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Standard Classification System for Chemicals According to Functional Groups[1]

This standard is issued under the fixed designation F1186; 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 This standard provides a classification system for chemical compounds whereby chemicals are assigned a 3-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.

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; protective; groups; functional

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[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 3-digit codes, originally found in the *Guidelines for the Selection of Chemical Protective Clothing,* 3rd Ed. (Vols I and II), Schwope 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, p 1f–30f.

[3] *Chemical Protective Clothing Permeation and Degradation Database,* K. Forsberg et al., Lewis Publisher, CRC Press Inc., 2000 Corporate Blvd., N.W., 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
100	**Acids Carboxylic**
102	Aliphatic and Alicyclic, Unsubstituted
103	Aliphatic and Alicyclic, Substituted
104	Aliphatic and Alicyclic, Polybasic
105	Aromatic, Benzoic
106	Aromatic, Others
110	**Acid Halides, Carboxylic**
111	Aliphatic and Alicyclic
112	Aromatic
113	Chloroformates
120	**Aldehydes**
121	Aliphatic and Alicyclic
122	Aromatic
130	**Amides**
132	Aliphatic and Alicyclic
133	Aromatic
134	Acetanilides
135	Acrylamides
137	Carbamides and Guanidines
140	**Amines**
141	Aliphatic and Alicyclic, Primary
142	Aliphatic and Alicyclic, Secondary
143	Aliphatic and Alicyclic, Tertiary
145	Aromatic, Primary
146	Aromatic, Secondary and Tertiary
147	Alkyl-Aryl, Monoamines
148	Aliphatic and Alicyclic Polyamines
149	Aromatic Polyamines
150	**Hydroxylamines and Ketoximes**
160	**Anhydrides**
161	Aliphatic and Alicyclic
162	Aromatic
170	**Azo/Azox4 Compounds**
210	**Isocyanates**
211	Aliphatic and Alicyclic
212	Aromatic
220	**Esters Carboxylic**
221	Formates
222	Acetates
223	Acrylates and Methacrylates
224	Aliphatic, Others
225	Lactones
226	Benzoates and Phthalates
227	Aromatic, Others
230	**Esters Non-Carboxylic**
231	Ortho Esters
232	Carbonates
233	Carbamates and Others
240	**Ethers**
241	Aliphatic and Alicyclic
242	Aromatic
243	Alkyl-Aryl
244	Ketals, Acetals
245	Glycol Ethers
246	Vinylic
260	**Halogen Compounds**
261	Aliphatic and Alicyclic
263	Aromatic
264	Vinylic
265	Allylic
266	Benzylic
270	**Heterocyclic Compounds**
271	Nitrogen, Pyridines
274	Nitrogen, Others
275	Oxygen, Epoxides
276	Carbohydrates
277	Oxygen, Furans
278	Oxygen, Others
279	Sulfur
280	**Hydrazines**
290	**Hydrocarbons**
291	Aliphatic and Alicyclic, Saturated
292	Aromatic
293	Aromatic Polynuclear
294	Aliphatic and Alicyclic, Unsaturated
295	Acetylenes
296	Polyenes and Poly-ynes
300	**Peroxides**
310	**Hydroxylic Compounds**
311	Aliphatic and Alicyclic, Primary
312	Aliphatic and Alicyclic, Secondary
313	Aliphatic and Alicyclic, Tertiary
314	Aliphatic and Alicyclic, Polyols
315	Aliphatic and Alicyclic, Substituted
316	Phenols
317	Naphthols
318	Aromatic, Others
330	Elements
340	**Inorganic Salts** and Inorganic Salt Solutions
345	Inorganic Cyano Compounds
350	**Inorganic Gases and Vapors**
360	**Inorganic Acid Halides**
365	Inorganic Acid Oxides

370 **Inorganic Acids**

380 **Inorganic Bases**

390 **Ketones**
391 Aliphatic and Alicylic
392 Aromatic
393 Alkyl-Aryl

410 **Quinones**

430 **Nitriles**

431 Aliphatic and Alicyclic
432 Aromatic

440 **Nitro Compounds**

441 Unsubstituted
442 Substituted

450 **Nitroso Compounds**

460 **Organo-Phosphorus Compounds**

461 Phosphines
462 Derivates of phosphourus-based acids

470 **Organo-Metallic Compounds**

480 **Organo-Silicon Compounds**

500 **Sulfur Compounds**

501 Thiols
502 Sulfides and Disulfides
503 Sulfones and Sulfoxides
504 Sulfonic Acids
505 Sulfonyl Chlorides
506 Sulfonamides
507 Sulfonates, Sulfates, and Sulfites
508 Thiones
509 Others

510 **Nitrates and Nitrites**

520 **Ureas**

530 **Zwittrerions**

550 **Organic Salts** and Organic Salt Solutions

590 Miscellaneous