Designation: ~~F1194 – 99 (Reapproved 2010)~~ F1194 – 18

Standard Guide for Documenting the Results of Chemical Permeation Testing of Materials Used in Protective Clothing[1]

This standard is issued under the fixed designation F1194; 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.

INTRODUCTION

Promulgation of standard test methods for measuring the resistance of protective clothing materials to permeation by liquid or gaseous chemicals has fostered the generation of increasing volumes of material performance data. Not all data have been, nor will be, generated using Test Method F739.

To be useful, such data should be combined with information that specifies detailed characteristics of each test. These characteristics include information on the material specimens, challenge chemicals, test apparatus, analytical method used, and test conditions (for example, temperature). The sensitivity or detection limit of the test system is of particular importance in comparing the data from different sources during the protective clothing selection process.

To date, most reports on permeation testing have not included such specificity. This guide, therefore, presents a standard format for recording all required information and data. The standard format is intended to facilitate the use of electronic databases to store, retrieve, and apply test results.

1. Scope

1.1 This guide provides a format for documenting information and performance data from a permeation test.

1.2 Documented information and data are grouped into five major categories that define important aspects of each test:

1.2.1 Protective ~~Clothing Material,~~clothing material,

1.2.2 Test ~~Method,~~method,

1.2.3 Challenge ~~Chemical,~~chemical,

1.2.4 Test ~~Results,~~results, and

1.2.5 Source of the ~~Data.~~data.

1.3 Use of this guide is facilitated by adherence to the procedures outlined in a standard test method.

1.4 *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. Referenced Documents

2.1 *ASTM Standards:*[2]

F739 Test Method for Permeation of Liquids and Gases through Protective Clothing Materials under Conditions of Continuous Contact

3. Significance and Use

3.1 This guide is intended to encourage thorough and consistent documentation of permeation testing and its results.

---

[1] This guide 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.

Current edition approved ~~Jan. 1, 2010~~June 1, 2018. Published ~~January 2010~~June 2018. Originally approved in 1989. Last previous edition approved in ~~2005~~2010 as ~~F1194 - 99~~F1194 – 99 (2010).~~(2005).~~ DOI: ~~10.1520/F1194-99R10.~~10.1520/F1194-18.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.2 Uniform information and performance data increase the likelihood of selecting proper chemical protective clothing material (CPC) by permitting direct comparisons of one product with another.

3.3 A standard format for test information and data also encourages computer storage of test results for easy retrieval, comparison, and correlations.

4. Data Fields

4.1 ~~The~~ A suggested reporting format is shown in ~~Annex A1~~Appendix X1, Fig. ~~A1.1~~X1.1.

4.2 If a particular data field is not applicable to the testing performed, insert "not applicable" in the field. If a particular piece of data has not been obtained, insert "no data" or "unknown" in the field.

4.3 A description of each field of information follows.

4.3.1 *Description of Product Evaluated*—A positive identification of the specific CPC product material evaluated.

4.3.1.1 *Condition Before Test* (~~field~~Field 1)—Notes the prior conditioning or treatment of the material specimen before testing. Examples are "new," "laundered," ~~after two weeks production usage," and "after decontamination." Any laundering or decontaminating procedures should be briefly described or referenced.~~and "following flexing and abrasion." Specify test methods or procedures that are used for conditioning or treating the material prior to testing. Also, specify the temperature, humidity, and duration of the environmental preconditioning of the specimens immediately prior to testing.

4.3.1.2 *Manufacturer* (Field 2)—~~Manufacturer (field 2)—The name, address~~The name, address, and telephone of the product producer. If unknown, then enter the source or supplier of the product.

4.3.1.3 *Product Identification* (~~field~~Field 3)—The manufacturer's code or catalog number, or "brand name" which uniquely describes the product tested.

4.3.1.4 *Lot Identification or Manufacture Date* (~~field~~Field 4)—The production lot/batch identification or date which uniquely identifies the product ~~which was evaluated. If this information cannot be found, enter the earliest date that the specific test product (sample) was known to exist, for example, the purchase date, supplier's stocking date, and so forth.~~that was evaluated.

4.3.1.5 *Thickness* (~~field~~ (Field 5)—(mm). The nominal thickness of the barrier material. Where polymers are coated on substrates, ~~a~~ obtain the coating thickness ~~may be available~~ from the manufacturer.

4.3.1.6 *Material Type* (~~field~~Field 6)—A generic description of the type of chemical resistant material that was tested. Examples are "neoprene," "natural rubber," and "nitrile rubber."

4.3.1.7 *Description* (~~field~~Field 7)—Includes items such as type of support fabric, supporting or substrate material basis weight, weight of material or substrate, and treatments such as surface chlorination.

4.4 *Challenge Chemical*—The pure chemical or chemical (mixture) to which the material specimen was exposed. The ~~exact identity of the chemical~~suggested reporting format in Appendix X1 ~~is essential for the user to determine if the data will be applicable to his situation. Provision is made for three component mixtures. More components can be entered~~provides for up to three components in a mixture. Enter more components if necessary.

NOTE 1—The exact identity of the chemical is essential for the user to determine if the data will be applicable to their situation.

4.4.1 *Chemical Name(s)* (~~field~~Field 8)—The name(s) of the component(s) ~~(of interest)~~ of the challenge chemical(s).

4.4.2 *CAS Number(s)* (~~field~~Field 9)—The unique registry number(s) assigned by the Chemical Abstracts Service of the American Chemical Society for each chemical component of the challenge chemical.

4.4.3 *Concentrations* (~~field~~Field 10)—The concentration of the components of the challenge chemical. If the challenge chemical is a mixture, the concentration of each component is ~~reported. For example~~reported, for example, as volume % for liquids or gases, mg/L for dissolved solids, and weight % for solids.

4.4.4 *Chemical Source* (~~field~~Field 11)—The manufacturer or supplier, catalog number, and the lot of the challenge chemical.

4.5 *Test Method*—A description of the test method and testing parameters used to generate the test results.

4.5.1 *Standard Test Method Used* (~~field~~Field 12)—Reference the specific standard test method and edition used (for example, Test Method F739–12$^{\varepsilon 1}$). If no standard test method was used, list "none."

4.5.2 ~~*Deviation From*~~*Deviations from Standard Test Method* (~~field~~Field 13)—~~Some testing conditions such as low volatile, insoluble, or very toxic chemicals, may require modifications to the standard test method. The differences could include description of an alternate permeation test cell.~~Include any differences from the referenced standards, such as an alternative permeation test cell or deviations from specific test conditions.

4.5.3 *Testing Laboratory* (~~field~~Field 14)—Include the name, address, and telephone number of the testing laboratory.

4.5.4 *Analytical Method and Calibration* (~~field~~Field 15)—A ~~general, not specific~~ general description of the method used to analyze for the challenge ~~chemical. An example is "GC/FID."~~chemical (an example is "GC/FID") and the method of calibrating the analytical method.

4.5.5 *Temperature* (~~field~~Field 16)—The temperature, in degrees Celsius (°C), at which the testing was carried out.

4.5.6 *Test Cell and Specimen Area Exposed* (~~field~~Field 17)—The surface area, in square centimetres (cm^2), of the test specimen exposed on the challenge side of the test cell and an image or description of the test cell used. Include any special methods used to mount the sample in the cell.

4.5.7 *Collection System and Sampling Frequency* ~~(field~~(Field 18)—Will normally be "open loop" ~~(single-pass),~~ (single pass), "closed loop" (recirculating), ~~or~~ "closed loop/aliquot replacement" (recirculating with aliquot replacement), ~~and so forth.~~ or "cumulative." Include information on the sampling frequency, for example, "one sample every 5 min." Include information on the sample volume, for example, "continuous analysis," or "aliquot sample volume of 0.001 L." Include information on any additional steps required for sample analysis.

4.5.8 *Collection Medium* ~~(field~~(Field 19)—The sorbent in which the chemical is collected for analysis. Examples are "nitrogen," "air," "saline solution," "5 % ~~methanol/95 %~~methanol/95 % water," and "gauze."

4.5.9 *Collection Medium Quantity* ~~(field~~(Field 20)—The volume ~~of sorbent~~ or amount of collection medium in the collection system. Units are litres (L) for liquids or gases and milligrams (mg) for solids. This data item is "not applicable" to solid sorbent or ~~open loop~~ open-loop collection systems.

4.5.10 *Collection Medium ~~Flowrate~~ Flow Rate* ~~(field~~(Field 21)—The ~~flowrate~~ flow rate of the ~~sorbent~~ collection medium through the collection system. The units are litres per minute (L/min) for liquids and gases. This field is "not applicable" for solid sorbent collection media.

4.5.11 *Breakthrough Detection Concentration* ~~(field~~(Field 22)—The ~~typical~~ concentration of each component of interest or individual chemical determined to be in the collection medium at the observed breakthrough time reported ~~below~~ in 4.6.4.

If no breakthrough was measured, the limit of quantification (LOQ) is reported. This is the minimum concentration of each component of interest or individual chemical that has been determined to give a measurable analytical instrument response in the test system. The units are typically reported in micrograms per litre ~~(µg/L).~~ (µg/L), but other appropriate units are acceptable.

4.5.12 *Test System Sensitivity Factor* (*SF*) ~~(field~~(Field 23)—A factor for comparing data produced in a given system with data from another system.

4.5.12.1 For ~~closed loop and aliquot/replacement systems~~ closed-loop, aliquot/replacement, and cumulative sampler systems, the factor is calculated ~~by~~by:

~~$SF_1 = C^*V/A$~~ (1)

$$SF_1 = C^*V/A = M/A \quad (1)$$

where:

~~C^* = the breakthrough detection concentration entered in field 22 (µg/L),~~
~~V = the volume of collection medium entered in field 20 (L), and~~
~~A = the exposed area of the tested sample entered in field 17 (cm^2).~~
~~SF_1 = (mg/cm^2)~~

C^* = the breakthrough detection concentration entered in Field 22 (µg/L),
V = the volume of collection medium entered in Field 20 (L),
A = the exposed area of the tested sample entered in Field 17 (cm^2),
M = the minimum detectable mass of chemical on a cumulative sampler (µg), and
SF_1 = (µg/cm^2).

4.5.12.2 For an ~~open loop or single pass~~ open-loop or single-pass system, the factor is calculated by:

~~$SF_2 = C^*F/A$~~ (2)

$$SF_2 = C^*F/A \quad (2)$$

where:

~~C^* = the breakthrough detection concentration entered in field 22 (µg/L),~~
~~F = the flow rate of the collection medium entered in field 21 (L/min), and~~
~~A = the exposed area of the tested sample entered in field 17 (cm^2).~~
~~SF_2 = ($mg/cm^2 \cdot min$)~~

C^* = the breakthrough detection concentration entered in Field 22 (µg/L),
F = the flow rate of the collection medium entered in Field 21 (L/min),
A = the exposed area of the tested sample entered in Field 17 (cm^2), and
SF_2 = (µg/cm^2·min).

4.5.13 *Comments/Other Conditions* ~~(field~~(Field 24)—~~Any unnoted~~ Include any other special test conditions or ~~other comments the researcher deems important should be included in this field.~~comments not noted elsewhere that are important in describing the test.

4.6 *Test Results:*

4.6.1 *Date Tested* ~~(field~~(Field 25)—~~Self-explanatory.~~Self-explanatory.

4.6.2 *Number of Specimens Tested* ~~(field~~(Field 26)—The number of replicates tested.

4.6.3 *Location Sampled From* ~~(field~~(Field 27)—The part of the ~~protective clothing (CPC)~~ CPC product from which the tested specimen was taken. Examples for gloves are "cuff," "palm," and "back."