This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

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Standard Guide for Selection of Substitute, Non-hazardous, Particulate Solid Filling Substances for Packagings Subjected to the United Nations Performance Tests[1]

This standard is issued under the fixed designation D8135; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 The purpose of this guide is to clarify the selection, use, and description criteria of non-hazardous particulate solid substitutes used to replace hazardous materials for the purpose of performance testing packagings. This includes identification of the physical parameters of substitute non-hazardous solid test fill materials that may affect packaging performance and test results and should be considered when selecting and describing a test fill material that conforms to the requirements of the Hazardous Materials Regulations (HMR). This guide is intended for use with package testing procedures for particulate solid materials that have flow characteristics. It is not intended for use with hazardous articles.

1.2 This guide provides information to assist packaging users, manufacturers, and performance testing service suppliers regarding the types of physical properties that should be considered when selecting substitute filling substances for the testing, certification and manufacture of packagings under the United Nations packaging protocols (UN Recommendations on the Transport of Dangerous Goods-Model Regulations) as adopted by US DOT in 49 CFR HMR.

1.3 This guide provides the suggested minimum information concerning the physical characteristics of the filling substances that should be documented in the certification test report and notification to users to allow for test repeatability and analysis, and to provide guidance to the user of a packaging of pertinent physical differences between potential hazardous lading and the filling substance with which the packaging was tested.

1.4 This guide does not purport to address regulatory requirements regarding the compatibility of filling substances with transport packagings. Compatibility requirements must be assessed separately, but it should be noted that under certain national and international dangerous goods regulations, the selection of the filling substances for package performance testing may be prescribed with respect to chemical compatibility requirements.

NOTE 1—Under the US HMR determination of packaging compatibility with a particular hazardous fill material is "the responsibility of the person offering the hazardous material for transportation" as prescribed in 49 CFR § 173.24(e).

1.5 When testing packaging designs intended for hazardous materials (dangerous goods), the user of this guide shall be trained in accordance with 49 CFR §172.700 and other applicable hazardous materials regulations such as the ICAO Technical Instructions, IMDG Code, other applicable national or international dangerous goods regulations that govern the testing, manufacture and use of packagings authorized for the transportation of dangerous goods, and carrier rules such as the IATA Dangerous Goods Regulations.

1.6 The units of measurement are consistent with the HMR.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4919 Guide for Testing of Hazardous Materials (Dangerous Goods) Packagings

D6393 Test Method for Bulk Solids Characterization by Carr Indices

[1] This guide is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.22 on Hazardous Materials.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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D7481 Test Methods for Determining Loose and Tapped Bulk Densities of Powders using a Graduated Cylinder
E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

2.2 *Federal Standard:*[3]
U.S. Department of Transportation Code of Federal Regulations Title 49, Transportation (49 CFR) Parts 100-199

2.3 *UN Standard:*[4]
United Nations Recommendations on the Transport of Dangerous Goods, Model Regulations (UN Orange Book)

2.4 *International Air Transport Association (IATA) Standard:*[5]
International Air Transport Association (IATA) Dangerous Goods Regulations

2.5 *ICAO Standard:*[6]
International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air

2.6 *IMDG Standard:*[7]
International Maritime Dangerous Goods Code (IMDG Code)

2.7 *ISO Standards:*[8]
ISO 2234 Packaging – Complete, Filled Transport Packages – Stacking Tests using Static Load
ISO 16495 Packaging – Transport Packaging for Dangerous Goods – Test Methods

3. Terminology

3.1 *Definitions:*

3.1.1 *angle of repose, n*—when particulate solids are poured onto a flat, horizontal surface, they form a conical pile. The angle of repose is the interior angle formed between the base of this cone and its side (see Fig. 1).

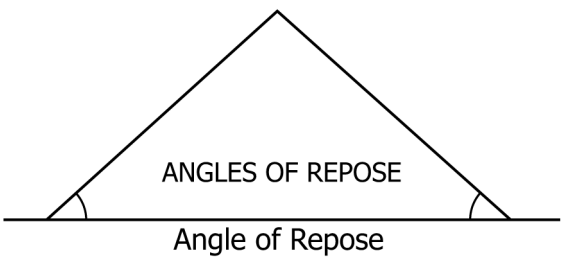

FIG. 1 Angle of Repose

3.1.2 *bulk density, n*—the mass (weight) of particulate solids divided by the total volume of sample; that is, bulk density is the ratio of the mass of large number particles of the material to the total volume of the sample and is an aggregate property that includes the volume(s) of the particles, inter-particle interstices and particle porosity. It is expressed as a ratio of weight/volume, or may be expressed as a unit-less ratio referenced to a standard material, such as water, as a specific gravity.

3.1.2.1 *Discussion*—It is not a characteristic intrinsic to a material. It is affected by how the sample is handled. Commonly expressed as "freely settled" or "poured" density; in distinction to a "tapped" density value that would be determined by a compaction method such as tapping a sample on a table during filling to represent compaction due to various types of vibration. For this guide, poured density would be the most applicable.

3.1.3 *particle size distribution, n*—the physical size of the individual particles in a given sample of a particulate solid. In almost all common solids this will be expressed as a particle size distribution. There are many ways to model or measure this distribution given the wide variety and irregularity of particle geometries and styles.

3.1.3.1 *Discussion*—The most effective and common way to measure this property is by sieve analysis. Where the particle size distribution is expressed as a percentage of the weight of the sample, retained in each step as the sample is passed through progressively finer sieves, to the weight of the whole sample. See Specification E11 and Table X1.2.

3.1.4 *specification packaging, n*—a packaging conforming to one of the specifications or standards for packagings in part 178 or part 179 of this subchapter (49 CFR).

3.1.4.1 *Discussion*—Packaging, as used in this guide, includes packaging constructed and tested to UN performance standards as adopted in the HMR (the focus of this guide) but does not exclude its use for other types of packagings.

NOTE 2—Additional terms and definitions are located in 49 CFR sections 171.8 and the UN Orange Book, Section 1.2.1.

4. Summary of Guide

4.1 The manufacturer, test facility or user of a packaging will apply the procedural considerations, based on the physical characteristics of the particulate solid hazardous material to be transported, outlined in this guide to select an appropriate fill material to use when testing a packaging. In addition, packaging manufacturers and test facilities will use this guide to provide sufficient information concerning the relevant physical characteristics of the test fill material to the user of a packaging to allow for a proper evaluation of suitability of a packaging for a particular particulate solid hazardous material.

5. Significance and Use

5.1 Regulations prescribing the test procedures for hazardous materials packaging allow for the substitution of non-hazardous fill materials for packaging performance tests with certain limitations prescribed and guidance offered (see 49 CFR 178.602(c)). This regulatory guidance has proven to be flexible enough, in common industry practice, to produce

[3] Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9371 (website: http://phmsa.dot.gov/hazmat).
[4] Available from the UN Economic Commission for Europe, Information Service, Palais des Nations, CH-1211 Geneva 10 Switzerland (website: http://www.unece.org/trans/danger/danger.htm).
[5] Available from the International Air Transport Association (IATA), 800 Place Victoria PO Box 113 Montreal - H4Z 1M1 Quebec - Canada (website: http://www.iata.org).
[6] Available from the International Civil Aviation Organization, (ICAO) 999 University Street, Montréal, Quebec H3C 5H7, Canada (website: http://www.icao.org).
[7] Available from the International Marine Organization (IMO), 4 Albert Embankment, London, SE1 7SR United Kingdom (website: http://www.imo.org/).
[8] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.