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Standard Classification System for Chemicals According to Functional Groups¹

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1. Scope

1.1 This standard provides a classification system for chemical compounds whereby chemicals are assigned a three-digit code based primarily on chemical class.² Poly-functional compounds should be classified by all applicable code numbers associated with their component functional groups.

1.2 *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. Significance and Use

2.1 In many situations where chemicals are interacting with other chemicals or materials, the interaction is strongly dependent and often correlated with the functional group(s) present. These interactions include chemical reaction, dissolution, and swelling/permeation of polymeric materials. For this reason, it is useful to have a standard means for classifying chemicals.

2.2 One application for this classification system is in the selection of chemical protective clothing based on the chemical resistance of the clothing materials.^{3,4,5} Chemical resistance

data are available for only a very small fraction of the chemicals for which protective clothing is used. However, for chemicals for which no data are available, a knowledge of the chemical class sometimes can give insight into the resistance of a prospective clothing material.

NOTE 1—The present state of knowledge precludes reliable estimates from chemical class alone.

2.3 The classification system also facilitates the development of predictive methodology by researchers in a variety of fields, in addition to protective clothing.

3. Terminology

3.1 Definitions:

3.1.1 *functional group*—the atom or group of atoms that defines the chemical class of a particular family of organic compounds and, at the same time, determines their properties.

4. Basis of Classification

4.1 Three-digit numbers were assigned to each class. The major classes generally were a multiple of 10 (printed in bold type), with subclasses numbered between.

4.2 Subcommittee F23.30 has jurisdiction for designating new classes. Proposals should be made to that group. The list will be updated periodically through the ASTM balloting process as needed; interim lists will be made immediately available from the subcommittee.

4.3 See **Annex A1** for the classification system.

5. Keywords

5.1 chemical classification; chemical resistance; chemicals; clothing; functional; groups; protective

¹ This classification system is under the jurisdiction of ASTM Committee F23 on Personal Protective Clothing and Equipment and is the direct responsibility of Subcommittee F23.30 on Chemicals.

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² Classification in this guide is based on assignment of three-digit codes, originally found in the *Guidelines for the Selection of Chemical Protective Clothing*, 3rd Ed. (Vols I and II), Schwoppe et al. NTIS Accession Nos. ADA179 516 and ADA179 164, to the groups listed in the Functional Group Index, Kodak Laboratory Chemicals, Kodak Laboratory Products Catalog No. 53, 1987–1988, pp. 1f–30f.

³ *Chemical Protective Clothing Permeation and Degradation Database*, K. Forsberg et al., Lewis Publisher, CRC Press Inc., Boca Raton, FL 33431-9964.

⁴ *Guidelines for the Selection of Chemical Protective Clothing*, Johnson et al., U.S. Dept. of Energy Report DE-02357T, 1991.

⁵ *Quick Selection Guide to Chemical Protective Clothing*, 5th ed., Forsberg and Mansdorf, John Wiley and Sons, Inc., Hoboken, NJ, 2007, ISBN 978-0-470-14681-1.

ANNEX

(Mandatory Information)

A1. CLASSIFICATION OF CHEMICALS/CHEMICAL CLASS NUMBERS

CLASS	CHEMICAL CLASS/SUBCLASS NAME	231	Ortho Esters
100	Acids Carboxylic	232	Carbonates
		233	Carbamates and Others
102	Aliphatic and Alicyclic, Unsubstituted	240	Ethers
103	Aliphatic and Alicyclic, Substituted	241	Aliphatic and Alicyclic
104	Aliphatic and Alicyclic, Polybasic	242	Aromatic
105	Aromatic, Benzoic	243	Alkyl-Aryl
106	Aromatic, Others	244	Ketals, Acetals
		245	Glycol Ethers
110	Acid Halides, Carboxylic	246	Vinyllic
111	Aliphatic and Alicyclic	260	Halogen Compounds
112	Aromatic		
113	Chloroformates	261	Aliphatic and Alicyclic
120	Aldehydes	263	Aromatic
		264	Vinyllic
121	Aliphatic and Alicyclic	265	Allylic
122	Aromatic	266	Benzyllic
130	Amides	270	Heterocyclic Compounds
132	Aliphatic and Alicyclic	271	Nitrogen, Pyridines
133	Aromatic	274	Nitrogen, Others
134	Acetanilides	275	Oxygen, Epoxides
135	Acrylamides	276	Carbohydrates
137	Carbamides and Guanidines	277	Oxygen, Furans
		278	Oxygen, Others
140	Amines	279	Sulfur
141	Aliphatic and Alicyclic, Primary	280	Hydrazines
142	Aliphatic and Alicyclic, Secondary	290	Hydrocarbons
143	Aliphatic and Alicyclic, Tertiary		
145	Aromatic, Primary	291	Aliphatic and Alicyclic, Saturated
146	Aromatic, Secondary and Tertiary	292	Aromatic
147	Alkyl-Aryl, Monoamines	293	Aromatic Polynuclear
148	Aliphatic and Alicyclic Polyamines	294	Aliphatic and Alicyclic, Unsaturated
149	Aromatic Polyamines	295	Acetylenes
		296	Polyenes and Poly-yenes
150	Hydroxylamines and Ketoximes	300	Peroxides
160	Anhydrides		
161	Aliphatic and Alicyclic	301	Inorganic
162	Aromatic	302	Organic
170	Azo/Azox4 Compounds	310	Hydroxylic Compounds
210	Isocyanates		
211	Aliphatic and Alicyclic	311	Aliphatic and Alicyclic, Primary
212	Aromatic	312	Aliphatic and Alicyclic, Secondary
		313	Aliphatic and Alicyclic, Tertiary
		314	Aliphatic and Alicyclic, Polyols
		315	Aliphatic and Alicyclic, Substituted
220	Esters Carboxylic	316	Phenols
221	Formates	317	Naphthols
222	Acetates	318	Aromatic, Others
223	Acrylates and Methacrylates	330	Elements
224	Aliphatic, Others	340	Inorganic Salts and Inorganic Salt Solutions
225	Lactones		
226	Benzoates and Phthalates	345	Inorganic Cyano Compounds
227	Aromatic, Others	350	Inorganic Gases and Vapors
230	Esters Non-Carboxylic		