYACETIC ACID, TYPE F, stabilized	≤ 43					OP8			3109	13) 16) 19)
PEROXYLAURIC ACID	≤ 100					OP8	+35	+40	3118	
PINANYL HYDROPEROXIDE	> 56 - 100					OP7			3105	13)
"	≤ 56	≥ 44				OP8			3109	
POLYETHER POLY-tert-BUTYLPEROXYCARBONATE	≤ 52		≥ 23			OP8			3107	
1,1,3,3-TETRAMETHYLBUTYL HYDROPEROXIDE	≤ 100					OP7			3105	
1,1,3,3-TETRAMETHYLBUTYL PEROXY-2 ETHYLHEXANOATE	≤ 100					OP7	+15	+20	3115	
1,1,3,3-TETRAMETHYLBUTYL PEROXYNEODECANOATE	≤ 72		≥ 28			OP7	-5	+5	3115	
"	≤ 52 as a stable dispersion in water					OP8	-5	+5	3119	
1,1,3,3-TETRAMETHYLBUTYL PEROXYPIVALATE	≤ 77	≥ 23				OP7	0	+10	3115	
3,6,9-TRIETHYL-3,6,9-TRIMETHYL-1,4,7-TRIPEROXONANE	≤ 42	≥ 58				OP7			3105	28)

Notes on 2.5.3.2.4:

- 1) Diluent type B may always be replaced by diluent type A. Boiling point diluent type B should be at least 60 °C higher than the SADT of the organic peroxide.
- 2) Available oxygen ≤ 4.7%.
- 3) "EXPLOSIVE" subsidiary risk label required (Model No. 01, see 5.2.2.2.2).
- 4) Diluent may be replaced by di-tert-butyl peroxide.
- 5) Available oxygen ≤ 9%.
- 6) With ≤ 9% hydrogen peroxide; available oxygen ≤ 10%.
- 7) Only non-metallic packagings allowed.
- 8) Available oxygen > 10% and ≤ 10.7%, with or without water
- 9) Available oxygen ≤ 10%, with or without water
- 10) Available oxygen ≤ 8.2%, with or without water
- 11) See 2.5.3.2.5.1.
- 12) Up to 2000 kg per receptacle assigned to ORGANIC PEROXIDE TYPE F on the basis of large scale trials.
- 13) "CORROSIVE" subsidiary risk label required (Model No. 08, see 5.2.2.2.2).
- 14) Peroxyacetic acid formulations which fulfil the criteria of 2.5.3.3.2 (d).
- 15) Peroxyacetic acid formulations which fulfil the criteria of 2.5.3.3.2 (e).
- 16) Peroxyacetic acid formulations which fulfil the criteria of 2.5.3.3.2 (f).
- 17) Addition of water to this organic peroxide will decrease its thermal stability.
- 18) No "CORROSIVE" subsidiary risk label required for concentrations below 80%.
- 19) Mixtures with hydrogen peroxide, water and acid(s).
- 20) With diluent type A, with or without water.
- 21) With ≥ 25% diluent type A by mass, and in addition ethylbenzene
- 22) With ≥ 19% diluent type A by mass, and in addition methyl isobutyl ketone
- 23) With < 6% di-tert-butyl peroxide.
- 24) With ≤ 8% 1-isopropylhydroperoxy-4-isopropylhydroxybenzene.
- 25) Diluent type B with boiling point > 110 °C.
- 26) With < 0.5% hydroperoxides content.
- 27) For concentrations more than 56%, "CORROSIVE" subsidiary risk label required (Model No. 08, see 5.2.2.2.2).
- 28) Available active oxygen ≤ 7.6 % in diluent type A, having a boil-off point in the range of 220 - 260 °C.
- 29) Not subject to the requirements of these Model Regulations for Division 5.2.

ANNEX 3: New organic peroxides

Test results and competent authority approvals

ORGANIC PEROXIDE + CA approval	Conc (%)	DETONATION		DEFLAGRATION				HEATING UNDER CONFINEMENT				EXPLOSIVE POWER		THERMAL EXPLOSION IN PACKAGE	SADT (°C)	Generic Entry Number	Packaging Method	Country of Origin
		A.1 50/60 (cm)	A.6 UN det. (cm)	C.1 T/P (ms)	C.2 Defl. (mm/s)	Overall result	E.1 Koepen (mm)	E.2 DPV (mm)	E.3 US PVT (mm)	Overall result	F.3 Trauzl (cm ³)	F.4 Mod. Trauzl (cm ³)	Overall result	G.2 Result				
Dicyclohexylperoxydicarbonate (as a stable dispersion in water) D/BAM/II.2/38/99-39/99	≤ 42	no*	-	≤ 2170 kPa	No	No	-	Low	7 ml	-	No	-	30	3119	OP8	D		
Dicyclohexylperoxydicarbonate (as a stable dispersion in water) D/BAM/II.2/14/00-15/00	≤ 42	no*	-	≤ 2170 kPa	No	No	-	Low	7 ml	-	No	-	25	3119	IBC, 31A	D		
1-(2-Ethylhexanoylperoxy)-1,3-dimethylbutylperoxyvalate >45% dil. type A	≤ 52	25 (65%)	-	69	1.9	Yes, slowly	1.5	7.0	-	Medium	-	-	0	3115	OP7	NL		
>10% dil. type B NL-TNO 01D2/0121-rev.1	≤ 77	-	17, 18.5	1954	1.52	Yes, slowly	1.5	7.0	-	Medium	-	-	20	3115	OP7	NL		
1,1,3,3-Tetramethylbutylperoxy pivalate, diluent type A NL-TNO 98/ID2/2927	≤ 77	-	-	1954	1.52	Yes, slowly	1.5	7.0	-	Medium	-	-	20	3115	OP7	NL		
Peroxy lauric acid NL DGG/V/IL-98010400	≤ 100	-	-	≤ 2170 kPa	0	No	<1.0	3.0	-	Low	-	-	45	3118	OP8	NL		
tert-Butylperoxyneohexanoate stable dispersion with water NL DGG/V/VKL-98010399	≤ 42	-	<20	≤ 2170 kPa	0.02	No	<1.0	<1.0	-	Low	-	-	20	3117	OP8	NL		
tert-Amylperoxy isopropylcarbonate diluent type A NL-TNO 01D2/1205	≤ 77	no	-	≤ 2070 kPa	0.05	No	≥ 2.0 < 2.0 (70%)	3.0	-	Violent	-	-	55	3103	OP5***	NL		
1,6-Di-(tert-butylperoxy)carbonyloxy)hexane diluent type A NL-TNO 01D2/1204	≤ 72	32.3	-	640	0.55	Yes, slowly	-	9.0	5.0	Violent	-	-	>50	3103	OP5	NL		
Polyether peroxy carbonate diluent type B USDOT CA-0004006	≤ 52	-	-	≤ 2170 kPa	0.141	No	-	2.0	2.0	Low	-	-	70	3107	OP8	US		

* Caviated
 ** UN screening procedure (i.e. modified Trauzl (F.4), DPVT (E.2) and Koepen test (E.1) or USPVT (E.3))
 *** OP5, based on CA approval (packaging actually tested between OP3 and OP5)