

Designation: F1186 - 03 (Reapproved 2013)

# Standard Classification System for Chemicals According to Functional Groups<sup>1</sup>

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  $(\varepsilon)$  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.<sup>2</sup> 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.<sup>3,4,5</sup> 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

<sup>&</sup>lt;sup>1</sup> 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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<sup>&</sup>lt;sup>2</sup> 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.

<sup>&</sup>lt;sup>3</sup> 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.

<sup>&</sup>lt;sup>4</sup> Guidelines for the Selection of Chemical Protective Clothing, Johnson et al., U.S. Dept. of Energy Report DE-02357T, 1991.

<sup>&</sup>lt;sup>5</sup> Quick Selection Guide to Chemical Protective Clothing, 5<sup>th</sup> 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

		231	Ortho Esters
		232	Carbonates
CLASS	CHEMICAL CLASS/SUBCLASS NAME	233	Carbamates and Others
100	Acids Carboxylic		
100	Allerte attended Allerte II. I I and be attended	240	Ethers
102	Aliphatic and Alicyclic, Unsubstituted		
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	Vinylic
			,
111	Aliphatic and Alicyclic	260	Halogen Compounds
112	Aromatic		
113	Chloroformates	261	Aliphatic and Alicyclic
		263	Aromatic
120	Aldehydes	264	Vinylic
	,		· ·
121	Aliphatic and Alicyclic	265	Allylic
122	Aromatic	266	Benzylic
122	Alomatic	070	Hatawa awalia Oamaa awada
130	Amides	270	Heterocyclic Compounds
130	Ailliues		
100	Aliabatia and Aliavalia	271	Nitrogen, Pyridines
132	Aliphatic and Alicyclic	274	Nitrogen, Others
133	Aromatic	275	Oxygen, Epoxides
134	Acetanilides	276	Carbohydrates
135	Acrylamides	277	Oxygen, Furans
137	Carbamides and Guanidines	278	Oxygen, Others
		279	Sulfur
140	Amines		
		280	Hydrazines
141	Aliphatic and Alicyclic, Primary		-
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	•
149	Aromatic Polyamines	295	Aliphatic and Alicyclic, Unsaturated
1 10	7 to made 1 diyaminoo		Acetylenes
150	Hydroxylamines and Ketoximes	296	Polyenes and Poly-ynes
130	Trydroxylamines and Retoxines		
160			
100	Anhydridae	300	Peroxides
	Anhydrides		
161	•	300 310	Peroxides  Hydroxylic Compounds
161	Aliphatic and Alicyclic	310	Hydroxylic Compounds
161 162	•		Hydroxylic Compounds  Aliphatic and Alicyclic, Primary
162	Aliphatic and Alicyclic Aromatic	310	Hydroxylic Compounds
	Aliphatic and Alicyclic	<b>310</b> 311	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary
162	Aliphatic and Alicyclic Aromatic	<b>310</b> 311 312	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary
162	Aliphatic and Alicyclic Aromatic	310 311 312 313	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols
162 170	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds	310 311 312 313 314 315	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary
162 170	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds	310 311 312 313 314 315 316	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols
162 170 210	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds Isocyanates	310 311 312 313 314 315 316 317	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols Naphthols
162 170 210 211	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds Isocyanates  Aliphatic and Alicyclic	310 311 312 313 314 315 316 317 318	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols Naphthols Aromatic, Others
162 170 210 211 212	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds  Isocyanates  Aliphatic and Alicyclic Aromatic	310 311 312 313 314 315 316 317	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols Naphthols
162 170 210 211	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds Isocyanates  Aliphatic and Alicyclic	310 311 312 313 314 315 316 317 318 330	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols Naphthols Aromatic, Others Elements
162 170 210 211 212	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds  Isocyanates  Aliphatic and Alicyclic Aromatic	310 311 312 313 314 315 316 317 318	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols Naphthols Aromatic, Others
162 170 210 211 212 220	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds Isocyanates  Aliphatic and Alicyclic Aromatic  Esters Carboxylic	310 311 312 313 314 315 316 317 318 330	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols Naphthols Aromatic, Others Elements  Inorganic Salts and Inorganic Salt Solutions
162 170 210 211 212 220 221 222	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds Isocyanates  Aliphatic and Alicyclic Aromatic  Esters Carboxylic  Formates Acetates	310 311 312 313 314 315 316 317 318 330	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols Naphthols Aromatic, Others Elements
162 170 210 211 212 220 221 222 223	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds  Isocyanates  Aliphatic and Alicyclic Aromatic  Esters Carboxylic  Formates Acetates Acrylates and Methacrylates	310 311 312 313 314 315 316 317 318 330 340	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols Naphthols Aromatic, Others Elements  Inorganic Salts and Inorganic Salt Solutions Inorganic Cyano Compounds
162 170 210 211 212 220 221 222 223 224	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds  Isocyanates  Aliphatic and Alicyclic Aromatic  Esters Carboxylic  Formates Acetates Acrylates and Methacrylates Aliphatic, Others	310 311 312 313 314 315 316 317 318 330	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols Naphthols Aromatic, Others Elements  Inorganic Salts and Inorganic Salt Solutions
162 170 210 211 212 220 221 222 223 224 225	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds Isocyanates  Aliphatic and Alicyclic Aromatic  Esters Carboxylic  Formates Acetates Acetates Acrylates and Methacrylates Aliphatic, Others Lactones	310 311 312 313 314 315 316 317 318 330 340 345	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols Naphthols Aromatic, Others Elements  Inorganic Salts and Inorganic Salt Solutions Inorganic Cyano Compounds Inorganic Gases and Vapors
162 170 210 211 212 220 221 222 223 224 225 226	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds Isocyanates  Aliphatic and Alicyclic Aromatic  Esters Carboxylic  Formates Acetates Acrylates and Methacrylates Aliphatic, Others Lactones Benzoates and Phthalates	310 311 312 313 314 315 316 317 318 330 340	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols Naphthols Aromatic, Others Elements  Inorganic Salts and Inorganic Salt Solutions Inorganic Cyano Compounds
162 170 210 211 212 220 221 222 223 224 225	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds Isocyanates  Aliphatic and Alicyclic Aromatic  Esters Carboxylic  Formates Acetates Acetates Acrylates and Methacrylates Aliphatic, Others Lactones	310 311 312 313 314 315 316 317 318 330 340 345 350	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols Naphthols Aromatic, Others Elements  Inorganic Salts and Inorganic Salt Solutions Inorganic Cyano Compounds  Inorganic Gases and Vapors  Inorganic Acid Halides
162 170 210 211 212 220 221 222 223 224 225 226	Aliphatic and Alicyclic Aromatic  Azo/Azox4 Compounds Isocyanates  Aliphatic and Alicyclic Aromatic  Esters Carboxylic  Formates Acetates Acrylates and Methacrylates Aliphatic, Others Lactones Benzoates and Phthalates	310 311 312 313 314 315 316 317 318 330 340 345	Hydroxylic Compounds  Aliphatic and Alicyclic, Primary Aliphatic and Alicyclic, Secondary Aliphatic and Alicyclic, Tertiary Aliphatic and Alicyclic, Polyols Aliphatic and Alicyclic, Substituted Phenols Naphthols Aromatic, Others Elements  Inorganic Salts and Inorganic Salt Solutions Inorganic Cyano Compounds Inorganic Gases and Vapors



		470	Organo-Metallic Compounds
370	Inorganic Acids		
		480	Organo-Silicon Compounds
380	Inorganic Bases		
		500	Sulfur Compounds
390	Ketones		
391	Aliphatic and Alicylic	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
		508	Thiones
431	Aliphatic and Alicyclic	509	Others
432	Aromatic		
		510	Nitrates and Nitrites
440	Nitro Compounds		
		520	Ureas
441	Unsubstituted		
442	Substituted	530	Zwittrerions
450	Nitroso Compounds	550	Organic Salts and Organic Salt Solutions
460	Organo-Phosphorus Compounds	590	Miscellaneous
461	Phosphines		
462	Derivates of phosphourus-based acids		

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