DEPARTMENT OF TRANSPORTATION

Research and Special Programs Administration

49 CFR Parts 171, 172, 173, and 178

[Docket No. HM-181D, Notice No. 90-12]

RIN 2137-AB90

Performance-Oriented Packaging Standards; Additional Proposals for Flammable Solids, Oxidizers, and Organic Peroxides

AGENCY: Research and Special Programs Administration (RSPA), DOT.

ACTION: Supplemental notice of proposed rulemaking.

SUMMARY: RSPA proposes to amend the Hazardous Materials Regulations (HMR), 49 CFR Parts 171–180, with regard to the hazard classification, packaging, and hazard communication requirements applicable to flammable solids, oxidizers, and organic peroxides. The proposed changes are based on the United Nations Recommendations on the Transport of Dangerous Goods (UN Recommendations). The purpose of the action is to: Promote safety through better classification and packagings; simplify the HMR; promote flexibility and technological advances in packaging; and harmonize domestic regulations for flammable solids, oxidizers, and organic peroxides with those used internationally. The intended effects of this action are to enhance safety and facilities international commerce.

DATES: Comments must be received on or before August 20, 1990.

ADDRESSES: Address comments to the Dockets Unit, Research and Special Programs Administration, U.S. Department of Transportation, Washington, DC 20590–0001. Comments should identify the docket and be submitted, if possible, in five copies. If confirmation of receipt of comments is desired, include a self-addressed stamped postcard showing the docket number (*i.e.*, Docket HM–181D). The Dockets Unit is located in Room 8419 of the Nassif Building, 400 Seventh Street SW., Washington, DC 20590–0001. Telephone: (202) 366–5046. The public dockets may be reviewed between the hours of 8:30 a.m. to 5:00 p.m., Monday through Friday.

FOR FURTHER INFORMATION CONTACT: Charles Schultz, Office of Hazardous Materials Transportation, RSPA, 400 Seventh Street SW., Washington, DC, (202) 366–4545.

SUPPLEMENTARY INFORMATION: This supplemental notice of proposed rulemaking (SNPRM) revises the proposals set forth in Docket HM–181, Notice 87–4 (52 FR 16482 and 52 FR 42772) as they relate to flammable solids, oxidizers, and organic peroxides. These changes would incorporate classifications for certain hazardous materials that are consistent with the classification criteria found in the sixth edition of the U.N. Recommendations.

The supplementary information is organized under the following headings to assist the reader:

I. Background

On May 5, 1987, RSPA issued an NPRM entitled "Performance-Oriented Packaging Standards; Miscellaneous Proposals" (Docket HM–181; Notice 87–4; 52 FR 16482), proposing sweeping changes to the HMR, including the adoption of performance-oriented packaging standards and hazard classification criteria. Docket HM–181 was republished on November 6, 1987 (52 FR 42772) and contained corrections and supplemental proposals to the May 5, 1987 publication. Substantial background information is provided in those rulemakings and the reader is referred to them for greater detail. The following are the major considerations in support of those proposals as they relate to hazard classification: (1) The UN classification system conveys more directly the hazard characteristics of flammable solids, oxidizers, and organic peroxides. (2) Proper classification is necessary to ensure appropriate packaging, hazard communication, and handling, thereby enhancing transportation safety. This notice revises and supplements the proposals in Notice 87–4, based on the UN Recommendations, concerning Classes 4 and 5.

The proposed changes in this supplemental notice would address the following areas: (1) The definitions of materials in Classes 4 and 5 would be improved and expanded; (2) the methods and criteria for classifying a material into Class 4 or 5, and then assigning the material to a packing group, would be described; (3) shipping names within Division 5.2 (organic peroxides) would be revised to conform with the UN Recommendations; (4) packaging requirements would be added for self-reactive materials and revised for organic peroxides.

The definitions of Classes 4 and 5 would be clarified and ambiguous terms eliminated. In addition, classification and packing group assignment criteria would be incorporated in the regulatory text and test methods for Class 4 and Division 5.1 are included in two appendices.

There are two classification systems being introduced in this SNPRM in the form of appendices to 49 CFR part 173. Each system provides tests and criteria for the assignment of a material to a division within a class and to a packing group. The methods used to classify a material are based on the UN Recommendations, Chapters 11 and 14, for Division 5.1 solids and Class 4 materials, respectively.

An additional classification system is being introduced for Division 5.2 materials. Since publication of Notice 87–4 on November 6, 1987, the United Nations has introduced "generic types" of shipping descriptions. When a new organic peroxide is introduced into commerce, its transportation hazards are determined using standard tests. A competent authority, as defined in accordance with 49 CFR 171.8, then assigns the new organic peroxide to a generic type description based on the test results. By using this procedure, it is not necessary to go through the lengthy process by which the importing and exporting countries reach agreement on packaging requirements or the assignment of a UN identification number whenever a new organic peroxide product comes on the market. More importantly, because the classification system is based on hazard considerations, its implementation will help effect uniform safety standards. Included as part of these safety standards is a new method for specifying Division 5.2 packaging.

In Notice 87–4, we stated that not all hazardous materials are accommodated by the use of the general non-bulk packaging sections. Because of unique physical, chemical, or lethality problems, some materials require special packaging and handling. In that document, two methods were proposed to handle these problem materials. One would be to add special packaging provisions in the § 172.101 Hazardous Materials Table (HMT). The other method for dealing with these hazardous materials is to add a unique packaging section for a particular material when the general packaging provisions are not adequate to package the material safely. The general packaging tables have sufficient flexibility so that they could be modified to handle most materials; however, for certain materials, the

number of special provisions needed is so large that their addition to the HMT would make it unwieldy. For these reasons, the addition of a separate packaging section is preferable. This SNPRM proposes two packaging sections, §§ 173.224 and 173.225, for self-reactive substances (Division 4.1) and organic peroxides (Division 5.2), respectively.

II. Related Rulemakings

Concurrent with this SNPRM, the following two advance notices of proposed rulemaking are withdrawn:

A. Docket HM-178

On May 7, 1981, RSPA published an advance notice of proposed rulemaking entitled, "Definition of Flammable Solid" (46 FR 25492) under Docket HM-178. RSPA recognized the shortcomings of the existing subjective classification system for flammable solids and proposed seven subgroupings for those materials. With a few exceptions, those seven subgroupings generally agree in principle with the definitions of Class 4 materials contained in the UN Recommendations and incorporated in this notice. The definitions omit wetted-explosives and self-reactive materials, however, and include some fermenting materials and elevated temperature materials. Elevated temperature materials have now been transferred into Docket HM-198A (54 FR 38930; September 21, 1989), but no work is currently planned on fermenting materials. In light of the duplication that would result from this supplemental notice and Docket HM-178, HM-178 is withdrawn. Hazard classification, hazard communication, and packaging standards for elevated temperature materials will still be given consideration under Docket HM-198A.

B. Docket HM-179

An advance notice of proposed rulemaking, under Docket HM-179, issued June 15, 1981 (46 FR 31294), entitled "Definition of Oxidizer", contained definitions, tests, and criteria for classifying oxidizers. The portion of that ANPRM which applied to solid oxidizers, has been incorporated into the UN Recommendations and is also contained in the proposed appendix F to part 173 in this notice. RSPA believes that rulemaking concerning liquid oxidizers should await adoption of criteria in the UN Recommendations. Therefore, Docket HM-179 is withdrawn.

III. Major Features

A. Class 4 Revisions

The further revisions to Class 4 would enhance the definitions for those materials proposed in § 173.124 (52 FR 42772) and explain, in an appendix (appendix E to part 173), the criteria by which a material is classified as Class 4. Although it was proposed to adopt Class 4 test criteria in Notice 87-4, these criteria were not included. This omission is corrected in this document.

Class 4 materials include flammable solids, spontaneously combustible materials, and materials that are dangerous when wet. The class includes some liquids in Divisions 4.2 and 4.3. Their classification scheme applies to a broad range of materials, including simple raw materials which may self-heat, and finished goods such as fusees (railway or highway). The proposed classification scheme would reflect that diversity. Test methods fall into two general categories: the first category uses fixed procedures of step-by-step protocol tests to evaluate specific characteristics of materials under conditions which may be experienced during transportation. The second category compares a new material with materials already in the division to determine its classification. The packing group is determined as part of the classification process. In order for a material to be classified within a division, some threshold of a specific hazard must be exceeded. The degree to which that hazard is assessed is determined by using packing groups. Packing Group III indicates minor danger; Packing Group II indicates moderate danger, while Packing Group I indicates great danger. In many cases, the packing group is determined using quantitative data derived from specific tests. Where quantitative tests have not been developed, packing group assignments are subjective and ultimately based upon the transportation experience with these or similar materials.

Certain self-reactive materials require special packaging and transport conditions. Their shipping requirements are not easily accommodated in the HMT and this notice would provide a new section (§ 173.224) which details packaging and temperature control requirements for self-reactive materials.

B. Class 5 Revisions

This notice proposes extensive revisions to the proposals made in Notice 87-4. The definitions for Divisions 5.1 and 5.2 in proposed §§ 173.127 and 173.128, respectively, would be revised. Test methods for classification and packing group criteria for Division 5.1 are proposed in a new appendix F to part 173. This system entails a graduated comparison to materials with known characteristics, of the potential of a specific material to accelerate combustion.

Revisions to Division 5.2 include 20 new generic shipping descriptions in the § 172.101 Table, a classification system for assigning those descriptions, and a packaging system which recognizes the unique characteristics of organic peroxides. The 20 new generic entries for organic peroxides would replace 156 existing entries in the § 172.101 Table. Generic types A through G would be defined in § 173.128, based on classification criteria incorporated by reference from the UN Recommendations, Tests and Criteria, Part III. The classification system reflects the hazard characteristics of organic peroxides as packaged for shipment and requires that the temperature of the package be controlled, when appropriate. Criteria for determining when temperature controls are appropriate are applicable to both self-reactive materials in Division 4.1 and organic peroxides in Division 5.2. These criteria appear in proposed § 173.223.

A listing of technical names for organic peroxides would appear in a new Organic Peroxides Table in proposed § 173.225, and would be used to determine the applicable generic shipping name, packaging, and other requirements for known organic peroxides. Materials not identified by technical name, or formulations of identified materials, would be subject to approval by the Director, Office of Hazardous Materials Transportation (OHMT), prior to shipment, except for certain samples.

A packaging system based on the UN Recommendations is included in proposed § 173.225 and replaces that proposed in Notice 87-4. It is proposed that certain organic peroxides which exhibit explosive properties, specifically organic peroxides Type B, would require an EXPLOSIVE subsidiary label. Bulk packaging requirements are proposed for certain liquid Type F organic peroxides.

IV. Review by Sections

Note: Unless otherwise noted, this section-by-section review is based on the recodification proposed in Notice 87-4 (52 FR 42772, November 6, 1987).

Section 171.7

This section is being amended to incorporate citations of the United

Nations classification testing. The tests and their purposes are discussed later in this preamble. This notice also proposes removing the reference to the SADT Test of the Organic Peroxide Producers Safety Division. That test is currently cited in the regulations (49 CFR 171.7), and it is the basis for the USA SADT Test in the UN Recommendations on the Transport of Dangerous Goods, Test and Criteria. The SADT Test citation is being changed only to reduce the number of referenced documents. This section is also being revised by a rulemaking concerning explosives under Docket HM-181A (55 FR 18439, May 2, 1990). The proposals in this notice supplement rather than preempt those revisions.

Section 172.101

The § 172.101 Table would be amended to reflect the introduction of the generic shipping description system for Division 5.2 and the removal of 156 obsolete entries for organic peroxides. Twenty generic entries for organic peroxides would be added. In addition, 21 entries for self-reactive materials would be revised to reference the new packaging table (§ 173.224) for those materials. However, two self-reactive entries would not be changed. As proposed in Notice 87-4, shipments of self-reactive samples (UN3031) and self-reactive trial quantities (UN3032) would require approval by the Director, OHMT.

In the preamble to the § 172.101 Table, paragraph (c)(14) would be added to require use of the new Organic Peroxides Table in § 173.225 for selection, based on the technical name of the organic peroxide, of an appropriate proper shipping name. Because of this change, it is also necessary to revise paragraph (c)(5) to delete the reference to organic peroxides.

Section 172.102

A special provision (T37; § 172.102(c)(ii)) for tert-butyl hydroperoxide is being deleted from this section because the provision would be relocated to § 173.225(c), under this notice. New special provisions 41 and 53 provide exceptions from the requirement for a subsidiary EXPLOSIVE label for certain packages for self-reactive materials.

Section 172.202

In a final rule issued under Docket HM-126C (54 FR 27138; June 27, 1989), RSPA issued new requirements for identifying the technical constituents of hazardous materials. Proposed § 172.202(f) is thereby rendered obsolete and is withdrawn in this notice.

Section 172.203

This section would be revised for consistency with Docket HM-126C, to add generic shipping names for organic peroxides in paragraph (k)(3), and to require in paragraph (k) that the concentration be added to the shipping description for those organic peroxides which may qualify for more than one generic entry depending on their concentration.

Section 173.21

Paragraph (f)(1) would be revised to reference the temperature control requirements proposed in § 173.223 of this notice. Paragraph (f)(2) is revised to reference the SADT test in the UN Recommendations on the Transport of Dangerous Goods, Test and Criteria, Part II. In addition, a restriction on the amount of active oxygen that may be present in certain types of organic peroxides is being proposed in new paragraph (j). This restriction reflects current requirements for domestic transportation.

Section 173.124

The definitions for the divisions in Class 4 are being expanded for clarity. Explanations or examples are being added so that the type of materials identified by name can be understood. As revised, the general term for matches and similar materials has been shortened to "materials which cause a fire through friction".

Section 173.125

This section is revised to show the criteria for assigning packing groups for Class 4 materials. In Notice 87-4, [52 FR 42772, November 6, 1987], RSPA proposed to supply the UN Recommendations' test methods and criteria for assignment of packing group. This is provided in appendix E. Placing those criteria in the regulations makes them more accessible.

Section 173.127

This newly proposed section contains the definition and packing group assignment for Division 5.1, so that definitional terms for Divisions 5.1 and 5.2 will be located in separate sections. The definition of Division 5.1 has been amended by deleting examples of specific anions which may contribute to a fire. The examples are no longer needed because of the revised definition and addition of test methods in the new appendix F.

Section 173.128

The definitions for organic peroxides are expanded from that proposed in Notice 87-4 to conform with changes to the UN Recommendations made since publication of Notice 87-4 on November 6, 1987. The definitions appear in paragraph (a). An exception, based on available oxygen, appears in paragraph (a)(4). Seven generic types of organic peroxides are defined in paragraph (b). The procedure for assigning a specific organic peroxide to a generic type is set forth in paragraph (c). If an organic peroxide is identified by technical name in the Organic Peroxides Table in § 173.225, the generic type is assigned in that Table. Otherwise, the type is assigned by the Director, OHMT, based on submission of test data. Test procedures are incorporated by reference to Part III of the UN Recommendations on the Transport of Dangerous Goods, Tests and Criteria, in paragraph (d) of § 173.128, and a specific testing protocol is set forth.

Section 173.129

This section is revised to address Division 5.2 because assignment of packing groups for Division 5.1 materials would now be located in § 173.127. All Division 5.2 materials are assigned to Packing Group II; the rationale is that all Division 5.2 materials represent at least a moderate danger. Materials that might be in Packing Group I would pose an even greater hazard if not permitted to vent should decomposition begin. In other words, a packaging failure due to decomposition would be a much greater hazard in a Packing Group I packaging than the failure of a Packing Group II packaging because more pressure would have built up within the former.

Section 173.152

Paragraph (b) is being revised to remove the reference to Packing Groups II and III for Division 5.2 materials, since all Division 5.2 materials are assigned to Packing Group II.

Section 173.223

This section is added to set forth criteria for determining when temperature controls are needed. The requirements for temperature control that are currently in the regulations for self-reactive materials and organic peroxides do not indicate how to establish an appropriate transportation temperature. The results of the material's SADT Test determines the temperature control requirements. The UN Recommendations lists the temperature control scheme for applying the test results. It is being included in

these regulations for clarity. Also note that, although the procedure for determining the temperature control requirements is being added, the requirement for approval by the Director, OHMT, for materials employing refrigeration for stabilization (§ 173.21) is not being removed.

Section 173.224

This section is added to specify packaging and temperature controls for self-reactive materials in Division 4.1. The packagings permitted for self-reactive materials are restricted, with two exceptions, to fiberboard outer packagings and plastic inner packagings. Furthermore, certain of these materials require temperature control. The most effective means of presenting these requirements is in a special section which is organized into two tables. The self-reactive materials table in paragraph (b) specifies, by identification number, the permitted packaging method(s) and the control and emergency temperatures, as appropriate, for the material being shipped. The table of packing methods in paragraph (c) specifies, by packing method, the types of packagings and package quantity limits. It should be noted that although these packagings are not in the UN Recommendations at present, RSPA anticipates inclusion of similar provisions in the UN Recommendations in the near future.

Section 173.225

The packaging system for organic peroxides proposed in Notice 87–4 (52 FR 42772, November 6, 1987) is withdrawn and replaced with a new system which has been incorporated into the UN Recommendations. Paragraph (a) states that packaging for organic peroxides must conform to the provisions of the section. Paragraph (b) sets forth an Organic Peroxides Table which specifies the technical name for specifically identified organic peroxides, the identification number which is used to select an appropriate generic proper shipping name from the § 172.101 Table, specifications for concentrations of the peroxide or constituents of solutions, packing methods that may be used, temperature controls, and additional special provisions.

Paragraph (c) sets forth procedures for new organic peroxides and formulations of identified peroxides and samples. New organic peroxides and formulations of currently identified peroxides would have to be approved for transport under the provisions of proposed § 173.128(c). Packaging would then be prescribed, by generic type, in the Packing Method Table for Generic Types in paragraph (c)(3) of § 173.225. Paragraph (c)(4) contains provisions for shipping samples for testing or evaluation. Approval by the Director, OHMT, would be required only for those materials subject to the refrigeration requirements of proposed § 173.21(f)(3) of Notice 87–4 (52 FR 42772, November 6, 1987).

Paragraph (d) sets forth two Tables of Packing Methods, for liquids and solids, respectively, specifying the types of packagings and quantity limits applicable to each packing method. Paragraph (e) specifies authorized bulk packagings for those organic peroxides for which bulk packagings are authorized in the Organic Peroxides Table in paragraph (b). Bulk packagings are authorized only for those certain organic peroxides which are Type F liquids, generally based on current packaging authorizations. The system proposed in this notice, is based on the hazard of the material as determined by the tests which are also used to assign it to a generic type. The greater the hazard posed by a chemical, the smaller the packaging in which it may be shipped. In this way, a weighted hazard (the product of the severity of the hazard multiplied by its quantity) is nearly constant for all of the generic types. For packing methods OP8A and OP8B, there is an additional consideration: for large amounts of either material, the structural integrity of the container may be limiting. For example, an OP8A allows the contents of inner plastic drums and receptacles to weigh 200 kg when in an outer fiber drum, but only 75 kg when in an outer fiber box.

Appendix E to Part 173

For ease of reference, the UN Recommendations' classification schemes for Class 4 materials are listed in appendix E. These materials have a wide range of properties, and, therefore, the nature of the classification tests is commensurately diverse. The testing is based on the behavior of a material under conditions in standardized tests, which are intended to predict the behavior of a material when exposed to conditions which may be encountered during transportation, (*e.g.*, heat, fire, air, or water). If, under the conditions of exposure to these elements, the materials cause or exacerbate a hazardous condition, they are then assigned to the appropriate packing group. Specifically, this appendix contains tests and criteria for readily combustible solids, pyrophoric materials, self-heating materials, and materials which are dangerous when wet. The tests have been devised so that they are simple, have minimal equipment requirements, and are economical to run. Tests for wetted-explosives are not included in this rulemaking. For a material to be classified as a wetted-explosive, it must be subject to the tests prescribed in Docket HM–181A. If it qualifies as an explosive when dry, but does not so qualify when wetted, it is classed in Division 4.1 and assigned to Packing Group I.

Currently, the United States is working with the UN to develop tests to classify self-reactive materials. However, until development of tests are completed, these materials will be classed based on comparisons with materials which are already considered to be self-reactive. In addition, there is no standard test for materials which can cause fire through friction. For this material to present a hazard, however, the material has been intentionally designed to possess a hazard (e.g., matches), therefore, there is no need to determine if this hazard is present.

Appendix F to Part 173

The classification and determination of packing group for oxidizers are based on the simple tests in Appendix F. A principle underlying the tests is that an oxidizer may stimulate combustion differently, depending on how much oxidizer is present in proportion to any combustible material. For this reason, two ratios of combustible material to oxidizer are used: 1 to 1 and 1 to 4. The contribution that an oxidizer makes toward accelerating the rate of combustion is evaluated relative to the contribution made by standards containing, in turn, ammonium persulfate, potassium perchlorate, or potassium bromate. As soon as a material is found in both ratios tested to be less hazardous on average than any standard, the test may be concluded.

Section 178.522

This section is being revised to introduce a new composite packaging with inner plastic receptacles (6HH2). In selecting that code to designate this new packaging, composite packaging 6HH has been redesignated as 6HH1. These packagings appear in the Packaging Method Tables for Division 5.2, organic peroxides. Therefore, it is appropriate to include them in this notice. In addition, an omission in the previous NPRMs under Docket No. HM–181 is being corrected—the maximum net mass for 6HA2 packaging has been included in this notice.

V. Administrative Notices

A. Executive Order 12291

The RSPA has determined that this rulemaking: (1) Is not "major" under Executive Order 12291; (2) is not "significant" under DOT's regulatory policies and procedures [44 FR 11034]; (3) will not affect not-for-profit enterprises or small governmental jurisdictions; and (4) does not require an environmental impact statement under the National Environmental Policy Act (40 U.S.C. 4321 *et seq.*). The proposals in this document entail technical amendment to the proposals made in Notice 87–4 (52 FR 16482 and 52 FR 42772, published May 5, 1987 and November 6, 1987, respectively). Their anticipated economic impacts are so minimal that preparation of a regulatory evaluation is not considered necessary. A regulatory evaluation for Notice 87–4 is available in Docket HM–181.

B. Executive Order 12612

This proposed action has been analyzed in accordance with the principles and criteria in Executive Order 12612, and it has been determined that the proposed rule does not have sufficient Federalism implications to warrant the preparation of a Federalism Assessment. This proposal has no substantial direct impact on the States, on the Federal-State relationship, or on the distribution of power and responsibilities among levels of government. Therefore, this proposed rulemaking contains no policies with Federalism implications as defined in Executive Order 12612.

C. Regulatory Flexibility Act

The proposed changes would generally affect persons involved in classification and hazard communication for certain categories of hazardous materials, some of whom may be small entities. Based on limited information concerning the size and nature of entities likely to be affected by this proposed rule, I certify that the regulations proposed within would not, if promulgated, have a significant economic impact on a substantial number of small entities under the criteria of the Regulatory Flexibility Act.

D. Paperwork Reduction Act

The information collection requirement contained in proposed § 173.128 is being submitted to the Office of Management and Budget (OMB) for approval under the provisions of the Paperwork Reduction Act of 1980 (44 U.S.C. 3504(h)).

The following list of **Federal Register** Thesaurus of Indexing Terms apply to this notice of proposed rulemaking.

List of Subjects

49 CFR Part 171

Exports, Hazardous materials transportation, Hazardous waste, Imports, Incorporation by reference, Reporting and recordkeeping requirements.

49 CFR Part 172

Hazardous materials transportation, Hazardous waste, Labeling, Packaging and containers, Reporting and recordkeeping requirements.

49 CFR Part 173

Explosives, Hazardous materials transportation, Packaging and containers, Radioactive materials, Reporting and recordkeeping requirements.

49 CFR Part 178

Hazardous materials transportation, Motor vehicle safety, Packaging and containers, Reporting and recordkeeping requirements.

In consideration of the foregoing, the proposals to amend 49 CFR parts 171, 172, 173, and 178, as published in Docket HM–181, Notice No. 87–4, on November 6, 1987 (52 FR 42772–43000), would be modified as follows:

PART 171—GENERAL INFORMATION, REGULATIONS, AND DEFINITIONS

1. The authority citation for part 171 would continue to read as follows:

Authority: 49 App. U.S.C. 1802, 1803, 1804, 1805, 1808; 49 CFR part 1.

2. Section 171.7(c), as proposed at 52 FR 42778 on November 6, 1987, would be amended in the table by removing the entry for the Society of Plastics Industries, Inc., Organic Peroxides Producers Safety Division and revising the entry for the United Nations, to read as follows:

§ 171.7 Matter incorporated by reference.

* * * * *

(c) * * *

Source and name of material	49 CFR reference
* * * * *	
United Nations, United Nations Sales Section, New York, NY 10017:	
UN Recommendations on the Transport of Dangerous Goods, Sixth Revised Edition (1989).	172.401; 172.407; 172.519.
UN Recommendations on the Transport of Dangerous Goods, Tests and Criteria, Parts I and II, First Edition (1986).	173.21; 173.56; 173.57; 173.223.
UN Recommendations on the Transport of Dangerous Goods, Tests and Criteria, Part III, First Edition, Addendum 1 (1988).	173.225.

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PART 172—HAZARDOUS MATERIALS TABLE, SPECIAL PROVISIONS AND HAZARDOUS MATERIALS COMMUNICATIONS REGULATIONS

3. The authority citation for part 172 would continue to read as follows:

Authority: 49 App. U.S.C. 1803, 1804, and 1808; 49 CFR part 1, unless otherwise noted.

4. In § 172.101, as proposed at 52 FR 42783 on November 6, 1987, paragraph (c)(5) is revised and paragraph (c)(14) is added to read as follows:

§ 172.101 Purpose and use of hazardous materials table.

* * * * *

(c) * * *

(5) When one entry references another entry by use of the word "see", if both names are in roman type, either name may be used as the proper shipping name (*e.g.*, Ethyl alcohol, *see* Ethanol); however, the referenced entry is preferred.

* * * * * *

(14) *Organic peroxides.* Generic proper shipping names for organic peroxides, as listed in Column 2 of the Table, shall be selected based on the technical name of the organic peroxide, in accordance with the provisions of § 173.225 of this subchapter.

* * * * *

§ 172.101 [Amended]

5. In § 172.101, the Hazardous Materials Table, as proposed at 52 FR 42787 on November 6, 1987, would be amended by removing the current entries assigned hazard class 5.2 in column 3 which have the identification numbers listed below; adding 20 new generic entries of hazard class 5.2 in alphabetical order; and revising columns 6, 7 and 8B for those class 4.1 entries known as self-reactive substances as follows:

REMOVE

UN2080, UN2081, UN2082, UN2083, UN2084, UN2085, UN2087, UN2088, UN2089, UN2090, UN2091, UN2092, UN2093, UN2094, UN2095, UN2096.

UN2097, UN2098, UN2099, UN2100, UN2101, UN2102, UN2103, UN2104, UN2105, UN2106, UN2107, UN2108, UN2110, UN2111, UN2112, UN2113, UN2114, UN2115, UN2116, UN2117, UN2118, UN2119, UN2120, UN2121, UN2122, UN2123, UN2124, UN2125, UN2126, UN2127, UN2128, UN2129, UN2130, UN2131, UN2132, UN2133, UN2134, UN2135, UN2136, UN2137, UN2138, UN2139, UN2140, UN2141, UN2142, UN2143, UN2144, UN2145, UN2146, UN2147, UN2148, UN2149, UN2150, UN2151, UN2152, UN2153, UN2154, UN2155, UN2156, UN2157, UN2158, UN2159, UN2160, UN2161, UN2162, UN2163, UN2164, UN2165, UN2166, UN2167, UN2168, UN2169, UN2170, UN2171, UN2172, UN2173, UN2174, UN2175, UN2176, UN2177, UN2178, UN2179, UN2180, UN2182, UN2183, UN2184, UN2185, UN2255, UN2550, UN2551, UN2562, UN2592, UN2593, UN2594, UN2595, UN2596, UN2597, UN2598, UN2755, UN2756, UN2883, UN2884, UN2885, UN2886, UN2887, UN2888, UN2889, UN2890, UN2891, UN2892, UN2893, UN2894, UN2895, UN2896, UN2897, UN2898, UN2899, UN2957, UN2958, UN2959, UN2960, UN2961, UN2962, UN2963, UN2964, UN3044, UN3045, UN3046, UN3047, UN3058, UN3059, UN3060, UN3061, UN3062, UN3063, UN3067, UN3068, UN3069, UN3081.

ADD

Symbols	Hazardous materials descriptions and proper shipping names	Hazard class	Identification Numbers	Packing group	Labels	Special provisions	(8) Packaging authorizations (§173.***)			(9) Quantity limitations		(10) Vessel stowage requirements	
							Exceptions	Non-bulk packaging	Bulk packaging	Passenger aircraft or railcar	Cargo aircraft only	Vessel Stowage	Other stowage provisions
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8A)	(8B)	(8C)	(9A)	(9B)	(10A)	(10B)
	Organic peroxide type A, liquid or solid	Forbidden											
	Organic peroxide type B, liquid	5.2	UN3101	II	ORGANIC PEROXIDE EXPLOSIVE.	53	None	225	None	FORBIDDEN.	FORBIDDEN.	D	12, 40
	Organic peroxide type B, solid	5.2	UN3102	II	ORGANIC PEROXIDE EXPLOSIVE.	53	None	225	None	FORBIDDEN.	FORBIDDEN.	D	12, 40
	Organic peroxide type C, liquid	5.2	UN3103	II	ORGANIC PEROXIDE.		152	225	None	5 l	10 l	D	12, 40
	Organic peroxide type C, solid	5.2	UN3104	II	ORGANIC PEROXIDE.		152	225	None	5 kg	10 kg	D	12, 40
	Organic peroxide type D, liquid	5.2	UN3105	II	ORGANIC PEROXIDE.		152	225	None	5 l	10 l	D	12, 40
	Organic peroxide type D, solid	5.2	UN3106	II	ORGANIC PEROXIDE.		152	225	None	5 kg	10 kg	D	12, 40
	Organic peroxide type E, liquid	5.2	UN3107	II	ORGANIC PEROXIDE.		152	225	None	10 l	25 l	D	12, 40
	Organic peroxide type E, solid	5.2	UN3108	II	ORGANIC PEROXIDE.		152	225	None	10 kg	25 kg	D	12, 40
	Organic peroxide type F, liquid	5.2	UN3109	II	ORGANIC PEROXIDE.		152	225	225	10 l	25 l	D	12, 40
	Organic peroxide type F, solid	5.2	UN3110	II	ORGANIC PEROXIDE.		152	225	None	10 kg	25 kg	D	12, 40
	Organic peroxide type B, liquid, temperature controlled.	5.2	UN3111	II	ORGANIC PEROXIDE EXPLOSIVE.	53	None	225	None	FORBIDDEN.	FORBIDDEN.	D	2, 40
	Organic peroxide type B, solid, temperature controlled.	5.2	UN3112	II	ORGANIC PEROXIDE EXPLOSIVE.	53	None	225	None	FORBIDDEN.	FORBIDDEN.	D	2, 40
	Organic peroxide type C, liquid, temperature controlled.	5.2	UN3113	II	ORGANIC PEROXIDE.		None	225	None	FORBIDDEN.	FORBIDDEN.	D	2, 40
	Organic peroxide type C, solid, temperature controlled.	5.2	UN3114	II	ORGANIC PEROXIDE.		None	225	None	FORBIDDEN.	FORBIDDEN.	D	2, 40
	Organic peroxide type D, liquid, temperature controlled.	5.2	UN3115	II	ORGANIC PEROXIDE.		None	225	None	FORBIDDEN.	FORBIDDEN.	D	2, 40
	Organic peroxide type D, solid, temperature controlled.	5.2	UN3116	II	ORGANIC PEROXIDE.		None	225	None	FORBIDDEN.	FORBIDDEN.	D	2, 40
	Organic peroxide type E, liquid, temperature controlled.	5.2	UN3117	II	ORGANIC PEROXIDE.		None	225	None	FORBIDDEN.	FORBIDDEN.	D	2, 40
	Organic peroxide type E, solid, temperature controlled.	5.2	UN3118	II	ORGANIC PEROXIDE.		None	225	None	FORBIDDEN.	FORBIDDEN.	D	2, 40
	Organic peroxide type F, liquid, temperature controlled.	5.2	UN3119	II	ORGANIC PEROXIDE.		None	225	None	FORBIDDEN.	FORBIDDEN.	D	2, 40
	Organic peroxide type F, solid, temperature controlled.	5.2	UN3120	II	ORGANIC PEROXIDE.		None	225	None	FORBIDDEN.	FORBIDDEN.	D	2, 40

REVISE

Symbols	Hazardous materials descriptions and proper shipping names	Hazard class	Identification Numbers	Packing group	Labels	Special provisions	(8) Packaging authorizations (§173.***)			(9) Quantity limitations		(10) Vessel stowage requirements	
							Exceptions	Non-bulk packaging	Bulk packaging	Passenger aircraft or railcar	Cargo aircraft only	Vessel Stowage	Other stowage provisions
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8A)	(8B)	(8C)	(9A)	(9B)	(10A)	(10B)
	2,2'-Azodi-(2,4-dimethyl-4-methoxyvaleronitrile..	4.1	UN2955	II	FLAMMABLE SOLID.		None	224	None	Forbidden	Forbidden	D	2
	2,2'-Azodi-(2,4 dimethylvaleronitrile)	4.1	UN2953	II	FLAMMABLE SOLID.		None	224	None	Forbidden	Forbidden	D	2
	1,1'-Azodi-(hexahydrobenzonitrile)	4.1	UN2954	II	FLAMMABLE SOLID.		None	224	None	15 kg	50 kg	B	12, 61, 85
	Azodiisobutyronitrile	4.1	UN2952	II	FLAMMABLE SOLID, EXPLOSIVES.	41, 53	None	224	None	Forbidden	Forbidden	D	2
	2,2'-Azodi (2-methyl-butyronitrile)	4.1	UN3030	II	FLAMMABLE SOLID.		None	224	None	Forbidden	Forbidden	D	2, 61
	Benzene-1,3-disulfohydrazide, *not more than 52 per cent as a paste.*	4.1	UN2971	II	FLAMMABLE SOLID.		None	224	None	15 kg	50 kg	B	12, 61, 85
	Benzene sulfohydrazide	4.1	UN2970	II	FLAMMABLE SOLID.		None	224	None	15 kg	50 kg	B	12, 61, 85
	4-(Benzyl(ethyl)amino)-3-ethoxybenzenediazonium zinc chloride.	4.1	UN3037	II	FLAMMABLE SOLID.		None	224	None	Forbidden	Forbidden	D	2
	4-(Benzyl(methyl)amino)3-ethoxybenzenediazonium zinc chloride.	4.1	UN3038	II	FLAMMABLE SOLID.		None	224	None	Forbidden	Forbidden	D	2
	3-Chloro-4-diethylaminobenzenediazonium zinc chloride.	4.1	UN3033	II	FLAMMABLE SOLID.		None	224	None	15 kg	50 kg	C	1
	2-Diazo-1-naphthol-4-sulpho-chloride	4.1	UN3042	II	FLAMMABLE SOLID, EXPLOSIVE.	53	None	224	None	Forbidden	Forbidden	D	
	2-Diazo-1-naphthol-5-sulpho-chloride	4.1	UN3043	II	FLAMMABLE SOLID, EXPLOSIVE.	53	None	224	None	Forbidden	Forbidden	D	
	2,5-Diethoxy-4-morpholinobenzenediazonium zinc chloride.	4.1	UN3036	II	FLAMMABLE SOLID.		None	224	None	15 kg	50 kg	C	2
	4-Dimethylamino-6-(2-dimethylaminoethoxy) toluene-2-diazonium zinc chloride.	4.1	UN3039	II	FLAMMABLE SOLID.		None	224	None	Forbidden	Forbidden	D	2
	N,N'-Dinitroso-N,N'-dimethyl terephthalamide *not more than 72% as a paste.*	4.1	UN2973	II	FLAMMABLE SOLID, EXPLOSIVE.	41, 53	None	224	None	Forbidden	Forbidden	D	12, 61
	N,N'-Dinitrosopentamethylenetetramine *not more than 82% with phlegmatizer.*	4.1	UN2972	II	FLAMMABLE SOLID, EXPLOSIVE.	41, 53	None	224	None	Forbidden	Forbidden	D	12, 61
	Diphenyloxide-4,4'disulfohydrazide	4.1	UN2951	II	FLAMMABLE SOLID.		None	224	None	15 kg	50 kg	B	12, 61, 85
	4-Dipropylaminobenzenediazonium zinc chloride.	4.1	UN3034	II	FLAMMABLE SOLID.		None	224	None	15 kg	50 kg	C	
	3-(2-Hydroxyethoxy)-4-pyrrolidin-1-ylbenzenediazonium zinc chloride.	4.1	UN3035	II	FLAMMABLE SOLID.		None	224	240	Forbidden	Forbidden	D	2
	Sodium 2-diazo-1-naphthol-4-sulphonate	4.1	UN3040	II	FLAMMABLE SOLID.		None	224	None	15 kg	50 kg	C	61
	Sodium 2-diazo-1-naphthol-5-sulphonate	4.1	UN3041	II	FLAMMABLE SOLID.		None	224	None	15 kg	50 kg	C	61

6. Section 172.102, as proposed at 52 FR 42932 on November 6, 1987, would be revised by removing special provision T37 in the table in paragraph (c)(7)(ii) and adding new special provisions 41 and 53 in the table in paragraph (c)(1) to read as follows:

§ 172.102 Special provisions.

* * * * *

(c) * * *

(1) * * *

Code	Special provisions
* * * * *	
41	When Packaging Method F1 or F5a (see § 173.224(c) of this subchapter) are used, an EXPLOSIVE label is not required.
* * * * *	
53	Packages of these materials should bear a subsidiary risk label, "EXPLOSIVE", unless exempted by the Director, OHMT, or the competent authority of the country of origin. A copy of the exemption shall accompany the shipping papers.
* * * * *	

§ 172.202]Amended]

7. In § 172.202, as proposed at 52 FR 42935 on November 6, 1987, remove "and paragraph (f) would be added" from amendatory instruction 14 and remove paragraph (f) from the regulatory text.

8. In § 172.203, as proposed at 42 FR 42935 on November 6, 1987, revise both amendatory instruction 15 and the regulatory text to read as follows:

In § 172.203, a sentence would be added at the end of the introductory text of paragraph (k) and paragraphs (j) and (m)(3) would be revised to read as follows:

§ 172.203 Additional description requirements.

* * * * *

(j) *Dangerous when wet material.* The words "Dangerous when wet" shall be entered on the shipping paper in association with the basic description for a material which meets the definition of a dangerous when wet material in § 173.124(c) of this subchapter.

(k) * * * For oganic peroxides which may qualify for more than one generic listing depending on concentration, the technical name must include the actual concentration being shipped or the concentration range for the appropriate generic listing.

* * * * *

(m) * * *

(3) For Division 2.3 materials Division 6.1, Packing Group I materials which are poisonous by inhalation under the criteria in § 173.133(i)(2) of this subchapter, the words "Poison-Inhalation Hazard" shall be entered on the shipping paper in association with the shipping description. The word "Poison" need not be repeated if it otherwise appears in the shipping description.

§ 172.203 [Amended]

9. In § 172.203, as proposed at 52 FR 42935 on November 6, 1987, this proposed change is added as item 15a to read as follows:

15a. In paragraph (k)(3) of § 172.203:

a. The following proper shipping names are removed: organic peroxide, solid, n.o.s. organic peroxide, liquid or solution, n.o.s.

b. The following proper shipping names are added in appropriate alphabetical sequence:

Organic peroxide type B, liquid
Organic peroxide type B, liquid, temperature controlled
Organic peroxide type B, solid
Organic peroxide type B, solid temperature controlled
Organic peroxide type C, liquid
Organic peroxide type C, liquid, temperature controlled
Organic peroxide type C, Solid
Organic peroxide type C, solid, temperature controlled
Organic peroxide type D, liquid
Organic peroxide type D, liquid, temperature controlled
Organic peroxide type D, solid
Organic peroxide type D, solid temperature controlled
Organic peroxide type E, liquid
Organic peroxide type E, liquid, temperature controlled
Organic peroxide type E, solid
Organic peroxide type E, solid, temperature controlled
Organic peroxide type F, liquid
Organic peroxide type F, liquid, temperature controlled
Organic peroxide type F, solid
Organic peroxide type F, solid, temperature controlled

PART 173—SHIPPERS—GENERAL REQUIREMENTS FOR SHIPMENTS AND PACKAGINGS

10. The authority citation for part 173 would be revised to read as follows:

Authority 49 App. U.S.C. 1802, 1803, 1804, 1808; 49 CFR part 1, unless otherwise noted.

11. Section 173.21 as proposed at 52 FR 42952 on November 6, 1987, is amended by revising paragraphs (f)(1) and (f)(2) and adding a new paragraph (j) to read as follows:

§ 173.21 Forbidden materials and packages

* * * * *

(f) * * *

(1) For organic peroxides, Division 5.2, the decomposition temperature of 130° (54.4°C) does not apply if the controlled temperature requirements specified in § 173.223 are applied to determine when refrigeration is required, and refrigeration is approved as required by paragraph (f)(3) of this section.

(2) The determination of whether a material is forbidden under this section may be made using the USA Self-accelerating Decomposition Temperature (SADT) Test, Test 1 in Part II of the UN Recommendations on the Transport of Dangerous Goods, Tests and Criteria, First Edition (1986).

* * * * *

(j) An organic peroxide of the "ketone peroxide" category which contains more than 9 percent available oxygen as caculated using the equation in § 173.128 (a)(4)(ii). The category, ketone peroxide, includes, but is not limited to:

Acetyl acetone peroxide
Cyclohexanone peroxide(s)
Diacetone alcohol peroxides
Methylcyclohexanone peroxide(s)
Methyl ethyl ketone peroxide(s)
Methyl isobutyl ketone peroxide(s)

12. Section 173.124, as proposed at 52 FR 42960 on November 6, 1987, is revised to read as follows:

§ 173.124 Class 4, Divisions 4.1, 4.2 and 4.3—Definitions.

(a) *Division 4.1 (Flammable Solid).* For the purpose of this subchapter, "flammable solid" (Division 4.1) means any of the following three types of materials:

(1) Wetted explosives that—

(i) When dry are Explosives of Class 1 other than those of compatibility group A, which are wetted with sufficient water, alcohol, or plasticizer to suppress explosive properties; and

(ii) Are specifically authorized by name either in the § 172.101 Table of this subchapter or have been assigned a shipping name and hazard class by the Director, OHMT, under the provisions of—

(A) An exemption issued under subchapter B of this chapter; or

(B) An approval issued under § 173.86(i).

(2) Self-reactive materials, that is, materials that are liable to undergo, at normal or elevated temperatures, a strongly exothermal decomposition caused by excessively high transport temperatures or by contamination; and

(3) Readily combustible solids, that is, materials that—

(i) Can be easily ignited by brief contact with an ignition source;

(ii) Are solids which may cause a fire through friction, such as matches;

(iii) Show a burning rate faster than 2.2 millimeters per second when tested in accordance with paragraph 2.3 of Appendix E to this part.

(iv) Any metal powders that can be ignited and react over the whole length of a sample in 10 minutes or less, when tested in accordance with paragraph 2.3 of appendix E to this part.

(b) *Division 4.2 (Spontaneously Combustible Material).* For the purposes of this subchapter, "spontaneously combustible material" (Division 4.2) means—

(1) A pyrophoric material. A pyrophoric material is a liquid or a solid that, even in small quantities and without an external ignition source, can ignite within five (5) minutes after coming in contact with air when tested according to paragraph 3.1.1 or 3.1.2, as appropriate, of appendix E to this part.

(2) A self-heating material. A self-heating material is a material that, when in contact with air and without an energy supply, is liable to self-heat. A material of this type which exhibits spontaneous ignition or if the temperature of the sample exceeds 200° C during the 24 hour test period when tested in accordance with paragraph 3.2.1 of appendix E to this part, is classed as a Division 4.2 material.

(c) *Division 4.3 (Dangerous when wet material).* For the purposes of this chapter, "dangerous when wet material" (Division 4.3) means a material that, by contact with water, is liable to become spontaneously flammable, or to give off flammable or toxic gas at a rate greater than 1 liter per kilogram of the material, per hour, when tested in accordance with paragraph 4 of appendix E to this part.

13. Section 173.125, as proposed at 52 FR 42961 on November 6, 1987, is revised to read as follows:

§ 173.125 Class 4—Assignment of packing group.

(a) The packing group of a Class 4 material is as assigned in column 5 of the § 172.101 table of this subchapter. When the § 172.101 table of this subchapter indicates that the packing group of a hazardous material is to be determined on the basis of test results following test methods given in appendix E, the packing group shall be determined by applying the appropriate criteria given in this section.

(b) Packing group criteria for readily combustible materials of Division 4.1 is as follows:

(1) For materials other than metal powders, a material is assigned to—

(i) Packing Group II, if the burning rate is greater than 2.2 mm/s and the flame passes the wetted zone; or

(ii) Packing Group III, if the burning rate is greater than 2.2 mm/s and the wetted zone stops the flame.

(2) For metal powders, a material is assigned to—

(i) Packing Group II, if the zone of reaction spreads over the whole length of the sample in 5 minutes or less; or

(ii) Packing Group III, if the zone of reaction spreads over the whole length of the sample in more than 5 but not more than 10 minutes.

(3) Solids which may cause a fire through friction are assigned to packing groups by analogy with existing entries in the § 172.101 table of this subchapter.

(c) Packing group criteria for Division 4.2 materials is as follows:

(1) Pyrophoric liquids and solids of Division 4.2 are assigned to Packing Group I.

(2) A self-heating material is assigned to—

(i) Packing Group II, if the material gives positive test result when tested with the 2.5-cm cube size sample; or

(ii) Packing Group III, if the material gives a positive test result when tested with the 10-cm cube size sample but a negative test result with the 2.5-cm cube size sample.

(d) A Division 4.3 dangerous when wet material is assigned to—

(1) Packing Group I, if spontaneous ignition occurs, or the material demonstrates a tendency of spontaneous ignition, or the rate of evolution of flammable gases is equal to or greater than 10 liters per kilogram of material over any one minute; or

(2) Packing Group II, if the rate evolution of flammable gases is equal to or greater than 20 liters per kilograms of material per hour, and which does not meet the criteria for Packing Group I; or

(3) Packing Group III, if the rate of evolution of flammable gases is greater than 1 liter per kilogram of material per hour, and which does not meet the criteria for Packing Group I or II.

14. Subpart D, as proposed at 52 FR 42958 on November 6, 1987, would be amended by revising § 173.127 to read as follows:

§ 173.127 Class 5, Division 5.1—Definition and Assignment of Packing Groups.

(a) *Definition.* For the purpose of this subchapter, "oxidizer" (Division 5.1) means a material that may, generally by yielding oxygen, cause or enhance the combustion of other materials. A solid material is classed as a Division 5.1. material if, when tested in accordance with Appendix F of this part, in either concentration tested, the mean burning time of the test mixture, is equal to or less than that of the average of the three tests with ammonium persulfate mixture. A liquid is classed as a Division 5.1 material by analogy of existing entries in the § 172.101 Table of this subchapter.

(b) *Assignment of packing groups.* (1) The packing group of a Division 5.1 material shall be as assigned in column 5 of the § 172.101 table of this subchapter.

(2) When the § 172.101 Table of this subchapter indicates that the packing group of a solid oxidizer is to be determined on the basis of the test results following test method given in appendix F of this part, the packing group shall be assigned by the following criteria.

(i) Packing Group I, for a material which, in either concentration tested, exhibits a burning time equal to or less than that of potassium bromate;

(ii) Packing Group II, for a material which, in either concentration tested, exhibits a burning time between that of potassium bromate and that of potassium perchlorate; or

(iii) Packing Group III, for a material which, in either concentration tested, exhibits a burning time between that of potassium perchlorate and that of ammonium persulphate.

(3) Liquid oxidizers are assigned to packing groups by analogy with existing entries in the § 172.101 Table.

15. Section 173.128, as proposed at 52 FR 42961 on November 6, 1987, is revised to read as follows:

§ 173.128 Class 5, Division 5.2—Definitions and Types.

(a) *Definitions.* For the purposes of this subchapter, "organic peroxide" (Division 5.2) means any organic compound containing oxygen (O) in the bivalent —O—O— structure and which may be considered a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals, unless any of the following paragraphs apply:

(1) The material meets the definition of an explosive as prescribed in subpart C of this part, in which case it must be classed as an explosive;

(2) The material is forbidden from being offered for transportation according to § 172.101 of this subchapter or § 173.21;

(3) The Director, OHMT, has determined that the material does not present a hazard which is associated with a Division 5.2 material; or

(4) The material meets one of the following conditions:

(i) For materials containing no more than 1.0% hydrogen peroxide, the available oxygen, as calculated using the equation in paragraph (a)(4)(ii) of this section, is not more than 1.0%, or

(ii) For materials containing more than 1.0% but not more than 7.0% hydrogen peroxide, the available oxygen, content (O_a) is not more than 0.5%, when determined using the equation:

$$O_a = 16 \times \sum_{i=1}^{k} \frac{n_i c_i}{m_i}$$

where, for a material containing *k* species of organic peroxides:

n_i = number of −O−O− groups per molecule of the *i*th species

c_i = concentration (mass %) of the *i*th species

m_i = molecular mass of the *i*th species

(b) *Generic types.* Division 5.2 organic peroxides are assigned to a generic system which consists of seven types. An organic peroxide identified by technical name in the Organic Peroxides Table in § 173.225 is assigned to a generic type in accordance with that Table. Organic peroxides not identified in the Organic Peroxides Table are assigned to generic types under the procedures of paragraph (c) of this section.

(1) *Type A.* Organic peroxide type A is an organic peroxide which can detonate or deflagrate rapidly as packaged for transport. Transportation of type A organic peroxides is forbidden.

(2) *Type B.* Organic peroxide type B is an organic peroxide which, as packaged for transport, neither detonates nor deflagrates rapidly, but can undergo a thermal explosion.

(3) *Type C.* Organic peroxide type C is an organic peroxide which, as packaged for transport, neither detonates nor deflagrates rapidly and cannot undergo a thermal explosion.

(4) *Type D.* Organic peroxide type D is an organic peroxide which—

(i) Detonates only partially, but does not deflagrate rapidly and is not affected by heat when confined;

(ii) Does not detonate, deflagrates slowly, and shows no violent effect if heated when confined; or

(iii) Does not detonate or deflagrate, and shows a medium effect when heated under confinement.

(5) *Type E.* Organic peroxide type E is an organic peroxide which neither detonates nor deflagrates and shows low, or no, effect when heated under confinement.

(6) *Type F.* Organic peroxide type F is an organic peroxide which will not detonate in a cavitated state, does not deflagrate, shows only a low, or no, effect if heated when confined, and has low, or no, explosive power.

(7) *Type G.* Organic peroxide type G is an organic peroxide which will not detonate in a cavitated state, will not deflagrate, shows no effect when heated under confinement, has no explosive power, is thermally stable (self-accelerating decomposition temperature above 60 °C), and, for desensitized liquid formulations, is desensitized with a compatible organic liquid which boils above 150 °C (diluent type A, see § 173.225(b)).

(c) *Procedure for assigning an organic peroxide to a generic type.* An organic peroxide shall be assigned to a generic type based on—

(1) Its physical state (*i.e.*, liquid or solid), in accordance with the definitions for liquid and solid in § 171.8 of this subchapter;

(2) A determination as to its control temperature and emergency temperature, if any, under the provisions of § 173.223;

(3) Performance of the organic peroxide under the test procedures specified in the United Nations Recommendations on the Transport of Dangerous Goods, Tests and Criteria, Part III, Addendum 1, and the provisions of paragraph (d) of this section; and

(4) Except for an organic peroxide which is identified by technical name in the Organic Peroxides Table in § 173.225(b) or an organic peroxide which may be shipped as a sample under the provisions of § 173.225(c), the organic peroxide is approved, in writing, by the Director, OHMT, including assignment of a generic type and shipping description. The person requesting approval shall submit all relevant data concerning physical state, temperature controls, and test results to the Director, OHMT.

(d) *Tests.* The generic type for an organic peroxide shall be determined using the testing protocol from Figure 1.1 (Classification and Flow Chart Scheme for Organic Peroxides) from the UN Recommendations, Tests and Criteria, part III, using only the following tests:

(1) Test series A: Gap Test for Organic Peroxides (Test method A.3);

(2) Test series B: Detonation Test in Package (Test method B.1);

(3) Test series C: Time/Pressure Test (Test method C.1) and Deflagration Test (Test method C.2);

(4) Test series D: Deflagration Test in Package (Test method D.1);

(5) Test series E: Dutch Pressure Vessel Test (Test method E.2) and United States Pressure Vessel Test (Test method E.3);

(6) Test series F: Modified Trauzl Test for Organic Peroxides (Test method F.4); and

(7) Test series G: Organic Peroxide Package Test (Test method G.2).

16. Section 173.129, as proposed at 52 FR 42961 on November 6, 1987, is revised to read as follows:

§ 173.129 Class 5, Division 5.2—Assignment of packing group.

All Division 5.2 materials are assigned to Packing Group II in Column 5 of the § 172.101 table.

§ 173.152 [Amended]

17. In § 173.152, as proposed at 52 FR 42965 on November 6, 1987, the phrase "in Packing Groups II and III" is removed from the introductory text of paragraph (b) and paragraph (b)(3).

18. Subpart E, as proposed at 52 FR 42958 on November 6, 1987, would be amended by revising § 173.223 to read as follows:

§ 173.223 Determination of temperature control for Divisions 4.1 and 5.2.

(a) For a self-reactive material not identified by technical name in § 173.224, an organic peroxide not identified by technical name in § 173.225, or a new formulation of one or more organic peroxides identified by technical name in § 173.225, that is required to be shipped under controlled temperature conditions, the control temperatue and emergency temperature for a package shall be as specified in the table in this paragraph, based upon the material's self-accelerating decomposition temperature (SADT). The SADT of a material shall be determined using the USA SADT Test in the UN Recommendations for the Transport of Dangerous Goods, Tests and Criteria, First Edition (1986), (see § 171.7 of this subchapter). The control temperature is the temperature above which a package of the material may not be offered for transportation or transported. The emergency temperature is the temperature at which, due to imminent danger, emergency measures must be initiated.

§ 173.223 TABLE: METHOD OF DETERMINING CONGROL AND EMERGENCY TEMPERATURE

SADT [1]	Control temperatures	Emergency temperature
SADT ≤ 20 °C (68 °F).	20 °C (36 °F) below SADT.	10 °C (18 °F) below SADT.
20 °C (68 °F) < SADT ≤ 35 °C (95 °F).	15 °C (27 °F) below SADT.	10 °C (18 °F) below SADT.

§ 173.223 TABLE: METHOD OF DETERMINING CONGROL AND EMERGENCY TEMPERATURE—Continued

SADT [1]	Control temperatures	Emergency temperature
35 °C (95 °F) < SADT < 50 °C (122 °F).	10 °C (18 °F) below SADT.	5 °C (9 °F) below SADT.
50 °C (122 °F) < SADT.	temperature control not required.	

[1] Self-accelerating decomposition temperature.

(b) For a self-reactive material identified by technical name in § 173.224, the control temperature and emergency temperature are as specified in § 173.224.

(c) For an organic peroxide identified by technical name in § 173.225, the control temperature and emergency temperature are as specified in § 173.225.

19. Subpart E, as proposed at 52 FR 42958 on November 6, 1987, would be amended by revising § 173.224 to read as follows:

§ 173.224 Packaging and control and emergency temperatures for self-reactive materials.

(a) When the § 172.101 table of this subchapter specifies that a Division 4.1 material be packaged in accordance with this section, only non-bulk packagings which conform to the provisions of this section may be used. Each packaging must conform to the general packaging requirements of subpart B, part 173, and to the requirements of part 178 of this subchapter at the Packing Group II performance level. Packing Group I and Packing Group III non-bulk packagings are not authorized. Self-reactive materials which require temperature control are subject to the provisions of § 173.21(f).

(b) *Self-reactive materials table.* The self-reactive materials table specifies, by identification (ID) number the packing method that must be used, the control temperature, and the emergency temperature, as follows:

(1) *ID numbers.* The first column of the table gives the identification numbers for self-reactive materials as assigned in column 4 of the § 172.101 table of this subchapter.

(2) *Packing methods.* The second column of the table designates the packing method or methods that are authorized to package the self-reactive material. The table of packing methods in paragraph (c) of this section defines the packing methods.

(3) *Temperatures.* Column 3a specifies the control temperature. Column 3b specifies the emergency temperature. The letters "NR" means that temperature controls are not required.

§ 173.224(b) TABLE—SELF-REACTIVE MATERIALS TABLES

ID number (1)	Proper shipping name (2)	Packing methods (3)	Temperature, °C (°F)	
			Control (4a)	Emergency (4b)
UN2951	Diphenyloxide-4, 4' disulfohydrazide	F1, F5a	NR	NR
UN2952	Azodiisobutyronitrile	F1, F2, F3, F5a	40 (104)	45 (113)
UN2953	2, 2' -Azodi-(2, 4 dimethylvalero-nitrile)	F1, F2, F3, F5a	10 (50)	15 (59)
UN2954	1, 1' -Azodi-(hexahydrobenzo-nitrile)	F1, F2, F3, F5a	NR	NR
UN2955	2, 2' -Azodi-(2, 4-dimethyl-4-methoxy valeronitrile)	F1, F2, F3, F5a	−5 (23)	5(41)
UN2970	Benzene sulfohydrazide	F1, F2, F3, F5a	NR	NR
UN2971	Benzene-1, 3-disulfohydrazide, [not more than 52 per cent as a paste]	F1, F2, F3, F5a	NR	NR
UN2972	N,N' -Dinitrosopentamethylenetetramine [not more than 82% with phlegmatizer]	F1, F2, F3, F5a	NR	NR
UN2973	N,N' -Dinitroso-N,N' -dimethyl terephthalamide [not more than 72% as a paste]	F1, F5a	NR	NR
UN3030	2, 2' -Azodi (2-methyl-butyro-nitrile)	F5b	40 (104)	45 (113)
UN3033	3-Chloro-4-diethylaminobenzene diazonium zinc chloride	F1, F6	NR	NR
UN3034	4-Dipropylaminobenzenediazonium zinc chloride	F1, F6	NR	NR
UN3035	3-(2-Hydroxyethoxy)-4-pyrrolidin-1-yl-benzenediazonium zinc chloride	F1, F6	40 (104)	45 (113)
UN3036	2, 5-Diethoxy-4-morpholinobenzene-diazonium zinc chloride	F1, F6	35 (95)	40(104)
UN3037	4-(Benzyl (ethyl) amino)-3-ethoxy-benzenediazonium zinc chloride	F1, F6	40 (104)	45 (113)
UN3038	4-(benzyl (methyl) amino) 3-ethoxy benzenediazonium zinc chloride	F1, F6	40 (104)	45 (113)
UN3039	4-Dimethylamino-6-(2-dimethyl) aminoethoxy) toluene-2-diazonium zinc chloride	F1, F6	40 (104)	45 (113)
UN3040	Sodium 2-diazo-1-naphthol-4-sulphonate	F1, F6	NR	NR
UN3041	Sodium 2-diazo-1-naphthol-5-sulphonate	F1, F6	NR	NR
UN3042	2-Diazo-1-naphthol-4-sulphochloride	F1	NR	NR
UN3043	2-Diazo-1-naphthol-5-sulphochloride	F1	NR	NR

(c) *Table of packing methods for self-reactive materials.* The table of packing methods for self-reactive materials specifies, by packing method, packaging quantity limits and the types of packagings that are authorized, as follows:

(1) *Packing method.* The first column of the table provides the packing method (*e.g.*, F1).

(2) *Quantity limitations.* Column 2a specifies the maximum net mass per inner packaging, in kilograms and pounds, where inner packagings are required. If column 2a is blank, inner packagings are not required. Column 2b specifies the maximum net mass per outer packaging, in kilograms and pounds.

(3) *Description of packaging.* Column 3a specifies the type of inner packaging that must be used. If column 3a is blank, inner packagings are not required. Column 3b specifies the outer packaging that must be used.

§ 173.224(c) TABLE—PACKING METHODS FOR SELF-REACTIVE MATERIALS

Packing method (1)	Contents (2)		Description of packaging (3)	
	Maximum of inner packaging (2a)	Maximum of whole packaging (2b)	Inner packaging	Outer packaging
F1		110 lb (50 kg)		Fiber drum 1G, with plastic liner or internal coating.

§ 173.224(c) TABLE—PACKING METHODS FOR SELF-REACTIVE MATERIALS—Continued

Packing method (1)	Contents (2)		Description of packaging (3)	
	Maximum of inner packaging (2a)	Maximum of whole packaging (2b)	Inner packaging	Outer packaging
F2	110 lb (50 kg)	110 lb (50 kg)	Plastic bag, packed singly	Fiberboard box 4G.
F3	11 lb (5 kg)	88 lb (40 kg)	Plastic boxes, plastic bottles or jars	Fiberboard box 4G.
F4	11 lb (5 kg)	55 lb (25 kg)	Plastic bottles or jars, plastic bags, plastic boxes.	Fiber drum 1G, fiberboard box 4G.
F5a		110 lb (55 kg)		Fiber drum, sift proof 1G.
F5b		55 lb (25 kg)		
F6	121 lb (55 kg)	121 lb (55 kg)	Plastic bags	Steel drum, removable head 1A2, aluminum drum, removable head 1B2.

20. Section 173.225, as proposed at 52 FR 42977 on November 6, 1987, is revised to read as follows:

§ 173.225 Packaging requirements and other provisions for organic peroxides.

(a) *General.* When the § 172.101 Table of this subchapter specifies that an organic peroxide be packaged under this section, the organic peroxide must be packaged and offered for transportation in accordance with the provisions of this section. Each packaging must conform to the general requirements of subpart B of part 173 and to the applicable requirements of part 178. Non-bulk packagings must meet Packing Group II performance levels. Packing Group I and Packing Group III non-bulk packagings are not authorized. Organic peroxides which require temperature control are subject to the provisions of § 173.21(f).

(b) *Organic peroxides table.* (1) The following Organic Peroxides Table specifies, by technical name, those organic peroxides that are authorized for transportation and not subject to the approval provisions of § 173.128 of this part. An organic peroxide identified by technical name in the following table is authorized for transportation only if it conforms to all applicable provisions of the table. For an organic peroxide not identified in the table by technical name or a formulation of an identified organic peroxide, the provisions of paragraph (c) of § 173.128 apply. The column headings of the Organic Peroxides Table are as follows:

(1) *Technical name.* The first column specifies the technical name.

(2) *ID number.* The second column specifies the identification (ID) number which is used to identify the proper shipping name in the § 172.101 Table of this subchapter.

(3) *Concentration of organic peroxide.* The third column specifies concentration (mass percent) limitations, if any, in mixtures or solutions for the organic peroxide. Limitations are given as minimums, maximums, or a range, as appropriate. A range includes the lower and upper limits (*i.e.*, "53–100" means from, and including, 53 percent to, and including 100 percent).

(4) *Concentration of stabilizers.* The fourth column specifies the type and concentration (mass percent) of diluent or inert solid, when required. Other types and concentrations of diluents may be authorized if approved by the Director, OHMT.

(i) The required mass percent of "Diluent type A" is specified in column 4a. A diluent type A is an organic liquid that does not detrimentally affect the thermal stability or increase the hazard of the organic peroxide and with a boiling point not less than 150 °C at atmospheric pressure. Type A diluents may be used for desensitizing all organic peroxides.

(ii) The required mass percent of "Diluent type B" is specified in column 4b. A diluent type B is an organic liquid that does not detrimentally affect the thermal stability or increase the hazard of the organic peroxide and which has a boiling point, at atmospheric pressure, of less than 150 °C but at least 60 °C, and a flash point greater than 5 °C. A type B diluent may only be used for the desensitization of an organic peroxide for which it is specified in the table. The boiling point of a type B diluent must be at least 50 °C above the control temperature of the organic peroxide. A Type A diluent may be used to replace a Type B diluent in equal concentration.

(iii) The required mass percent of "Inert solid" is specified in column 4c. An inert solid is a solid that does not detrimentally affect the thermal stability or increase the hazard of the organic peroxide.

(5) *Concentration of water.* Column 5 specifies, in mass percent, the minimum amount of water, if any, which must be in solution with the organic peroxide.

(6) *Packing method.* Column 6 specifies the highest packing method (largest packaging capacity) which is authorized for the organic peroxide. Lower numbered packing methods (smaller packaging capacities) are also authorized. For example, if OP3A is specified, then OP2A and OP1A are also authorized. The Table of Packing Methods in paragraph (d) of this section defines the packing methods.

(7) *Temperatures.* Column 7a specifies the control temperature. Column 7b specifies the emergency temperature. Temperatures are specified only when temperature controls are required. (See § 173.223.)

(8) *Notes.* Column 8 specifies other applicable provisions, as set forth in notes following the table.

ORGANIC PEROXIDES TABLE

Technical Name	ID Number	Concentration	Stabilizer (%)			Water	Packing Method	Temperature(°C)		Notes
			A	B	I			Control	Emergency	
(1)	(2)	(3)	(4a)	(4b)	(4c)	(5)	(6)	(7a)	(7b)	(8)
Acetyl acetone peroxide	UN3105	≦42	≧48			≧8	OP7A			2
Acetyl acetone peroxide	UN3106	≦32					OP7B			21
Acetyl benzoyl peroxide	UN3105	≦45	≧55				OP7A			
Acetyl cyclohexanesulfonyl peroxide	UN3112	≦82				≧12	OP4B	−10	0	
Acetyl cyclohexanesulfonyl peroxide	UN3115	≦32		≧68			OP7A	−10	0	
tert-Amyl hydroperoxide	UN3107	≦88	≧6			≧6	OP8A			
tert-Amyl peroxybenzoate	UN3105	≦96	≧4				OP7A			
tert-Amyl peroxy-2-ethylhexanoate	UN3115	≦100					OP7A	20	25	

ORGANIC PEROXIDES TABLE—Continued

Technical Name	ID Number	Concentration	Stabilizer (%)			Water	Packing Method	Temperature(°C)		Notes
			A	B	I			Control	Emergency	
(1)	(2)	(3)	(4a)	(4b)	(4c)	(5)	(6)	(7a)	(7b)	(8)
tert-Amyl peroxyneodecanoate	UN3115	≦77		≧23			OP7A	0	10	
tert-Amyl peroxypivalate	UN3113	≦77		≧23			OP5A	10	15	
tert-Amylperoxy-3,5,5-trimethylhexanoate	UN3101	≦100					OP5A			
tert-Butyl cumyl peroxide	UN3105	≦100					OP7A			
n-Butyl-4,4-di-(tertbutylperoxy)-valerate	UN3103	<52, ≦100					OP5A			
n-Butyl-4,4-di-(tertbutylperoxy)-valerate	UN3106	≦52			≧48		OP7A			
tert-Butyl hydroperoxide	UN3103	73-90				≧10	OP5A			
tert-Butyl hydroperoxide	UN3105	≦80	≧20				OP7A			4
tert-Butyl hydroperoxide	UN3109	≦72				≧28	OP8A			14
tert-Butyl hydroperoxide *and*	UN3103	≦82				≧7	OP5A			
di-tert-Butyl peroxide		≧9								
tert-Butyl monoperoxymaleate	UN3102	<52, ≦100					OP5B			
tert-Butyl monoperoxymaleate	UN3103	≦52	≧48				OP6A			
tert-Butyl monoperoxymaleate *as a paste*	UN3108	≦42					OP8B			21
tert-Butyl monoperoxyphthate	UN3102	≦100					OP5B			
tert-Butyl peroxyacetate	UN3101	<52, ≦77	≧23				OP5A			
tert-Butyl peroxyacetate	UN3101	≦52	≧48				OP6A			
tert-Butyl peroxybenzoate	UN3103	78-100	≦22				OP5A			
tert-Butyl peroxybenzoate	UN3105	<52, ≦77	≧23				OP7A			
tert-Butyl peroxybenzoate	UN3106	≦52			≧48		OP7B			
tert-Butyl peroxycrotonate	UN3105	≦77	≧23				OP7A			
tert-Butyl peroxydiethylacetate	UN3113	≦100					OP5A	20	25	
tert-Butyl peroxydiethylacetate *and*	UN3105	≦33	≧33				OP7A			
tert-Butyl peroxybenzoate		≦33								
tert-Butyl peroxy-2-ethylhexanoate	UN3113	53-100					OP6A	20	25	
tert-Butyl peroxy-2-ethylhexanoate *and*	UN3115	≦31		≧33			OP7A	35	40	
2,2-Di-(tert-butylperoxy)butane		≦36								
tert-Butyl peroxy-2-ethylhexanoate *and*	UN3106	≦12	≧14			≧60	OP7A			
2,2-Di-(tert-butylperoxy)butane		≦14								
tert-Butyl peroxyisobutyrate	UN3111	<52, ≦77		≧23			OP5A	15	20	
tert-Butyl peroxyisobutyrate	UN3115	≦52		≧48			OP7A	15	20	
tert-Butylperoxy isopropyl carbonate	UN3103	≦77	≧23				OP5A			
tert-Butyl peroxyneodecanoate	UN3115	<77, ≦100					OP7A	−5	5	
tert-Butyl peroxyneodecanoate	UN3115	≦77		≧23			OP7A	0	10	
3-tert-Butylperoxy-3-phenylphthalide	UN3106	≦100					OP7A			
tert-Butyl peroxypivalate	UN3113	<67, ≦77	≦23				OP5A	0	10	
tert-Butyl peroxypivalate	UN3115	≦67		≧33			OP7A	0	10	
tert-Butylperoxy stearylcarbonate	UN3106	≦100					OP7B			
tert-Butyl peroxy-3,5,5-trimethylhexanoate	UN3105	≦100					OP7A			
3-Chloroperoxybenzoic acid	UN3102	<57, ≦86				≧14	OP1B			
3-Chloroperoxybenzoic acid	UN3106	≦57			≧3	≧40	OP7B			
Cumyl hydroperoxide	UN3109	≦90	≧10				OP8A			14, 9
Cumyl peroxyneodecanoate	UN3115	≦77		≧23			OP7A	−10	0	
Cumyl peroxypivalate	UN3115	≦77		≧23			OP7A	−5	5	
Cyclohexanone peroxide(s)	UN3104	≦91				≧9	OP6B			
Cyclohexanone peroxide(s) *as a paste*	UN3106	≦72					OP7B			5, 21
Cyclohexanone peroxide(s)	UN3105	≦72	≧28				OP7A			5
Cyclohexanone peroxide(s)	Exempt	≦32			≧68					
Diacetone alcohol peroxides	UN3115	≦57		≧26		≧8	OP7A	30	35	7
Diacetyl peroxide	UN3115	≦27		≧73			OP7A	20	25	8,4
Di-tert-amyl peroxide	UN3107	≦100					OP8A			
Dibenzoyleroxide	Exempt	≦35			≧65					
Dibenzoyl peroxide	UN3102	52-100			≦48		OP2B			
Dibenzoyl peroxide	UN3102	78-94				≧6	OP4B			
Dibenzoyl peroxide	UN3104	≦77				≧23	OP6B			
Dibenzoyl peroxide	UN3106	≦62			≧28	≧10	OP7B			
Dibenzoyl peroxide *as a paste*	UN3106	<52, ≦62					OP7B			21
Dibenzoyl peroxide *as a paste*	UN3108	≦52					OP8B			21
Dibenzoyl peroxide	UN3106	36-52			≧48		OP7B			
Dibenzyl peroxydicarbonate	UN3112	≦87				≧13	OP5B	25	30	
Di-(4-tert-butylcyclohexyl) peroxydicarbonate	UN3114	≦100					OP6B	30	35	
Di-(4-tert-butylcyclohexyl) peroxydicarbonate *as a stable dispersion in water.*	UN3119	≦42					OP8A	30	35	
Di-tert-butyl peroxide	UN3107	≦100					OP8A			
2,2-Di-(tert-butylperoxy)butane	UN3103	≦52	≧48				OP6A			
1,1-Di-(tert-butylperoxy)cyclohexane	UN3101	81-100					OP5A			
1,1-Di-(tert-butylperoxy)cyclohexane	UN3103	<52, ≦80	≧20				OP5A			
1,1-Di-(tert-butylperoxy)cyclohexane	UN3105	≦52	≧48				OP7A			

ORGANIC PEROXIDES TABLE—Continued

Technical Name	ID Number	Concentration	Stabilizer (%)			Water	Packing Method	Temperature(°C)		Notes
			A	B	I			Control	Emergency	
(1)	(2)	(3)	(4a)	(4b)	(4c)	(5)	(6)	(7a)	(7b)	(8)
1,1-Di-(tert-butylperoxy)cyclohexane	UN3106	≦42	≧13		≧45		OP7B			
1,1-Di-(tert-butylperoxy)cyclohexane	UN3107	≦27	≧36	≧36			OP8A			
2,2-Di-(4,4-tert-butylperoxycyclo-hexyl)propane	UN3106	≦42			≧58		OP7B			
Di-n-butyl peroxydicarbonate	UN3115	<27, ≦52		≧48			OP7A	−15	−5	
Di-n-butyl peroxydicarbonate	UN3117	≦27		≧73			OP8A	−10	0	
Di-sec-butyl peroxydicarbonate	UN3113	<52, ≦100					OP4A	−20	−10	
Di-sec-butyl peroxydicarbonate	UN3115	≦52		≧48			OP7A	−15	−5	
Di-(2-tert-butylperoxyisopropyl)-benzene(s)	UN3106	43–100			≦57		OP7B			
Di-(2-tert-butylperoxyisopropyl)-benzene(s)	Exempt	≦42			≧58					
Di-(tert-butylperoxy)phthalate	UN3105	<42, ≦52	≧48				OP7A			
Di-(tert-butylperoxy)phthalate *as a paste*	UN3106	≦52					OP7B			21
Di-(tert-butylperoxy)phthalate	UN3107	≦42	≧58				OP8A			
2,2-Di-(tert-butylperoxy)propane	UN3105	≦52	≧48				OP7A			
2,2-Di-(tert-butylperoxy)propane	UN3106	≦42	≧13		≧45		OP7B			
1,1-Di-(tert-butylperoxy)-3,3,5-trimethyl cyclohexane.	UN3101	<57, ≦100					OP5A			
1,1-Di-(tert-butylperoxy)-3,3,5-trimethyl cyclohexane.	UN3106	≦57			≧43		OP7B			
1,1-Di-(tert-butylperoxy)-3,3,5-trimethyl cyclohexane.	UN3107	≦57	≧43				OP8A			
Dicetyl peroxydicarbonate	UN3116	≦100					OP7B	20	25	
Dicetyl peroxydicarbonate *as a stable dispersion in water.*	UN3119	≦42					OP8A	30	35	
Di-4-chlorobenzoyl peroxide	UN3102	≦77				≧23	OP5B			
Di-4-chlorobenzoyl peroxide *as a paste*	UN3106	≦52					OP7B			21
Di-4-chlorobenzoyl peroxide	Exempt	≦32			≧68					
Dicumyl peroxide	UN3110	<42, ≦100			≦57		OP8B			13
Dicumyl peroxide	Exempt	≦42			≧58					
Dicyclohexyl peroxydicarbonate	UN3112	<91, ≦100					OP5B	5	10	
Dicyclohexyl peroxydicarbonate	UN3114	≦91				≧9	OP3B	5	10	
Didecanoyl peroxide	UN3102	≦100					OP6B	15	20	
Di-2,4-dichlorobenzoyl peroxide	UN3102	≦77				≧23	OP5B			
Di-2,4-dichlorobenzoyl peroxide *as a paste with silicon oil.*	UN3106	≦52					OP7B			
Di-(2-ethylhexyl) peroxydicarbonate	UN3113	<77, ≦100					OP5A	−20	−10	
Di-(2-ethylhexyl) peroxydicarbonate	UN3115	≦77					OP7A	−15	−5	
Di-(2-ethylhexyl) peroxydicarbonate *as a stable dispersion in water.*	UN3117	≦42					OP8A	−15	−5	
Di-(2-ethylhexyl) peroxydicarbonate *as a stable dispersion in water (frozen).*	UN3117	≦42					OP8B	−15	−5	
Diethyl peroxydicarbonate	UN3115	≦27		≧73			OP7A	−10	0	
2,2-Dihydroperoxypropane	UN3102	≦27			≧73		OP5B			
Di-(1-hydroxycyclohexyl) peroxide	UN3106	≦100					OP7B			
Diisobutyryl peroxide	UN3111	<32, ≦52		≧48			OP5A	−20	−10	
Diisobutyryl peroxide	UN3115	≦32		≧68			OP7A	−20	−10	
Diisopropyl peroxydicarbonate	UN3112	<52, ≦100					OP2B	−15	−53	
Diisopropyl peroxydicarbonate	UN3115	≦52		≧48			OP7A	−10	0	
Diisotridecyl peroxydicarbonate	UN3115	≦100					OP7A	−10	0	
Dilauroyl peroxide	UN3106	≦100					OP7B			
Dilauroyl peroxide *as a stable dispersion in water.*	UN3109	≦42					OP8A			
Di-(2-methylbenzoyl) peroxide	UN3112	≦87				≧13	OP5B	30	35	
2,5-Dimethyl-2,5-di-(benzoyl-peroxy) hexane	UN3102	<82, ≦100					OP5B			
2,5-Dimethyl-2,5-di-(benzoyl-peroxy) hexane	UN3106	≦82			≧18		OP7B			
2,5-Dimethyl-2,5-di-(benzoyl-peroxy) hexane	UN3104	≦82				≧18	OP5B			
2,5-Dimethyl-2,5-di-(tert-butyl-peroxy)hexane	UN3105	<52, ≦100					OP7A			
2,5-Dimethyl-2,5-di-(tert-butyl-peroxy)hexane	UN3106	≦52			≧48		OP7B			
2,5-Dimethyl-2,5-di-(tert-butyl-peroxy)hexyne-3	UN3103	<52, ≦100					OP5A			
2,5-Dimethyl-2,5-di-(tert-butyl-peroxy)hexyne-3	UN3106	≦52			≧48		OP7B			
2,5-Dimethyl-2,5-di-(2-ethylhexanoylperoxy)hexane.	UN3115	≦100					OP7A	20	25	
2,5-Dimethyl-2,5-dihydroperoxyhexane	UN3104	≦82				≧18	OP6B			
2,5-Dimethyl-2,5-di-(3,5,5-trimethylhexanoylperoxy)hexane.	UN3105	≦77	≧23				OP7A			
Dimyristyl peroxydicarbonate	UN3116	≦100					OP7B	20	25	
Dimyristyl peroxydicarbonate *as a stable dispersion in water.*	UN3119	≦42					OP8A, N	20	25	
Di-n-nonanoyl peroxide	UN3116	≦100					OP7B	0	10	
Di-n-octanoyl peroxide	UN3114	≦100					OP5B	10	15	

ORGANIC PEROXIDES TABLE—Continued

Technical Name	ID Number	Concentration	Stabilizer (%)			Water	Packing Method	Temperature(°C)		Notes
			A	B	I			Control	Emergency	
(1)	(2)	(3)	(4a)	(4b)	(4c)	(5)	(6)	(7a)	(7b)	(8)
Diperoxy azelaic acid	UN3116	≦27			≧73		OP7B	35	40	
Diperoxy dodecane diacid	UN3116	<13, ≦42			≧58		OP7B	40	45	
Diperoxy dodecane diacid	Exempt	≦13								
Di-(2 Phenoxyethyl) peroxydicarbonate	UN3102	<85, ≦100					OP5B			
Di-(2 Phenoxyethyl) peroxydicarbonate	UN3106	≦85				≧15	OP7B			
Dipropionyl peroxide	UN3117	≦27		≧73			OP8A	15	20	
Di-n-propyl peroxydicarbonate	UN3113	≦100					OP4A	−25	−15	
Distearyl peroxydicarbonate	UN3106	≦87			≧13		OP7B			
Disuccinic acid peroxide	UN3102	<72, ≦100					OP4B			
Disuccinic acid peroxide	UN3116	≦72				≧28	OP7B	10	15	18
Di-(3,5,5-trimethyl-1,2-dioxo-lanyl-3) peroxide *as a paste.*	UN3116	≦52					OP7B	30	35	21
Di-(3,5,5-trimethylhexanoyl) peroxide	UN3115	≦82	≧18				OP7A			
Ethyl-3,3-di-(tert-amylperoxy)-butyrate	UN3105	≦67	≧33				OP7A			
Ethyl-3,3-di-(tert-butylperoxy)-butyrate	UN3103	<77, ≦100					OP5A			
Ethyl-3,3-di-(tert-butylperoxy)-butyrate	UN3105	≦77	≧23				OP7A			
Ethyl-3,3-di-(tert-butylperoxy)-butyrate	UN3106	≦52			≧48		OP7B			
3,3,6,6,9,9-Hexamethyl-1,2,4,5-tetraoxacyclononane.	UN3102	<52, ≦100					OP4B			
3,3,6,6,9,9-Hexamethyl-1,2,4,5-tetraoxacyclononane.	UN3105	≦52	≧48				OP7A			
3,3,6,6,9,9-Hexamethyl-1,2,4,5-tetraoxacyclononane.	UN3106	≦52			≧48		OP7B			
Isopropylcumyl hydroperoxide	UN3109	≦72	≧28				OP8A			14
p-Menthyl hydroperoxide	UN3105	<55, ≦100					OP7A			
p-Menthyl hydroperoxide	UN3109	≦55	≧45				OP8A			14
Methylcyclohexanone peroxide(s)	UN3115	≦67		≧33			OP7A	35	40	
Methyl ethyl ketone peroxide(s)	UN3101	≦52	≧48				OP5A			9
Methyl ethyl ketone peroxide(s)	UN3105	≦45	≧55				OP7A			10
Methyl ethyl ketone peroxide(s)	UN3107	≦40	≧60				OP8A			11
Methyl isobutyl ketone peroxide(s)	UN3105	≦62	≧19	≧19			OP7A			
Peroxyacetic acid, type D, stabilized	UN3105	≦43					OP7A			20
Peroxyacetic acid, type E, stabilized	UN3107	≦43					OP8A			20
Peroxyacetic acid, type F, stabilized	UN3109	≦43					OP8A			20
Pinanyl hydroperoxide	UN3105	<55, ≦100					OP7A			
Pinanyl hydroperoxide	UN3109	≦55	≧45				OP8A			14
Tetrahydronaphthyl hydroperoxide	UN3106	≦100					OP7B			
1,1,3,3-Tetramethylbutyl hydroperoxide	UN3105	≦100					OP7A			
1,1,3,3-Tetramethylbutylperoxy-2-ethylhexanoate.	UN3115	≦100					OP7A	20	25	
2,4,4-Trimethylpentyl-2-peroxy phenoxyacetate	UN3115	≦37		≧63			OP7A	−10	0	
tert-Butyl peroxy-2-ethylhexanaote	UN3117	≦52		≧48			OP8A	20	25	
Di-(3,5,5-trimethyl-1,2-dioxolanyl-3) peroxide *as a paste.*	UN3116	≦52					OP7B	30	33	21
tert-Butyl peroxy-2-ethylhexanoate	UN3117	≦52		≧48			OP8A	20	25	

Notes:

1. [Reserved]
2. Available oxygen must be <47%.
3. [Reserved]
4. The diluent may be replaced by di-tert-butyl peroxide.
5. Available oxygen must be <9%.
6. Available oxygen must be <7.5%.
7. Hydrogen peroxide must be <9%; available oxygen must be <4.7%.
8. Only non-metallic packagings are authorized.
9. Available oxygen must be >10%.
10. Available oxygen must be <10%.
11. Available oxygen must be <8.2%.
12. Samples may only be offered for transportation when all available data indicate that the sample is no more dangerous than an Organic Peroxide type C, and the sample is packaged using packaging method OP2A for liquids or OP2B for solids, as appropriate, in quantities less than 10 kg per shipment, employing any necessary temperature controls.
13. Up to 2000 kg per receptacle assigned to Organic Peroxide type F on the basis of large scale trials.
14. This material may be transported in bulk packagings under the provisions of § 173.225(e).
15–17. [Reserved]
18. Addition of water to this organic peroxide will decrease its thermal stability.
19. [Reserved]
20. Mixtures with hydrogen peroxide, water and acid(s).
21. With diluent type A, with or without water.
22. With >3% by mass, ethylbenzene.
23. With >19%, by mass, methyl isobutyl ketone.

(c) *New organic peroxides, formulations and samples.* (1) Except as provided for samples in paragraph (c)(4) of this section, no person may offer for transportation an organic peroxide which is not identified by technical name in the Organic Peroxides Table of this section, or a formulation of one or more organic peroxides which are identified by technical name in that table, unless the organic peroxide is assigned a generic type and shipping description and is approved by the Director, OHMT, under the provisions of § 173.128(c).

(2) Except as provided under the provisions of an approval under § 173.128(c), bulk packagings are not authorized.

(3) Non-bulk packagings are authorized as specified in the Packing Method Table for Generic Types, as follows. Column 1 of the table specifies

the generic type by identification (ID) number from the § 172.101 Table of this subchapter. Column 2 of the table specifies the generic proper shipping name from the § 172.101 Table of this subchapter. Column 3 of the table specifies the series of packing methods authorized for use (*e.g.*, "OP1A–OP5A" means that packing methods OP1A, OP2A, OP3A, OP4A, and OP5A are authorized). The Table of Packing Methods in paragraph (d) of this section defines the packing methods. The Packing Method Table for Generic Types is as follows:

§ 173.225(c) TABLE—PACKING METHOD TABLE FOR GENERIC TYPES

UN No. (1)	Proper shipping name (2)	Packing method (3)
UN3101...	Organic peroxide type B, liquid.	OP1A–OP5A
UN3102...	Organic peroxide type B, solid.	OP1B–OP5B
UN3103...	Organic peroxide type C, liquid.	OP1A–OP6A
UN3104...	Organic peroxide type C, solid.	OP1B–OP6B
UN3105...	Organic peroxide type D, liquid.	OP1A–OP7A
UN3106...	Organic peroxide type D, solid.	OP1B–OP7B
UN3107...	Organic peroxide type E, liquid.	OP1A–OP8A OP1A–OP5A
	controlled.	
UN3112...	Organic peroxide type B, solid, temperature controlled.	OP1B–OP5B
UN3113...	Organic peroxide type C, liquid, temperature controlled.	OP1A–OP6A
UN3114...	Organic peroxide type C, solid, temperature controlled.	OP1B–OP6B
UN3115...	Organic peroxide type D, liquid, temperature controlled.	OP1A–OP7A
UN3116...	Organic peroxide type D, solid, temperature controlled.	OP1B–OP7B
UN3117...	Organic peroxide type E, liquid, temperature controlled.	OP1B–OP8A
UN3118...	Organic peroxide type E, solid, temperature controlled.	OP1B–OP8B
UN3119...	Organic peroxide type F, liquid, temperature controlled.	OP1B–OP8A
UN3120...	Organic peroxide type F, solid, temperature controlled.	OP1B–OP8B

(4) *Samples.* Samples of new organic peroxides or new formulations of organic peroxides identified in the Organic Peroxides Table in paragraph (b) of this section, for which complete test data are not available, and which are to be transported for further testing or evaluation, may be assigned an appropriate shipping description for organic peroxide Type C, packaged and offered for transportation, under the following conditions:

(i) Data available to the person offering the material for transportation must indicate that the sample would pose a level of hazard no greater than that of an organic peroxide Type C and that the control temperature, if any, is sufficiently low to prevent any dangerous decomposition and sufficiently high to prevent any dangerous phase separation;

(ii) The sample must be packaged in accordance with packing method OP2A or OP2B, for a liquid or solid, respectively;

(iii) Packages of the organic material may be offered for transportation and transported in a quantity not to exceed 10 kg (22 pounds) per transport vehicle; and

(iv) One of the following shipping descriptions must be assigned:

(A) Organic peroxide Type C, liquid, 5.2, UN3103;

(B) Organic peroxide Type C, solid, 5.2, UN3104;

(C) Organic peroxide Type C, liquid, temperature controlled, 5.2, UN3113; or

(D) Organic peroxide Type C, solid, temperature controlled, 5.2, UN3114.

(d) *Tables of packing methods.* The tables in this paragraph specify the types of packagings and quantity limitations that apply for each packing method in the series OP1A–OP8A, for liquids (Packagings for Liquid Organic Peroxides), and the series OP1B–OP8B, for solids (Packaging for Solid Organic Peroxides). In each table, column 1a specifies the type of packaging, column 1b specifies the packaging code, and columns 2a through 2h specify the packing methods.

(1) A liquid organic peroxide for which a packing method is specified in paragraph (b) or (c) of this section must be packaged in accordance with the following provisions:

§ 173.225(d)(1)—TABLE 11.2(A) PACKAGINGS FOR LIQUID ORGANIC PEROXIDES

Type and materials	Packaging code (see 9.4.7)	Maximum quantity or net mass per packing method [1]							
		OP1A [2]	OP2A [2]	OP3A [2]	OP4A [2]	OP5A [2]	OP6A [2]	OP7A	OP8A
Steel drum	1A1	(*)	(*)	(*)	(*)	(*)	(*)	60	225
Steel drums [3]	1A2	(*)	(*)	(*)	(*)	(*)	(*)	50 kg	200 kg
Aluminum drum	1B1	(*)	(*)	(*)	(*)	(*)	(*)	60 liters	225 liters
Fiber drum [3]	1G	0.5 kg	0.5/10 kg	5 kg	5 kg	25 kg	50 kg	50 kg	200 kg
Plastic drum	1H1	0.5	0.5	5	5	30	60	60	225
Plastics jerrican	3H1	0.5	0.5	5	5	30	60	60	60
Wooden box [3]	4C1	0.5 kg	0.5/10 kg	5 kg	5/25 kg	25 kg	50 kg	50 kg	100 kg
Plywood box [3]	4D	0.5 kg	0.5/10 kg	5 kg	5/25 kg	25 kg	50 kg	50 kg	100 kg
Fiberboard box [3]	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	(*)	(*)	(*)	(*)	(*)	(*)	60	225
Plastics receptacle with outer aluminum drum	6HB1	(*)	(*)	(*)	(*)	(*)	(*)	60	225
Plastics receptacle with outer fiber drum	6HG1	0.5	0.5	5	5	30	60	60	225
Plastics receptacle with outer fiberboard box	6HG2	0.5	0.5	5	5	30	60	60	60
Plastics receptacle with outer plastics drum	6HH1	0.5	0.5	5	5	30	60	60	225
Plastics receptacle with outer solid plastics box	6HH2	0.5	0.5	5	5	30	60	60	60

* 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 must be suitable for liquids.

(2) A solid organic peroxide for which a packing method is specified in paragraph (b) or (c) of this section must be packaged in accordance with the following provisions:

§ 173.225(d)(2)—TABLE PACKAGINGS FOR SOLID ORGANIC PEROXIDES

Type and Materials	Packaging Code (see 9.4.7)	Maximum quantity or net mass per packing method [1]							
		OP1B [2]	OP2B [2]	OP3B [2]	OP4B [2]	OP5B [2]	OP6B [2]	OP7B	OP8B
Steel drum	1A2	(*)	(*)	(*)	(*)	(*)	(*)	50 kg	200 kg
Aluminum drum	1B2	(*)	(*)	(*)	(*)	(*)	(*)	50 kg	200 kg
Fiber 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	4/C1	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
Fiberboard 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 aluminum drum	6HB1	(*)	(*)	(*)	(*)	(*)	(*)	50 kg	200 kg
Plastics receptacle with outer fier drum	6HG1	0.5 kg	0.5 kg	5 kg	5 kg	25 kg	50 kg	50 kg	200 kg
Plastics receptacle with outer fiberboard box	6HG2	0.5 kg	0.5 kg	5 kg	5 kg	30 kg	60 kg	50 kg	75 kg
Plastics receptacle with outer plastics drum	6HH1	0.5 kg	0.5 kg	5 kg	5 kg	30 kg	60 kg	50 kg	200 kg
Plastics receptacle with outer solid plastics box	6HH2	0.5 kg	0.5 kg	5 kg	5 kg	30 kg	60 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.

(e) *Bulk packagings for organic peroxides.* When bulk packagings are authorized under the provisions of the Organic Peroxides Table in paragraph (b) of this section, only the following packagings are authorized:

(1) *Rail cars.* DOT 103W, 103AW, 111A60F1, 111A60W1, 111A100F2, and 111A100W2 tank car tanks are authorized. DOT 103W, 111A60F1 and 111A60W1 tank car tanks must have bottom outlets effectively sealed from inside. Gauging devices are required on DOT 103W tank car tanks. Riveted tank car tanks are not authorized.

(2) *Cargo tanks.* Specification MC 310, MC 311 and MC 312 cargo tank motor vehicles with a tank design pressure of at least 25 psig (172 kPa) are authorized. Bottom outlets are not authorized.

(3) *Portable tanks.* Specification IM 101 intermodal portable tanks are authorized as follows:

(i) Each tank must have a minimum design pressure of 2.67 bars (38.7 psig), a minimum shell thickness of 6.35 mm (0.025 inch) mild steel.

(ii) Bottom outlets are not authorized.

(iii) Each tank must be equipped with at least two self-reclosing pressure relief devices of at least 7.62 cm (3.0 inches) diameter. The pressure relief devices must be set at a pressure that is determined by the following formula:

Pressure relief valve setting = 1.2 × (Vapor pressure of lading at 46 °C (115 °F) + Static head of lading + Pressure of gas padding, if any).

(iv) For tertiary butyl hydroperoxide (TBHP), each tank must contain 7.62 cm (3.0 inches) low density polyethylene (PE) saddles having a melt index of between 0.2 and 10.0 g/min (ASTM D1238, condition E) as part of the lading, with a ratio of PE to TBHP over a range of 0.008 to 0.012 by mass. Alternatively, plastic or metal containers equipped with fusible plugs having a melting point between 69 °C (156 °F) and 71 °C (160 °F) and filled with a sufficient quantity of water to dilute the TBHP to 65% or less by mass may be used. The PE saddles must be visually inspected after each trip and, at a minimum, once every 12 months, and replaced when discoloration, fracture, severe deformation, or other indication of change is noted.

21. Part 173, as proposed to be amended at 52 FR 42988 on November 6, 1987, is further amended to add an item 129a to read as follows:

129a. New appendixes E and F would be added to part 173, to read as follows:

Appendix E—Guidelines for the Classification and Packing Group Assignment of Class 4 Materials

1. General

Tests and criteria for assignment to the three divisions of Class 4 are addressed below. The following principles should be applied to the classification of and assignment of a packing group to a new material or a new composition of existing material(s) not already covered by the entries in the § 172.101 Hazardous Material Table.

2. Classification and Packing Group Assignment of a Division 4.1 Material

2.1. A wetted explosive is listed as Division 4.1 in the § 172.101 Hazardous Material Table after consideration of all appropriate data to ensure that its explosive properties are suppressed.

2.1.1. Packing Group I is assigned to any wetted explosive.

2.2. A self-reactive material is listed in the § 172.101 Hazardous Material Table after consideration of the particular properties of the material. The following considerations apply:

(a) Any self-reactive material which, when packaged for transport, can detonate, is forbidden.

(b) Any self-reactive material which in laboratory testing shows a high mechanical sensitivity and is liable to detonate or deflagrate rapidly is forbidden. (Deflagration is the subsonic transmission of a decomposition front through a material without the necessary participation of oxygen from the air.)

(c) Any self-reactive material which in laboratory testing shows a high mechanical sensitivity is provisionally acceptable as a self-reactive material of Division 4.1, provided that this formulation does not detonate or deflagrate rapidly.

2.2.1. Assignment of Packing Groups. Packing Group II is assigned to self-reactive materials.

2.3. Readily combustible solids are classed in Division 4.1 in accordance with the following test methods and the procedure indicated in the flow-chart, figure E-1.

2.3.1. Preliminary screening test.

(a) The material in its commercial form, is formed into an unbroken strip or powder train about 250 mm long by 20 mm wide by 10 mm high on a cool, impervious, low-heat conducting base plate.

(b) A hot flame (minimum temperature 1000 °C) from a gas burner (minimum diameter 5 mm is applied to one end of the powder train until the powder ignites or for a maximum of 2 minutes (5 minutes for powders of metals or metal-alloys). It should be noted whether combustion propagates along 200 mm of the train within the 2 minute test period (or 20 minutes for metal powders).

(c) If the material does not ignite and propagate combustion either by burning with flame or smoldering along 200 mm of the

powder train within the 2 minute (or 20 minute) test period, then the material may not be classified as a flammable solid and no further testing is required.

(d) If the material propagates burning of a 200 mm length of the powder train in less than 2 minutes, or less than 20 minutes for metal powders, the full test program below must be carried out.

2.3.2. Burning rate test

(a) The powdered or granular material, in its commercial form, is loosely filled into a mold of 250 mm long with a triangular cross-section of inner height 10 mm and width 20 mm. (See Figure E-2.) On both sides of the mold, in the longitudinal direction, two metal sheets are mounted as lateral limitations which extend 2 mm beyond the upper edge of the triangular cross-section (figure 2). The mold is then dropped three times from a height of 2 cm onto a solid surface. The lateral limitations are then removed and the impervious, non-combustible, low heat conducting plate is placed on top of the mold, the apparatus inverted and the mold removed. Pasty materials are spread on a non-combustible surface in the form of a rope 250 mm in length with a cross-section of about 1 cm^2. Any suitable ignition source such as a small flame or a hot wire of minimum temperature 1000 °C is used to ignite the pile at one end. In the case of a moisture sensitive material, the test must be carried out as quickly as possible, after its removal from the container.

(b) Arrange the pile across the draft in a fume-chamber. The air speed must be sufficient to prevent fumes escaping into the laboratory and should not be varied during the test. A draft screen may be erected around the apparatus.

(c) Add 1 ml of a wetting solution to the pile 30–40 mm beyond the 100 mm timing zone. (See 2.3.2.(d).) With many materials, water rolls off the sides of the pile, so the addition of wetting agents may be necessary. Wetting agents used must be free from combustible diluents and the total active matter in the wetting solution may not exceed 1%. This liquid may be added to a hollow up to 3 mm deep and 5 mm in diameter in the top of the pile. Apply the wetting solution to the ridge drop by drop, ensuring the whole cross-section of the pile is wetted without loss of liquid from the sides. The liquid must be applied over the shortest possible length of the pile consistent with avoiding loss from the sides. This portion of the test is not applicable to metal powders.

(d) Ignite one end of the pile. When the pile has burned a distance of 80 mm, measure the rate of burning over the next 100 mm. Note whether or not the wetted zone stops propagation of the flame. The test is performed six times using a clean cool plate each time, unless a positive result is observed earlier.

2.3.3. Criteria for classification

(a) Powdered, granular or pasty materials are classified in Division 4.1 when the time of burning of one or more of the test runs, according to the test method described in 2.3.2, is less than 45 s or the rate of burning is more than 2.2 mm/s.

(b) Powders of metals or metal alloys are classified when they can be ignited and the reaction spreads over the whole length of the sample in 10 minutes or less.

2.3.4. Assignment of Packing Groups

2.3.4.1. Combustible solids (other than metal powders). Packing Group II is assigned if the burning time is less than 45 s and the flame passes the wetted zone. Packing Group III is assigned if the burning time is less than 45 s and the wetted zone stops the flame propagation for at least 4 minutes.

2.3.4.2. Powders of metal or metal alloys. Packing Group II is assigned if the zone of reaction spreads over the whole sample in 5 minutes or less. Packing Group III is assigned if the reaction spreads over the whole length of the sample in more than 5 minutes.

2.4. Solids which may cause or contribute to fire through friction are classified in Division 4.1 by analogy with existing entries.

2.4.1. Assignment of Packing Group for solids which may cause or contribute to a fire through friction. The packing group is assigned by comparison with existing classifications or in accordance with any appropriate special provision.

3. Division 4.2—Materials Liable to Spontaneous Combustion

3.1. Pyrophoric materials

3.1.1. Test method for solid pyrophoric materials. 1 to 2 cm^3 of the powdery material to be tested is poured from about 1 m height onto a non-combustible surface and it is observed whether the material ignites during dropping or within 5 minutes of settling. This procedure is repeated six times unless a positive result is obtained earlier.

3.1.2. Test methods for liquid pyrophoric materials

(a) Part 1: A porcelain cup of about 10 cm diameter is filled with diatomaceous earth or silica gel at room temperature to a height of about 5 mm. Approximately 5 ml of the liquid to be tested is poured into the prepared procelain cup and it is observed if the material ignites within 5 minutes. This procedure is repeated six times unless a positive result is obtained earlier.

(b) Part 2: A 0.5 ml test sample is delivered from a syringe to an indented dry No. 3 Whatman filter paper. The test is conducted at 25 ± 2 °C and a relative humidity of 50 ± 5%. Observations are made to see if ignition or charring occurs on the filter paper within five minutes after the liquid to be tested is introduced. This procedure is repeated three times using fresh filter paper each time unless a positive result is obtained earlier.

3.1.3. Criterion for classification

3.1.3.1. Solid material. If the sample ignites in one of the tests, the material is considered pyrophoric and should be classified in Division 4.2.

3.1.3.2. Liquid material. If the liquid ignites in Part 1 of the test, or if it ignites or chars the filter paper in Part 2 of the test, it is considered to be pyrophoric and should be classified in Division 4.2.

3.1.4. Assignment of Packing Group. Packing Group I is assigned to all pyrophoric solids and liquids.

3.2. Self-heating materials

3.2.1. Test method for self-heating materials

(a) A hot air circulating type of oven with an inner volume of more than 9 liters and capable of controlling the internal temperature at 140 ± 2 °C is used.

(b) Cubic sample containers of 2.5 cm and 10 cm side, made of stainless steel net with a mesh opening of 0.053 mm, with their top surface open, are used. Each container is housed in a cubic container cover made from a stainless steel net with a mesh opening of 0.595 mm and slightly larger than the sample container, so that the container fits in this cover. In order to avoid the affect of air circulation, another stainless steel cage, made from a net with a mesh opening of 0.595 mm and 15 × 15 × 25 cm in size, is further installed to house the cover.

(c) Chromel-Alumel thermocouples of 0.3 mm diameter are used for temperature measurement. One is placed in the center of the sample and another between the sample container and the oven wall. The temperatures are measured continuously.

(d) The sample, powder or granular, in its commercial form, is filled to the brim of the sample container and the container tapped several times. If the sample settles, more is added. If the sample is heaped, it is levelled to the brim. The container is housed in the cover and cage, then hung at the center of the oven.

(e) The oven temperature is raised to 140 °C and kept there for 24 hours. The temperature of the sample is recorded. The first test is conducted with a 10 cm cube sample. Observations are made to determine if spontaneous ignition occurs or if the temperature of the sample exceeds 200 °C. If negative results are obtained no further test is necessary. If positive results are obtained a second test is conducted with a 2.5 cm cube sample to determine the data for packing group assignment.

3.2.2. Criteria for classification. A self-heating material should be classified in Division 4.2 if in the first test using a 10 cm cube sample, spontaneous ignition occurs or the temperature of the sample exceeds 200 °C during the 24 hour testing time. This criterion is based on the self-ignition temperature of charcoal, which is 50 °C for a cubic volume of 27 m^3 and 140 °C for a one litre sample. Materials with self-ignition temperatures higher than 50 °C for 27 m^3 should not be classified in Division 4.2.

3.2.3. Assignment of Packing Groups

3.2.3.1. Packing Group II is assigned to materials which give positive results when tested with the 2.5 cm cube sample.

3.2.3.2. Packing Group III is assigned to materials which give positive results when tested with the 10 cm cube sample but which give a negative result with a 2.5 cm cube sample.

4. Assignment of Materials for Division 4.3

The following test method is used to determine whether the reaction of a material with water leads to the development of a dangerous amount of gases which may be flammable. The test method can be applied to solid and liquid materials. It is not applicable to pyrophoric materials.

4.1. Test method

The material should be tested at a temperature of 20 °C and atmospheric pressure by bringing it into contact with water. For a solid material, the package should be inspected for any particles <500

μm diameter. If that powder constitutes more than 1% (mass) of the total or if the material is friable, then the whole of the sample should be ground to a powder before testing to allow for a reduction in particle size during handling and transport, otherwise the material should be tested in its commercial state. The testing should be performed three times.

If spontaneous ignition of the gas occurs at any step, the material is classified in Division 4.3, and no further testing is necessary.

(a) A small quantity (approximately 2 mm diameter) of the test material is placed in a trough of distilled water at 20 °C. It is noted whether any gas is evolved and if it spontaneously ignites.

(b) A small quantity of the test material (approximately 2 mm diameter) is placed in the center of a filter paper which is floated flat on the surface of distilled water at 20 °C in a 100 mm diameter evaporating dish. The filter paper is to keep the material in one place, under which condition the likelihood of spontaneous ignition of any gas is greatest. It is noted whether any gas is evolved and if it spontaneously ignites.

(c) The test material is made into a pile approximately 2 cm high and 3 cm in diameter with an indentation in the top. A few drops of water are added to the hollow. It is noted whether any gas is evolved and if it spontaneously ignites.

(d) Water is put into the dropping funnel and enough of the material (up to a maximum weight of 25 g) to produce between 100 cm^3 and 250 cm^3 of gas is weighed and placed in a conical flask. The tap of the dropping funnel is opened to let the water into the conical flask and a stop watch is started. The volume of gas evolved is measured by any suitable means. The time taken for all the gas to be evolved is noted and where possible, intermediate readings are taken. The rate of evolution of gas is calculated over 7 hours at one hour intervals. If the rate of evolution is erratic or is increasing after 7 hours, the measuring time should be extended to a maximum time of 5 days. The five day test may be stopped if the rate of evolution becomes steady or continually decreases and sufficient data has been established to assign a packing group to the material or to determine that the material should not be classified in Division 4.3. If the chemical identity of the gas is unknown the gas should be tested for flammability.

4.2. Criteria for classification. A material should be classified in Division 4.3 if:

(a) spontaneous ignition takes place in any step of the test procedure, or

(b) there is an evolution of a flammable gas at a rate greater than 1 liter per kilogram of the material per hour.

4.3. Assignment of Packing Groups

(a) Packing Group I is assigned to any material which reacts vigorously with water at ambient temperatures and demonstrates generally a tendency for the gas produced to ignite spontaneously, or which reacts readily with water at ambient temperatures such that the rate of evolution of flammable gas is equal to or greater than 10 liters per kilogram of material over any one minute.

(b) Packing Group II is assigned to any material which reacts readily with water at ambient temperatures such that the maximum rate of evolution of flammable gas is equal to or greater than 20 liters per kilogram of material per hour, and which does not meet the criteria for Packing Group I.

(c) Packing Group III is assigned to any material which reacts slowly with water at ambient temperatures such that the maximum rate of evolution of flammable gas is greater than 1 litre per kilogram of material per hour, and which does not meet the criteria for Packing Groups I or II.

Appendix F—Guidelines for the Classification and Packing Group Assignment of Division 5.1 Materials

1. Introduction

This test method is designed to measure the potential for a solid substance to increase the burning rate or burning intensity of a combustible substance when the two are thoroughly mixed. Two tests are run in triplicate for each substance to be evaluated, one at a 1 to 1 ratio, by mass, of the sample to sawdust and one at a 4 to 1 ratio, by mass, of the sample to sawdust. To determine whether a material should be in Division 4.1, the burning characteristics of each mixture are compared with a standard having a 1 to 1 ratio, by mass, of ammonium persulfate and sawdust. If a material is classified in Division 4.1, the packing group is determined using the same method, with potassium perchlorate and potassium bromate substituted for ammonium persulfate as necessary.

2. Procedure

Ammonium persulfate, potassium perchlorate, and potassium bromate are reference substances. These substances should pass through a sieve mesh size smaller than 0.3 mm and should not be ground. Dry the reference substances at 65 °C for 12 hours and keep in a desiccator until required.

The combustible material for this test is softwood sawdust. It should pass through a sieve mesh smaller than 1.6 mm and should contain less than 5% of water by weight. If necessary, spread it in a layer less than 25 mm thick, dry for 4 hours and keep in a desiccator until required.

Prepare a 30.0 g±0.1 g mixture of the reference substance and sawdust in a 1 to 1 ratio, by mass. Two 30.0±0.1 g mixtures of the material to be tested, in the particle size in which it is to be transported, and the sawdust, are prepared in ratios of 1 to 1, by mass and 4 to 1 by mass. Each mixture should be mixed mechanically without excessive stress as thoroughly as possible.

The test should be conducted in ventilated area under the following ambient conditions:

temperature 20 °C±5 °C
humidity 50% ±10%

Form each of the mixtures into a conical pile with dimensions of approximately 70 mm base diameter and 60 mm height on a cool, impervious, low heat conducting surface. Ignite the pile by means of a wire of inert metal in the form of a circular loop 40 mm in diameter positioned inside the pile 1 mm above the test surface. Heat the wire electrically to 1000 °C until the first sign of combustion are observed or it is clear that the pile cannot be ignited. Turn off the electrical power used to heat the wire as soon as there is combustion.

Record the time from the first observable signs of combustion to the end of all reaction: smoke, flame, incandescence. Repeat the test three times for each of the two mixing ratios.

3. Criteria for Classification

A Substance should be classified in Division 5.1 if, in either concentration tested, the mean burning time of the sawdust, established from three tests, is equal to or less than that of the average of the three tests with ammonium persulfate mixture.

4. Assignment of Packing Group

Packing Group I is assigned to any substance which, in either mixture ratio tested, exhibits a burning time less than potassium bromate.

Packing group II is assigned to any substance which, in either mixture ratio tested, exhibits a burning time equal to or less than that of potassium perchlorate and the criteria for Packing Group I is not met.

Packing Group III is assigned to any substance which, in either concentration tested, exhibits a burn time equal to or less than that of ammonium persulfate and the criteria for Packing Groups I and II are not met.

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FIGURE E-1: FLOW CHART FOR ASSIGNING READILY COMBUSTIBLE SOLIDS (EXCEPT METAL POWDER) TO DIVISION 4.1

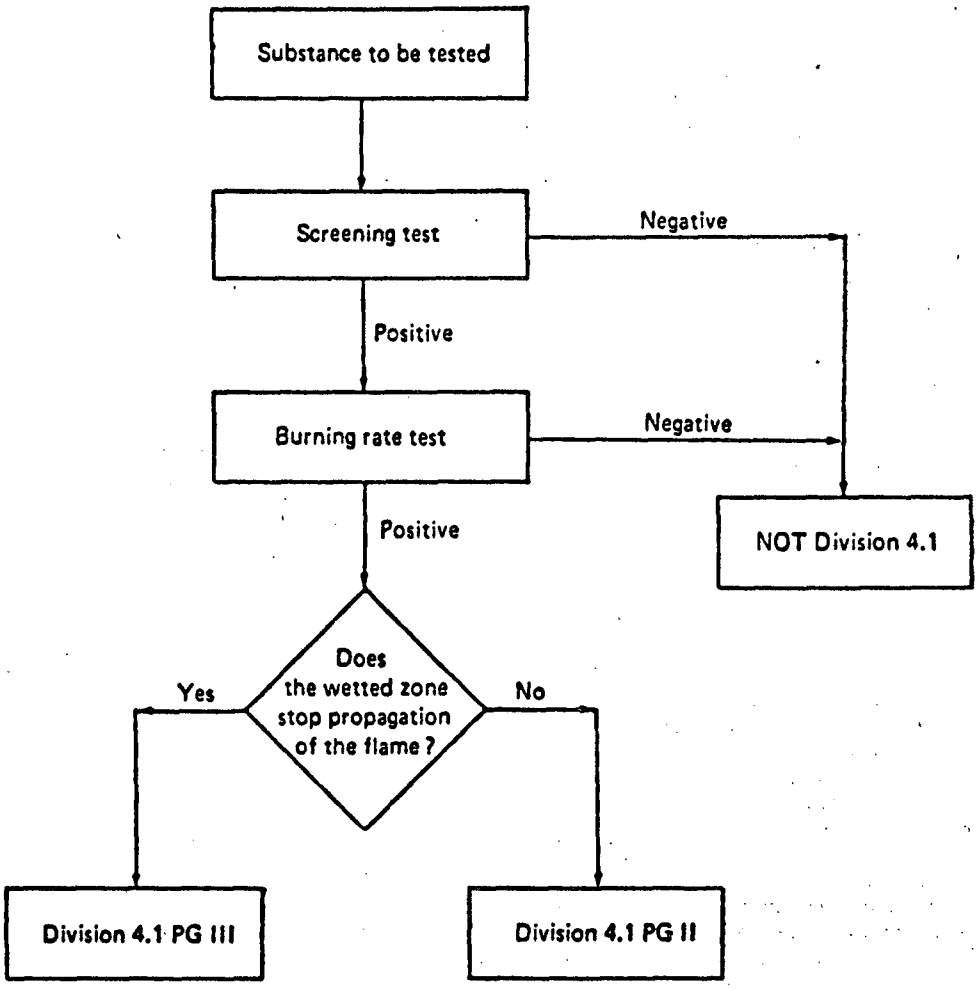
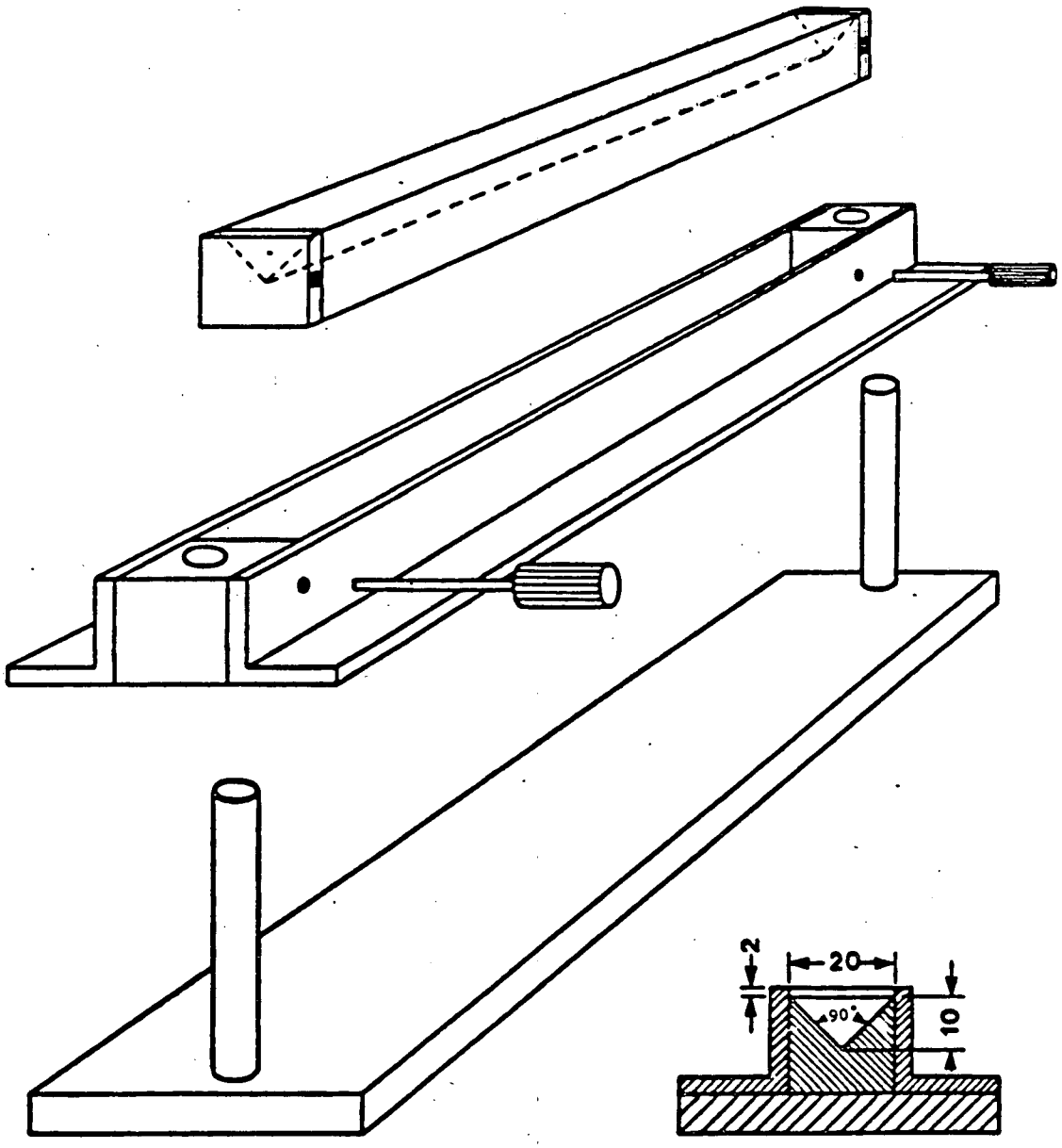


FIGURE E-2 POWDER TRAIN MOLD



Dimensions shown
are in millimeters (mm)

Length of mold: 250 mm

PART 178—SPECIFICATIONS FOR PACKAGINGS

23. The authority citation for part 178 would be revised to read as follows:

Authority: 49 App. U.S.C. 1803, 1804, 1805, 1806, 1808; 49 CFR part 1, unless otherwise noted.

24. Section 178.522, as proposed at 52 FR 42995 on November 6, 1987 is amended by revising paragraphs (a)(10), (b)(3)(viii), (b)(4) and (b)(5) and by adding paragraphs (a)(11) and (b)(3)(ix) to read as follows:

§ 178.522 Standards for composite packagings with inner plastic receptacles.

(a) * * *

(10) 6HH1 for a plastic receptacle within a protective plastic drum.

(11) 6HH2 for a plastic receptacle within a protective solid plastic box.

(b) * * *

(3) * *

(viii) 6HH1: Protective packaging must conform to the requirements for plastic drums, § 178.509(b).

(ix) 6HH2: Protective packaging must conform to the requirements for solid plastic boxes, § 179.517(b).

(4) Maximum capacity of inner receptacles is as follows: 6HA1, 6HB1, 6HD1, 6HG1, 6HH1—250 liters (66.0 gallons); 6HA2, 6HB2, 6HC, 6HD2, 6HG2, 6HH2— 60 liters (15.9 gallons).

(5) Maximum net mass is as follows: 6HA1, 6HB1, 6HD1, 6HG1, 6HH1—400 kg (881.8 pounds); 7HA2, 6HB2, 6HC, 6HD2, 6HG2, 6HH2—75 kg (165.4 pounds).

Issued in Washington, DC, on June 12, 1990 under authority delegated in 49 CFR part 106, appendix A.

Alan I. Roberts,

Director, Office of Hazardous Materials Transportation.

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