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Standard Test Method for Evaluation of Glove Effects on Wearer Finger Dexterity Using a Modified Pegboard Test¹

This standard is issued under the fixed designation F2010/F2010M; 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.

1. Scope

1.1 This test method is used for evaluating finger dexterity while wearing gloves.

1.1.1 This test method covers procedures in which the wearer picks up small objects between the thumb and index finger.

1.2 This test method is suitable for evaluating gloves and other forms of hand protection that allow the wearer to pick up small objects between their thumb and index finger.

1.3 This test method does not address all effects of glove use on hand function. Other methods should be considered to evaluate the effects of gloves on grip, tactility, and other hand functions of interest.

NOTE 1—This test method may not apply to all glove types or applications.

1.4 The values stated in SI units or in other units shall be regarded separately as standard. The values stated in each system must be used independently of the other, without combining values in any way.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *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.*

¹ This test method is under the jurisdiction of ASTM Committee F23 on Personal Protective Clothing and Equipment and is the direct responsibility of Subcommittee F23.60 on Human Factors.

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2. Referenced Documents

2.1 *ASTM Standards:*²

F1494 Terminology Relating to Protective Clothing

F2961 Test Method for Characterizing Gripping Performance of Gloves Using a Torque Meter

2.2 *BSI Standard:*³

BS EN 420 Protective Gloves—General Requirements and Test Methods

3. Terminology

3.1 *Definitions:*

3.1.1 *dexterity, n*—a hand function referring to the ability of the individual to manipulate objects with their hands.

3.1.1.1 *Discussion*—Dexterity may be classified as requiring fine motor skills in which relatively small objects are manipulated, or those involving gross motor skills in which relatively large objects are handled.

3.1.2 *glove, n*—an item of protective clothing designed and constructed for protecting the hand and wrist.

3.1.3 *hand function, n*—the relative motion and manipulative abilities of the hand.

3.1.3.1 *Discussion*—In this test method, the effect of gloves on a specific hand function, dexterity, is evaluated.

3.1.4 *protective clothing, n*—a product which is designed and constructed for the purpose of isolating parts of the body from a potential hazard.

3.1.4.1 *Discussion*—In this test method, gloves are evaluated to determine the effect on the hand function of the wearer.

3.1.5 For definitions of other protective clothing-related terms used in this test method, refer to Terminology F1494.

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 Available from British Standards Institution (BSI), 389 Chiswick High Rd., London W4 4AL, U.K., <http://www.bsigroup.com>.

4. Summary of Test Method

4.1 The time required for a test subject to place pegs into a pegboard is measured without gloves and then later while wearing gloves. The percentage difference in the times required to perform the task while wearing gloves, as compared to not wearing the gloves, is reported and is used to indicate the effects of the gloves on wearer finger dexterity.

5. Significance and Use

5.1 The test method is intended to provide a quantitative measurement about the effect of gloves on wearer finger dexterity by comparing the times required to perform a simple task with and without gloves.

5.2 This test method does not discriminate all glove effects on wearer hand function or apply to all glove types and applications. Additional evaluations or tests representative of the glove use application are recommended to determine the overall impact of gloves on wearer hand function.

5.2.1 Test Method **F2961** provides an assessment for the impact of gloves' grip by measuring the torque force associated with turning a cylindrical object both with and without gloves.

5.2.2 Clause 6.2 of BS EN 420 assesses gloved tactility by determining the diameter of a metal pin that can be picked up off a flat, smooth surface and grasped.

5.3 Results from this test can be influenced by many factors, including relative fit of the gloves and the age, gender, and general health conditions of the subjects. Exercise care when comparing the results using different subjects.

6. Apparatus

6.1 *Test Apparatus*—A pegboard apparatus consisting of 25 stainless steel pins and a pegboard. Each stainless steel pin shall have a diameter of $9.5 \text{ mm} \pm 0.26 \text{ mm}$ [$0.375 \text{ in.} \pm 0.01 \text{ in.}$] and length of $38.0 \text{ mm} \pm 0.25 \text{ mm}$ [$1.5 \text{ in.} \pm 0.01 \text{ in.}$]. The pegboard shall be $200 \text{ mm} \pm 13 \text{ mm}$ [$8.0 \text{ in.} \pm 0.5 \text{ in.}$]. The pegboard shall have 25 holes, with each hole having a diameter of $10.0 \text{ mm} \pm 0.25 \text{ mm}$ [$0.39 \text{ in.} \pm 0.01 \text{ in.}$] and a depth of $13.0 \text{ mm} \pm 0.5 \text{ mm}$ [$0.5 \text{ in.} \pm 0.02 \text{ in.}$]. The holes shall be in a five-by-five pattern, and each hole shall have a separation of $25 \text{ mm} \pm 2 \text{ mm}$ [$1.0 \text{ in.} \pm 0.1 \text{ in.}$] from adjacent holes.

6.2 *Stopwatch*, to measure the time to place the pegs into the pegboard in seconds.

6.3 *Test Surface*—An area at least 600 mm by 900 mm [23.5 in. by 33.5 in.] with a flat, level, smooth surface having a hardness of 50 ± 5 Shore A.

6.3.1 Use a test surface that has a raised edge along its border to prevent the pegs from rolling off the testing surface.

7. Test Specimen

7.1 For each style of glove evaluated, test three pairs of gloves for each size, in at least two different sizes.

NOTE 2—If only two sizes are selected for testing, it is recommended that the selected sizes for evaluation represent two different user populations of gloves that are commonly used, such as small for female hands and large for male hands. It is recognized that an evaluation of all available sizes using a larger number of diverse human subjects provides a more comprehensive evaluation for the effects for gloves on wearer hand function.

7.2 If the specific glove being evaluated is offered in one size, test six pairs of gloves using the one available size, and select test subjects of varying hand dimensions in terms of hand width and length.

7.3 Test each glove in new, as-distributed condition. Do not apply special softening treatments to gloves prior to tests.

8. Test Preparation

8.1 Evaluate each pair of gloves with a separate test subject.

8.1.1 Use equal numbers of male and female subjects.

8.2 Choose gloves that provide a fit according to the manufacturer's recommended sizing guidelines, where such size guidelines are provided. Otherwise, allow the test subject to choose the gloves that provide the best fit among the available sizes provided by the manufacturer.

NOTE 3—Different types of sizing guidelines are available from glove manufacturers that depend on the type of glove and the number of glove layers in the glove design. Some glove systems are based on hand measurements, while others do not have any associated hand dimensions.

8.3 Familiarize test subjects with the test apparatus and procedure by having test subjects practice the test three times before conducting an actual test, but not on the same day as the actual test. Each test subject should use their dominant hand in picking up pegs.

8.4 Use test subjects that have a baseline dexterity time between 25 s and 45 s.

8.5 Test subjects need to have vision that is correctable to at least 20/20.

9. Procedure

9.1 Before each test, randomly scatter the pegs on the test surface adjacent to the pegboard (lying flat on the test surface) in the working area most comfortable to the test subject (that is, on the right side for right-handed test subjects and on the left side for left-handed test subjects, or directly in front).

9.2 Instruct the test subject to pick up with one hand (using their dominant hand) one peg at a time and place them in the pegboard beginning at the upper left corner and proceeding left to right and top to bottom. Instruct the test subject to pick up each peg with a pincer motion near the center of the barrel of the peg and not by sliding, standing, or otherwise supporting the peg with another object (such as the pegboard, another peg, or the test subject's free hand). Instruct the test subject to use only one hand, and not to alternate hands during the test series. Instruct the test subject that the pegboard may be stabilized, if necessary, such as with the use of the test subject's free hand.

9.2.1 Alternatively, the testing can be reversed for a left-handed test subject who prefers picking up with one hand one peg at a time and placing them in the pegboard beginning at the upper right corner and proceeding right to left and top to bottom.

9.3 Measure the time for the test subject to put pegs into the pegboard, beginning when the test subject touches the first peg until the test subject places the last peg into the pegboard.

9.4 Perform steps 9.1 – 9.3 with the test subject barehanded. Repeat this procedure until the coefficient of variation is less than 10%.