



Designation: F 1186 – 9903

An American National Standard

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

This standard is issued under the fixed designation F 1186; 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 ( $\epsilon$ ) 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

---

<sup>1</sup> This guide classification system is under the jurisdiction of ASTM Committee F23 on Protective Clothing and is the direct responsibility of Subcommittee F23.30 on Chemicals .

Current edition approved ~~Jan. July 10, 1999; 2003~~. Published ~~March 1999; September 2003~~. Originally published as F 1186 – 88; approved in 1988. Last previous edition approved in 1999 as F 1186 – 989.

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>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), 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.

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

<sup>5</sup> *Quick Selection Guide to Chemical Protective Clothing*, 3rd ed., Forsberg and Mansdorf, ~~Van Nostrand Reinhold, 111 Fifth Ave., New York, NY 10003, 1997.~~ 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
<b>100</b>	<b>Acids Carboxylic</b>
102	Aliphatic and Alicyclic, Unsubstituted
103	Aliphatic and Alicyclic, Substituted
104	Aliphatic and Alicyclic, Polybasic
105	Aromatic, Benzoic
106	Aromatic, Others
<b>110</b>	<b>Acid Halides, Carboxylic</b>
111	Aliphatic and Alicyclic
112	Aromatic
<u>113</u>	<u>Chloroformates</u>
<b>120</b>	<b>Aldehydes</b>
121	Aliphatic and Alicyclic
122	Aromatic
<b>130</b>	<b>Amides</b>
132	Aliphatic and Alicyclic
133	Aromatic
134	Acetanilides
135	Acrylamides
137	Carbamides and Guanidines
<b>140</b>	<b>Amines</b>
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
<b>150</b>	<b><u>Hydroxylamines and Ketoximes</u></b>
<b>160</b>	<b>Anhydrides</b>
161	Aliphatic and Alicyclic
162	Aromatic
<b>170</b>	<b><u>Azo/Azox4 Compounds</u></b>
<u>170</u>	<u>Azo/Azox4 Compounds</u>
<b>210</b>	<b>Isocyanates</b>
211	Aliphatic and Alicyclic
212	Aromatic
<b>220</b>	<b>Esters Carboxylic</b>
221	Formates
222	Acetates
223	Acrylates and Methacrylates
224	Aliphatic, Others
225	Lactones
226	Benzoates and Phthalates
227	Aromatic, Others
<b>230</b>	<b>Esters Non-Carboxylic</b>



231	Ortho Esters
232	Carbonates
233	Carbamates and Others
<b>240</b>	<b>Ethers</b>
241	Aliphatic and Alicyclic
242	Aromatic
243	Alkyl-Aryl
244	Ketals, Acetals
245	Glycol Ethers
246	Vinyllic
<b>260</b>	<b>Halogen Compounds</b>
261	Aliphatic and Alicyclic
263	Aromatic
264	Vinyllic
265	Allylic
266	Benzylic
<b>270</b>	<b>Heterocyclic Compounds</b>
271	Nitrogen, Pyridines
274	Nitrogen, Others
275	Oxygen, Epoxides
276	Carbohydrates
277	Oxygen, Furans
278	Oxygen, Others
279	Sulfur
<b>280</b>	<b>Hydrazines</b>
<b>290</b>	<b>Hydrocarbons</b>
291	Aliphatic and Alicyclic, Saturated
292	Aromatic
293	Aromatic Polynuclear
294	Aliphatic and Alicyclic, Unsaturated
295	Acetylenes
296	<u>Polyenes (ynes)</u>
296	<u>Polyenes and Poly-ynes</u>
<b>300</b>	<b>Peroxides</b>
<b>310</b>	<b>Hydroxylic Compounds</b>
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	<u>Aromatic, Phenols</u>
316	<u>Phenols</u>
317	<u>Aromatic, Naphthols</u>
317	<u>Naphthols</u>
318	Aromatic, Others
330	Elements
<b>340</b>	<b><u>Inorganic Salts (Solutions)</u></b>
<b>340</b>	<b><u>Inorganic Salts and Inorganic Salt Solutions</u></b>
345	Inorganic Cyano Compounds
<b>350</b>	<b>Inorganic Gases and Vapors</b>
<b>360</b>	<b>Inorganic Acid Halides</b>
365	Inorganic Acid Oxides
<b>370</b>	<b>Inorganic Acids</b>
<b>380</b>	<b>Inorganic Bases</b>
<b>390</b>	<b>Ketones</b>
391	Aliphatic and Alicyclic
392	Aromatic
393	Alkyl-Aryl



<b>410</b>	<b>Quinones</b>
<b>430</b>	<b>Nitriles</b>
431	Aliphatic and Alicyclic
432	Aromatic
<b>440</b>	<b>Nitro Compounds</b>
441	Unsubstituted
442	Substituted
<b>450</b>	<b>Nitroso Compounds</b>
<b>460</b>	<b>Organo-Phosphorus Compounds</b>
461	Phosphines
462	Derivates of phosphorus-based acids
<b>470</b>	<b>Organo-Metallic Compounds</b>
<b>480</b>	<b>Organo-Silicon Compounds</b>
<b>500</b>	<b>Sulfur Compounds</b>
501	Thiols
502	Sulfides and Disulfides
503	Sulfones and Sulfoxides
504	Sulfonic Acids
505	Sulfonyl Chlorides
506	Sulfonamides
	<del>Sulfonates, Sulfates, and Sulfites</del>
507	<u>Sulfonates, Sulfates, and Sulfites</u>
508	Thiones
509	Others
<b>510</b>	<b>Nitrates and Nitrites</b>
<b>520</b>	<b>Ureas</b>
<b>530</b>	<b><u>Zwitterions</u></b>
<b>550</b>	<b><u>Organic Salts (Solutions)</u></b>
<b>550</b>	<b><u>Organic Salts and Organic Salt Solutions</u></b>
590	Miscellaneous
590	<u>Miscellaneous</u>

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or [service@astm.org](mailto:service@astm.org) (e-mail); or through the ASTM website ([www.astm.org](http://www.astm.org)).