Designation: F 1236 – 96$^{\epsilon 1}$

# Standard Guide for Visual Inspection of Electrical Protective Rubber Products [1]

This standard is issued under the fixed designation F 1236; 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.

$\epsilon^1$ NOTE—Figures 6, 23, and 37 were added and figures renumbered in May 1997.

## 1. Scope

1.1 The purpose of this guide is to present methods and techniques for the visual inspection of electrical protective rubber products. This guide also includes descriptions and photographs of irregularities found in these products.

NOTE 1—It is not the purpose of this guide to establish the acceptance level of any irregularity described herein. That shall be established by the standard for each product.

1.2 The values stated in inch-pound units are to be regarded as standard. The SI units in parentheses are for information only.

1.3 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*

F 496 Specification for In-Service Care of Insulating Gloves and Sleeves [2]

F 819 Definitions of Terms Relating to Electrical Protective Equipment for Workers [2]

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *abrasions and scratches*—surface damage that normally occurs when a product makes contact with an abrasive surface. Scuff-like damage can also occur from a brush contact with a hot object such as a soldering iron. This can sometimes look like the graining on leather (see Fig. 1 and Fig. 2).

3.1.2 *age cracks*—surface cracks that may look like the crazing of glazed ceramics and become progressively worse with time. It is normally a slow oxidation process caused by exposure to sunlight and ozone in the atmosphere and starts in areas of the rubber that are under stress (see Fig. 3).

3.1.3 *breakdown*—the electrical discharge or arc occurring between the electrodes and through the equipment being tested (see Fig. 4).

3.1.4 *chemical bloom*—a white or yellowish discoloration on the surface of a rubber product caused by the migration to the surface of chemical additives used in the manufacture of the finished product (see Fig. 5).

3.1.5 *color splash*—a spot or blotch on the surface of a rubber product that occurred during the manufacturing process when a contrasting colored particle of unvulcanized rubber became embedded into the finished product (see Fig. 6).

3.1.6 *cuts*— smooth incisions in the surface of the rubber that are usually caused by a sharp-edged object that can increase in size when they are placed under strain (see Fig. 7).

3.1.7 *depressions or indentations*—a shallow recess in the surface of the rubber that exhibits a thinner rubber thickness at the bottom of the depression than in the surrounding areas (see Fig. 8).

3.1.8 *detergent cracks*—cracks that appear on the inside surface of a glove or sleeve that encircle the outline of a spot of detergent residue that was not removed during the cleaning and rinsing of the form prior to the dipping process.

3.1.9 *embedded foreign matter*—a particle of non-rubber material that has been molded into the finished product and may appear as a bump when the rubber is stretched (see Fig. 9).

3.1.10 *form marks*—a raised or indented section on the surface of the rubber that was caused by an irregularity in the form.

3.1.11 *hard spot*—a hardened area on the rubber surface that is usually caused by exposure to high heat or chemical attack (see Figs. 10-13).

3.1.12 *mold marks*—a raised or indented section on the surface of the rubber that was caused by an irregularity in the mold (see Figs. 14 and 15).

3.1.13 *nicks, snags, or scratches*—angular tears, notches, or chip-like injuries in the surface of the rubber that have been caused by barbed wire, sharp pointed tools, staples, splinters or similar sharp edged hazards (see Fig. 2, Fig. 16, and Fig. 17).

3.1.14 *ozone cracks*—a series of interlacing cracks that may start at stress points and quickly worsen as a result of rapid oxidation in a highly concentrated ozone atmosphere usually produced by electrical arcing (see Fig. 18 and Fig. 19).

3.1.15 *parting line or flash line*—a ridge of rubber left on finished products occurring at mold joints during the manufacturing process.

[1] This guide is under the jurisdiction of ASTM Committee F-18 on Electrical Protective Equipment for Workers and is the direct responsibility of Subcommittee F18.60 on Terminology.

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[2] *Annual Book of ASTM Standards*, Vol 10.03.

3.1.16 *pitting*—a pit-like depression in the surface of the rubber that may have been created by the rupturing of an air bubble at or near the surface of the rubber during the manufacturing process (see Fig. 20).

3.1.17 *protuberance*—bulge or swelling that protrudes above the surface of the rubber that may have occurred during manufacture (see Fig. 21).

3.1.18 *puncture*—penetration by a sharp object through the entire thickness of the rubber product (see Fig. 22).

3.1.19 *repair marks*—an area on the surface of the finished product that has a different texture due to the repair or reworking of an irregularity in the mold or form (see Fig. 23).

3.1.20 *runs*— raised flow marks that may occur on the fingers of rubber gloves during the dipping process.

3.1.21 *skin breaks*—cavities in the surface of the rubber with filmy ragged edges and smooth interior surfaces that are normally caused by embedded dirt specks during manufacture.

3.1.22 *soft spots*—surface areas of the rubber that have become soft and sometimes tacky as a result of exposure to heat, oils, or chemical solvents.

3.1.23 *tears*— a separation of the rubber through its entire thickness, usually at an edge, that has been created by a forceful pulling apart of the rubber (see Fig. 24).

3.1.24 *tracking*—the formation of a carbonized path on the surface of a solid insulating medium, resulting from excessive current leakage over the surface (see Fig. 25 and Fig. 26).

## 4. Significance and Use

4.1 This guide provides inspection techniques that may be used to examine electrical protective rubber products for irregularities. The methods have applications in manufacturing locations, testing facilities, and in the field where the products are used.

4.2 This guide also contains photographs that supplement the descriptions of terms listed in Section 3 and in Definitions F 819.

## 5. Inspection Methods

5.1 *Rolling:*

5.1.1 Inspect glove and sleeve surface areas by gently rolling their entire outside and inside surface areas between the hands. This technique requires gently squeezing together the inside surfaces of the glove or sleeve to bend the outside surface area and create sufficient stress to inside surfaces of the glove or sleeve to highlight cracks, cuts, or other irregularities. When the entire outside surface area has been inspected in this manner, turn the glove or sleeve inside-out and repeat the inspection on the inside surface (now on the outside). If necessary, a more careful inspection of suspicious areas can be achieved by gently pinching and rolling the rubber between the fingers. Never leave a glove or sleeve in an inside-out condition. Stretch the thumb and finger crotches by pulling apart adjacent thumb and fingers to look for irregularities in those areas (see Fig. 27 and Fig. 28).

5.1.2 Place rubber blankets on a clean, flat surface and roll up tightly starting at one corner and rolling toward the diagonally opposite corner. Inspect the entire surface for irregularities as it is rolled up. Unroll the blanket and roll it up again at right angles to the original direction of rolling. Repeat the rolling operations on the reverse side of the blanket (see Fig. 29).

5.1.3 Examine the inside surfaces of the insulating line hose by holding the hose at the far end from the lock and placing both hands side-by-side palms down around the hose. With the slot at the top and the long free end of the hose on the left, slowly bend the two ends of the hose downward while forcing the slot open with the thumbs. The hose should be open at the bend, exposing the inside surface. Slide the left hand about a foot down the hose and then, with both hands firmly gripping the hose, simultaneously move the left hand up and the right hand down to pass this section over the crown of the bend for inspection. Slide the right hand up the hose to the left hand. Hold the hose firmly with the right hand while the left hand again slides another foot down the hose. Repeat the inspection and, in this way, the entire length of hose passes through the hands from one end to the other.

5.2 *Inflation*:

5.2.1 Punctures and other small holes in rubber insulating gloves can be found by inflating the gloves with air pressure. Gloves can be inflated manually by grasping the side edges of the glove opening (see Fig. 30) and stretching gently, side-by-side, to close and slightly seal the open end, (see Fig. 31). Roll up the gauntlet end about 1½ in. (38 mm) toward the palm by twirling the glove in a rotating motion using the rolled edges of the glove opening as an axis. Grasp the rolled up end in one hand to contain the entrapped air in the palm and fingers (see Fig. 32). Hold the inflated glove close to one ear and, with the free hand, squeeze the glove palm to increase the air pressure while listening and feeling for pinhole leaks (see Fig. 33). Release the entrapped air.

5.2.2 To entrap air in heavy weight gloves, it may be necessary to lay the glove on a flat surface, palm up, and press the open end closed with the fingers, (see Fig. 34). While holding the end closed, tightly roll up about 1½in. (38 mm) of the gauntlet (see Fig. 35). Grasp the rolled-up end and inspect for small holes in accordance with 5.2.1 (see Fig. 36).

5.2.3 Mechanical glove or sleeve inflaters may also be used to inspect the surface areas of the products (see Fig. 37).

5.2.4 Take care not to over inflate the gloves and sleeves as noted in Specification F 496, since their physical characteristics may be adversely affected by over inflating. Type 1 gloves and sleeves shall not be inflated or stretched to more than twice their normal size. Type 2 gloves and sleeves shall not be inflated or stretched to more than 1.25 times their normal size.

5.3 *Lighting*—The visual inspection of electrical protective rubber products requires good lighting and the products should be thoroughly cleaned before inspection. The light source should be at least 200 fc (2152.81x) with a reflector and should be adjustable for different lighting conditions. Some irregularities can be more easily seen with the light shining down on the surface being examined; other irregularities require a low angle of light to allow the defect to cast a shadow in order to be seen.

FIG. 1 Abrasion

FIG. 3 Age Cracks

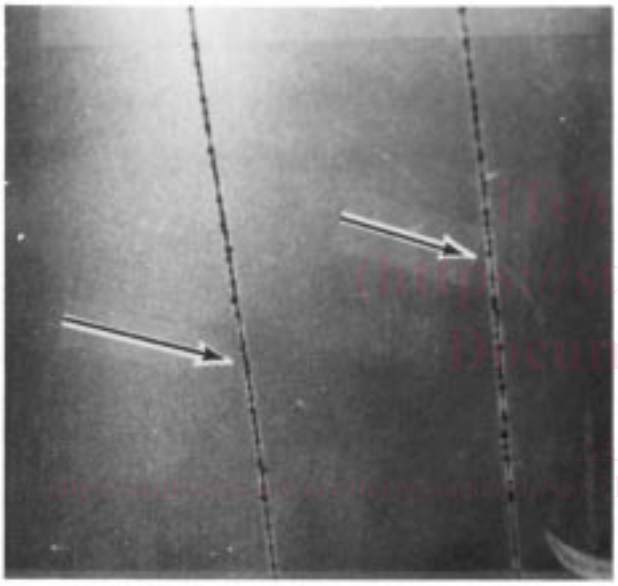

FIG. 2 Scratches

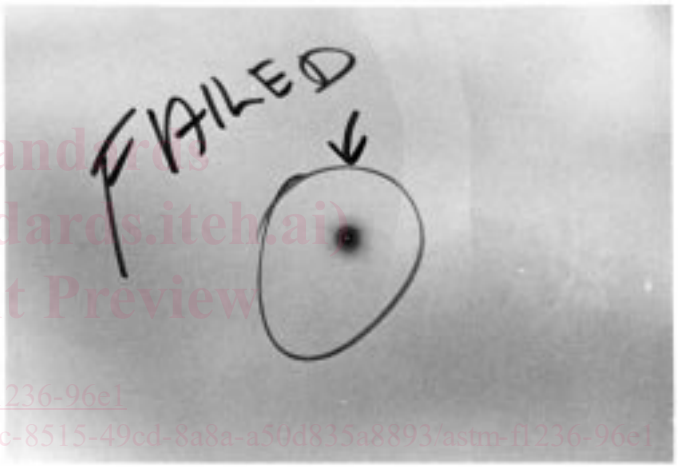


FIG. 4 Breakdown (Dielectric Failure)

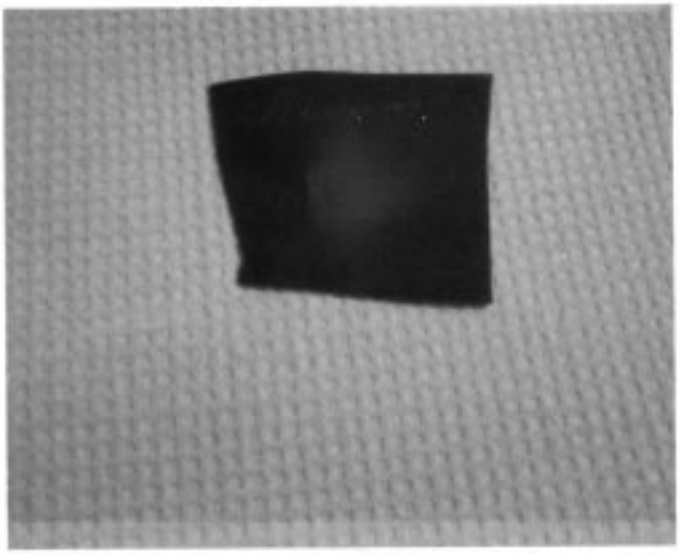

FIG. 5 Chemical Bloom

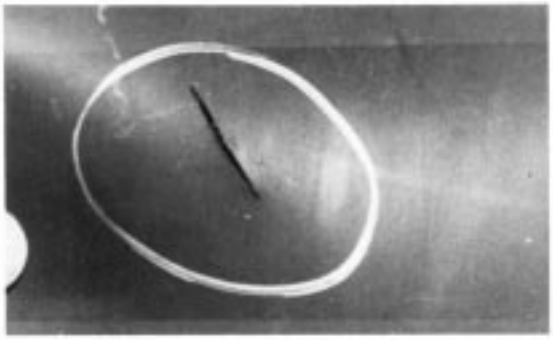

FIG. 7 Cuts

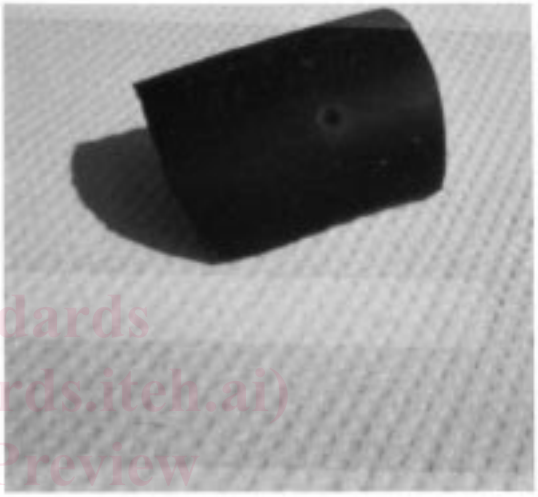

FIG. 8 Depressions or Indentations

FIG. 6 Color Splash

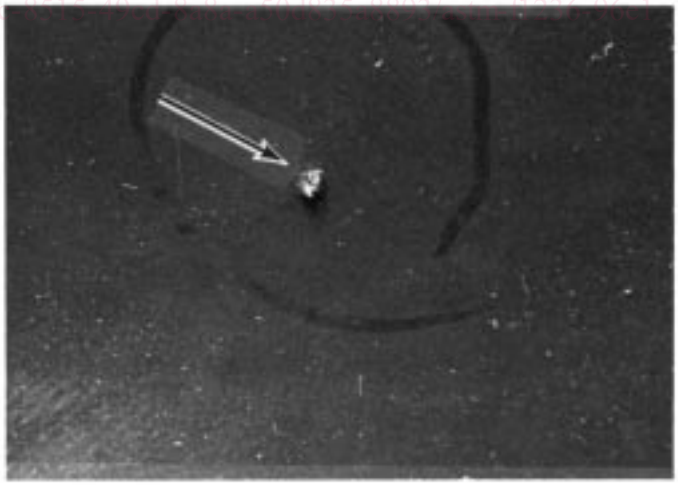

FIG. 9 Foreign Matter

FIG. 10 Hard Spot

FIG. 11 Hard Spot

FIG. 12 Hard Spot

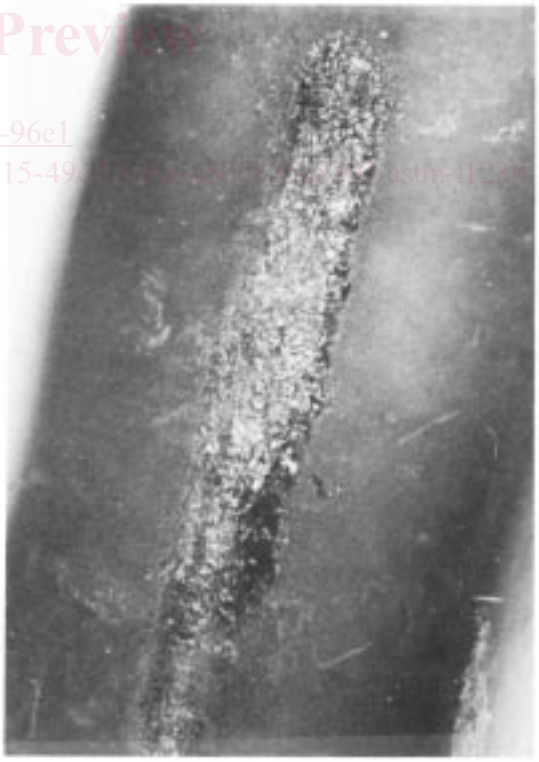

FIG. 13 Hard Spot

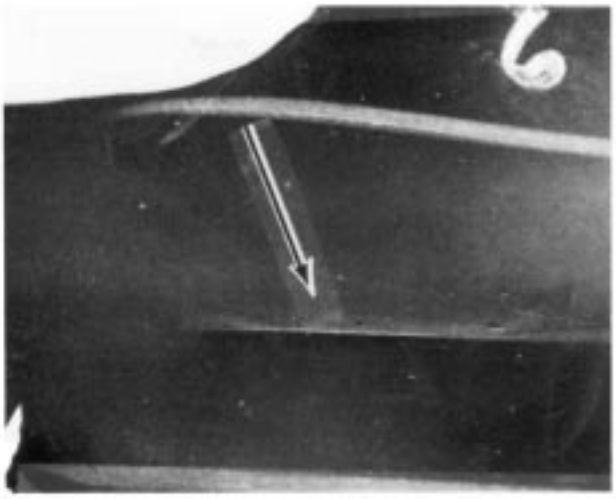

FIG. 14 Mold Marks

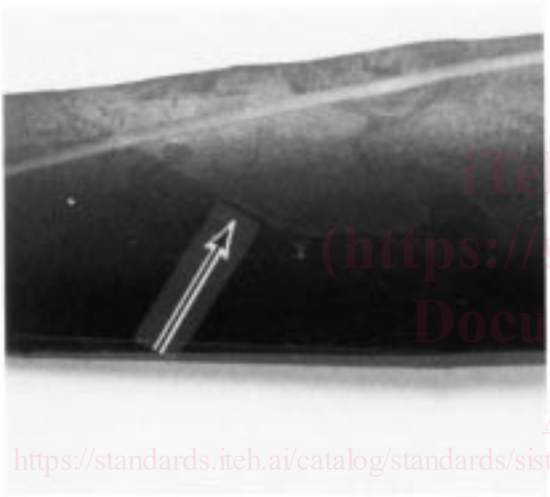

FIG. 15 Mold Marks

FIG. 16 Nick

FIG. 17 Snag