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# Standard Guide for Documenting the Results of Chemical Permeation Testing of Materials Used in Protective Clothing<sup>1</sup>

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## 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,
- 1.2.2 Test method,
- 1.2.3 Challenge chemical,
- 1.2.4 Test results, and
- 1.2.5 Source of the 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.*

<sup>1</sup> 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.

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## 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

[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.

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 A suggested reporting format is shown in [Appendix X1, Fig. 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

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

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 1)—Notes the prior conditioning or treatment of the material specimen before testing. Examples are “new,” “laundered,” 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)—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 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 4)—The production lot/batch identification or date which uniquely identifies the product that was evaluated.

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

4.3.1.6 *Material Type* (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 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 suggested reporting format in [Appendix X1](#) 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 8)—The name(s) of the component(s) of the challenge chemical(s).

4.4.2 *CAS Number(s)* (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 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, as volume % for liquids or gases, mg/L for dissolved solids, and weight % for solids.

4.4.4 *Chemical Source* (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 12)—Reference the specific standard test method and edition used (for example, Test Method [F739–12<sup>e1</sup>](#)). If no standard test method was used, list “none.”

4.5.2 *Deviations from Standard Test Method* (Field 13)—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 14)—Include the name, address, and telephone number of the testing laboratory.

4.5.4 *Analytical Method and Calibration* (Field 15)—A general description of the method used to analyze for the challenge chemical (an example is “GC/FID”) and the method of calibrating the analytical method.

4.5.5 *Temperature* (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 17)—The surface area, in square centimetres (cm<sup>2</sup>), 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 18)—Will normally be “open loop” (single pass), “closed loop” (recirculating), “closed loop/aliquot replacement” (recirculating with aliquot replacement), 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 19)—The sorbent in which the chemical is collected for analysis. Examples are “nitrogen,” “air,” “saline solution,” “5 % methanol/95 % water,” and “gauze.”

4.5.9 *Collection Medium Quantity* (Field 20)—The volume 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 collection systems.

4.5.10 *Collection Medium Flow Rate* (Field 21)—The flow rate of the 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 22)—The concentration of each component of interest or individual chemical determined to be in the collection medium at the observed breakthrough time reported 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), but other appropriate units are acceptable.

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