



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 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

¹ This classification system is under the jurisdiction of ASTM Committee F23 on Protective Clothing 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), 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, 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*, 3rd ed., Forsberg and Mansdorf, John Wiley and Sons, Inc., Hoboken, NJ ISBN 0-471-27105-5.

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

365	Inorganic Acid Oxides		
370	Inorganic Acids	470	Organo-Metallic Compounds
380	Inorganic Bases	480	Organo-Silicon Compounds
390	Ketones	500	Sulfur Compounds
391	Aliphatic and Alicyclic	501	Thiols
392	Aromatic	502	Sulfides and Disulfides
393	Alkyl-Aryl	503	Sulfones and Sulfoxides
		504	Sulfonic Acids
410	Quinones	505	Sulfonyl Chlorides
		506	Sulfonamides
430	Nitriles	507	Sulfonates, Sulfates, and Sulfites
431	Aliphatic and Alicyclic	508	Thiones
432	Aromatic	509	Others
		510	Nitrates and Nitrites
440	Nitro Compounds	520	Ureas
441	Unsubstituted		
442	Substituted	530	Zwitterions
450	Nitroso Compounds	550	Organic Salts and Organic Salt Solutions
460	Organo-Phosphorus Compounds	590	Miscellaneous
461	Phosphines		
462	Derivates of phosphorus-based acids		

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