Designation: E2016 – 15

Standard Specification for Industrial Woven Wire Cloth[1]

This standard is issued under the fixed designation E2016; 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

Industrial wire cloth can be produced in many thousands of combinations of size and shape of opening, wire diameter, type of weave, and metal. This specification covers woven wire cloth for industrial use, including the separation of particles. Its purpose is to introduce standard terms and definitions, to note the normal range of specifications woven, and to establish tolerances and requirements. This specification excludes sieve cloth from its scope, since this is covered under Specification E11. If a user has a specific application for industrial wire cloth that is not within the scope of this specification, it is recommended that the wire cloth supplier be consulted.

1. Scope

1.1 This specification covers industrial woven wire fabric, referred to as wire cloth, for general use including the separation of particles. Wire cloth can be made of any primary metal or metal alloy wire that is suitable for weaving. This specification does not apply to the following special types of wire cloth: filter cloth or dutch weave (see Appendix X1), fourdrinier and cylinder cloth, galvanized hardware cloth, insect wire screening, spiral weave wire cloth, testing sieve cloth, or welded wire cloth.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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.*

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]

A510 Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

A555/A555M Specification for General Requirements for Stainless Steel Wire and Wire Rods

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

E1638 Terminology Relating to Sieves, Sieving Methods, and Screening Media

E2814 Guide for Industrial Woven Wire Filter Cloth

3. Terminology

3.1 *Definitions*—For definitions of related terms, refer to Terminology E1638.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *aperture, n*—the opening in a screening or sieving medium.

3.2.2 *aperture size, n*—the dimension defining an opening in a screening or sieving medium (see also *width opening*).

3.2.3 *bolting cloth, n*—wire cloth meeting a group of specifications that are typical for higher sifting capacities and which can speed the bolting action of vibratory screening machines, manufactured based on using a limited number of wire diameters for a large group of mesh designations.

3.2.3.1 *Discussion*—"Bolting Grade" designations are often misused; and should not be specified without a wire diameter, as the designations have become non-standard.

[1] This specification is under the jurisdiction of ASTM Committee E29 on Particle and Spray Characterization and is the direct responsibility of E29.01 on Sieves, Sieving Methods, and Screening Media.

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[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.

3.2.4 *firmness, n*—a subjective term referring to the planar rigidity of wire cloth (as a roll good, not mounted in a frame).

3.2.4.1 *Discussion*—Firmness is established by the tensile strength of the material, the relationship of the mesh to wire diameters, the type of weave, and amount of crimp in the wires. The absence of firmness in wire cloth is termed *sleaziness*.

3.2.5 *market grade wire cloth, n*—wire cloth meeting a group of specifications that are typical for use in the general industrial market, manufactured based on using a different wire diameter for each of the common mesh designations.

3.2.5.1 *Discussion*—"Market Grade" designations are often misused; and should not be specified without a wire diameter, as the designations have become non-standard.

3.2.6 *mesh, n*—the number of wires or openings per linear inch (25.4 mm), counted from the center of any wire to a point exactly 1 in. (25.4 mm) distant, including the fractional distance between either thereof.

3.2.7 *mill grade wire cloth, n*—wire cloth meeting a group of specifications that are typical for milling grain and other light screening, manufactured based on using a different wire diameter for each of the common mesh designations.

3.2.7.1 *Discussion*—"Mill Grade" designations are often misused; and should not be specified without a wire diameter, as the designations have become non-standard.

3.2.8 *percent open area, n*—the ratio of the area of the openings to the total area expressed as a percentage, that theoretically can be calculated as follows:

$$OA = (1 - M_w\ D_w)(1 - M_s\ D_s)(100) \quad (1)$$

where:

OA = the percent open area,
M_w = the mesh warp,
M_s = the mesh shute,
D_w = the diameter warp wire, and
D_s = the diameter shute wire.

3.2.9 *rectangular (off-count) mesh, n*—either precrimp or double crimp wire cloth having a different number of wires in the warp and shute, producing rectangular openings; the diameter of the warp and shute wires may be the same or different.

3.2.10 *screen, n*—(*1*) a surface provided with apertures of uniform size and shape; (*2*) another term used interchangeably for woven wire cloth; and (*3*) a machine provided with one or more screen surfaces.

3.2.11 *selvage, n*—the edge or border of wire cloth finished off so as to prevent unraveling; examples of finished edges include looped selvage (see Fig. 1), folded selvage (see Fig. 2), cut and tucked (see Fig. 3), welded, plastic bonded, and bent-back picket, as opposed to a raw or cut edge (see Fig. 4).

3.2.12 *shute wires, n*—the wires running the short way of, or across the cloth as woven (also referred to as the shoot, fill, or weft wires).

3.2.13 *sieve cloth, n*—woven wire cloth conforming to Specification E11.

3.2.13.1 *Discussion*—Sieve cloth is generally used for the determination of particle size as opposed to the separation of particles.

3.2.14 *sleaziness, n*—wire cloth that does not exhibit firmness.

3.2.15 *space cloth, n*—wire cloth that is designated by the width of the open spaces between the inside faces of adjacent parallel wires, expressed in inches or the metric equivalent (see 4.2 for the normal range of space cloth specifications).

3.2.16 *square mesh, n*—wire cloth having the same number of wires in both the warp and shute.

3.2.17 *Types of Crimps:*

3.2.17.1 *crimp, n*—the corrugation in the warp or shute wire, or both.

3.2.17.2 *Discussion*—The crimp in the wires is formed either during the weaving process, or with a crimping machine prior to weaving. If formed during the weaving process, the tension existing between the warp and shute wires fundamentally determines the respective amount or depth of crimp, which locks the wires in place and in part establishes the firmness of the wire cloth.

3.2.17.3 *double crimp wire cloth, n*—wire cloth woven with approximately equal corrugations in both the warp and shute wires to lock the wires in position (see Fig. 5).

3.2.17.4 *flat top wire cloth, n*—wire cloth with deep crimps, as in lock crimp, except that all crimps are on the underside of the cloth, leaving the top surface all in one plane.

3.2.17.5 *Discussion*—Sometimes designated smooth top (see Fig. 6).

3.2.17.6 *intermediate crimp wire cloth, n*—precrimped wire cloth with extra crimps or corrugations between the points or intersection.

3.2.17.7 *Discussion*—Sometimes designated intercrimp or multiple crimp (see Fig. 7).

3.2.17.8 *lock crimp wire cloth, n*—precrimped wire cloth with deep crimps at points of intersection to lock the wires securely in place (see Fig. 8).

3.2.17.9 *precrimp wire cloth, n*—wire cloth woven with both the warp and shute wires crimped before weaving.

3.2.17.10 *triple shute wire cloth, n*—wire cloth woven with three shute wires inserted adjacent to each other, often constructed in conformance with precrimp rectangular.

3.2.18 *Types of Weaves:*

3.2.18.1 *herringbone twill, n*—wire cloth in which the direction of a twilled weave is reversed at regular intervals to produce a striped or herringbone effect.

3.2.18.2 *plain, n*—wire cloth in which the warp wires and shute wires pass over one and under one wire in both directions (see Fig. 9).

3.2.18.3 *twill, n*—wire cloth in which the warp wires and shute wires pass over two and under two wires in both directions (see Fig. 10).

3.2.19 *warp wires, n*—the wires running the long way of the cloth as woven.

3.2.20 *weight per unit area, n*—the weight per square foot for wire cloth can be approximated (without consideration for crimp) by the following equation:

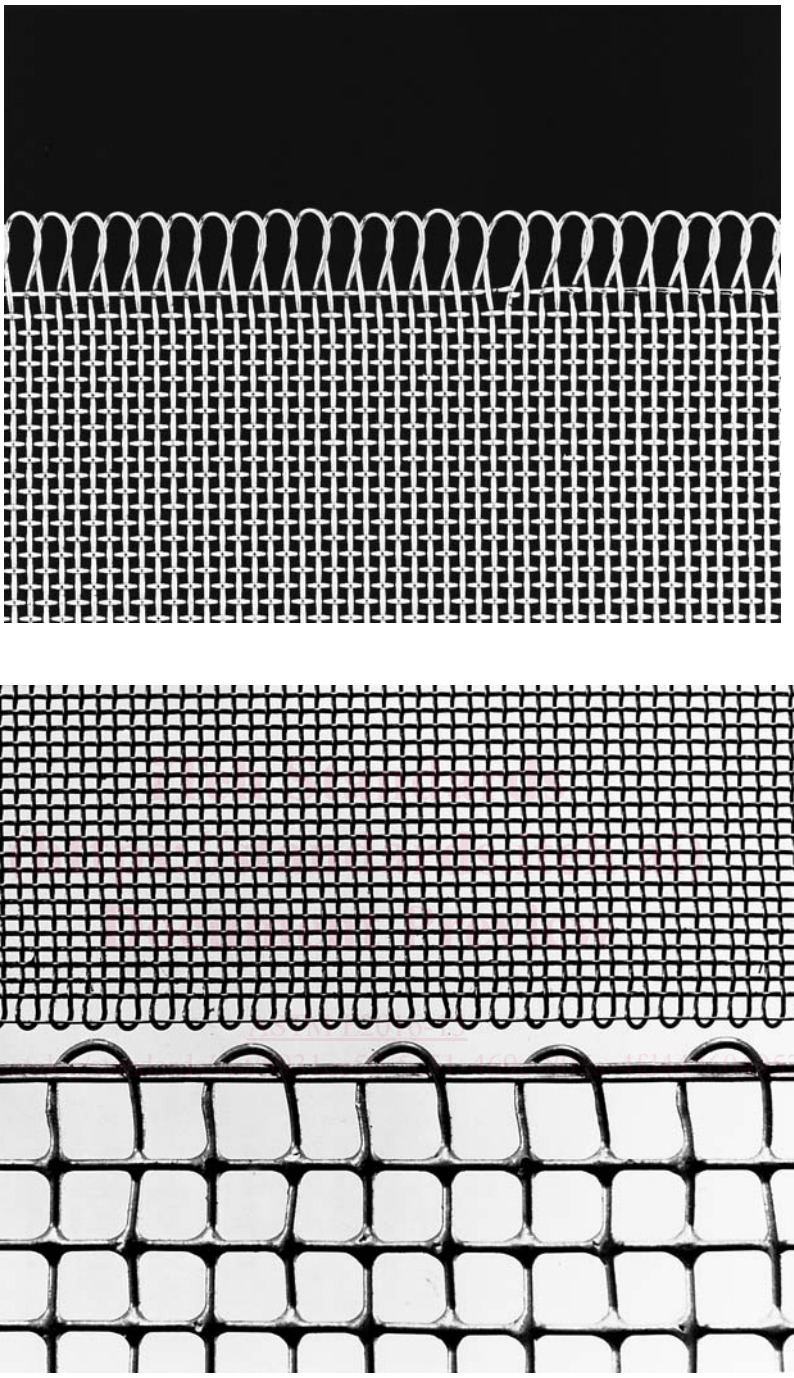


FIG. 1 Looped Edge

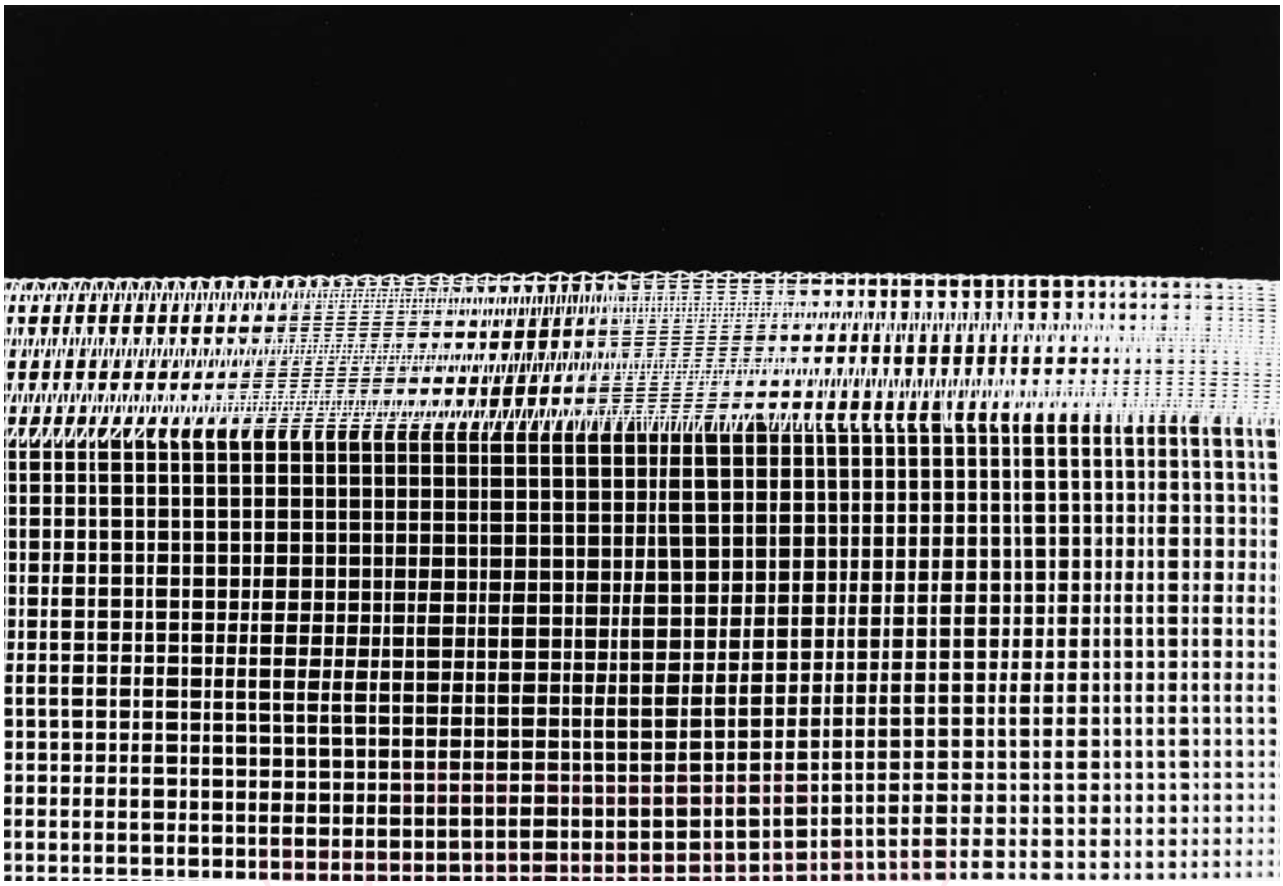


FIG. 2 Folded Edge

$$\text{Wt/ft}^2 = (12\ M_w\ (12\pi\ (D_w{}^2/4)\ \rho)) + (12\ M_s\ (12\pi\ (D_s{}^2/4)\ \rho)) \quad (2)$$

where:

Wt/ft^2 = the weight (lb/ft^2),
M_w = the mesh warp (number of wires per inch),
M_s = the mesh shute (number of wires per inch),
D_w = the diameter warp wire (decimal parts of an inch),
D_s = the diameter shute wire (decimal parts of an inch),
ρ = the density of material (lb/in.^3) (0.2836 for plain or carbon steel), and
π = the constant 3.1416,

which for square mesh wire cloth with the same wire diameter in both the warp and shute reduces to:

$$\text{Wt/ft}^2 = 72\pi\rho MD^2$$

where:

Wt/ft^2 = the weight (lb/ft^2) per square foot,
M = the mesh (number of wires per inch), and
D = the diameter wire (decimal parts of an inch).

3.2.20.1 *Discussion*—See Table 1 for a listing of conversion factors from plain steel for various other metals and alloys. The theoretical mass/unit area can be similarly calculated with SI units or an approximate multiplier factor of 4.8824 can be used to obtain kg/m^2.

3.2.21 *width opening, n*—distance between two parallel adjacent warp or shute wires, measured in the projected plane.

3.2.21.1 *Discussion*—The theoretical width of an opening in the direction of interest can be calculated by subtracting the nominal wire diameter from the reciprocal of the mesh in that direction as follows:

$$Opn = (1/M) - D \quad (3)$$

where:

Opn = the width opening (in decimal parts of an inch),
M = the mesh, and
D = the diameter wire (in decimal parts of an inch).

The theoretical width of an opening can be calculated similarly with SI units converting the pitch ($1/M$) to millimetres by the multiplier factor 25.4 and subtracting the wire diameter in millimetres.

4. Wire Cloth Specifications

4.1 *Normal Range of Double-Crimp, Square Mesh Wire Cloth (Expressed By Mesh):*

4.1.1 *Carbon Steel*—For the normal range of woven wire cloth specifications for double-crimp, square mesh carbon steel, see Table 2.

4.1.2 *Stainless Steel*—For the normal range of woven wire cloth specifications for double-crimp, square mesh stainless steel, see Table 3.

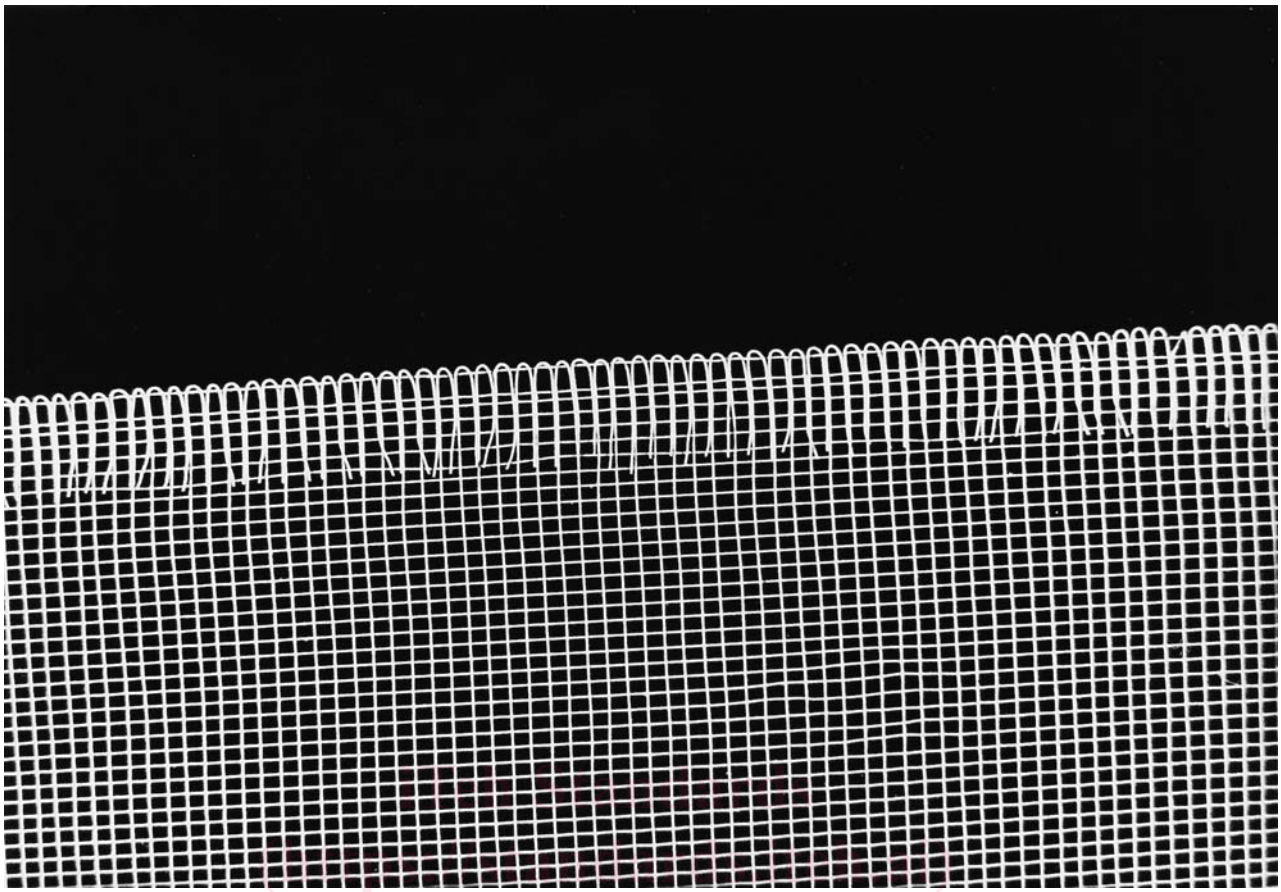


FIG. 3 Cut and Tucked Edge

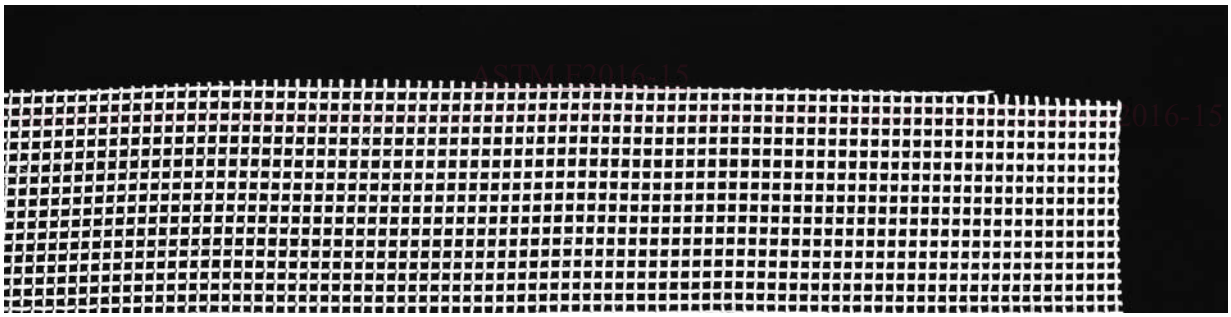


FIG. 4 Raw or Cut Edge

4.2 *Normal Range of Space Cloth (Expressed By Width Opening):*

4.2.1 *Carbon Steel*—For the normal range of space cloth specifications for carbon steel, see Table 4.

4.2.2 *Stainless Steel*—For the normal range of space cloth specifications for stainless steel, see Table 5.

5. Technical Requirements

5.1 *Wire Tolerances*—The wire diameter shall be expressed in decimal parts of an inch or the metric equivalent, and the tolerance for wire before weaving shall be in accordance with Table 6. It is recognized that mechanical deformation of the wire occurs during weaving, and therefore, the diameter measured after weaving only can be used as a guide of the original nominal diameter.

5.2 *Wire Cloth Tolerances:*

5.2.1 Industrial wire cloth can be woven from a great variety of metals and alloys. For the purposes of tolerances as woven, the following metals are applicable:

5.2.1.1 Aluminum (5000 series),
5.2.1.2 Brass,
5.2.1.3 Carbon steel,
5.2.1.4 Copper,
5.2.1.5 Monel metal (trademark[3]),
5.2.1.6 Nickel;
5.2.1.7 Phosphor bronze, and
5.2.1.8 Stainless steel (300 and 400 series).

[3] Monel metal is a trademark of Special Metals Corporation.

FIG. 5 Double Crimp

5.2.2 Wire cloth tolerances for other metals may or may not be applicable depending on the particular specification and should be discussed with the supplier.

5.2.3 *Tolerances on Mesh—*Tolerances in mesh count shall be applied separately for warp and shute and in accordance with Table 7.

5.2.4 Tolerances on opening for space cloth The tolerance in opening of space cloth shall be in accordance with Table 8.

5.3 *Wire Cloth Blemishes:*

5.3.1 Wire cloth shall be woven with first-class workmanship, although some blemishes or defects are inherent in the weaving process.

5.3.2 *Permissible Number of Major Blemishes—*Unless otherwise agreed upon, the permissible number of major blemishes or defects as defined in Annex A1 shall be as shown in Table 9. The shute count shall determine the mesh category.

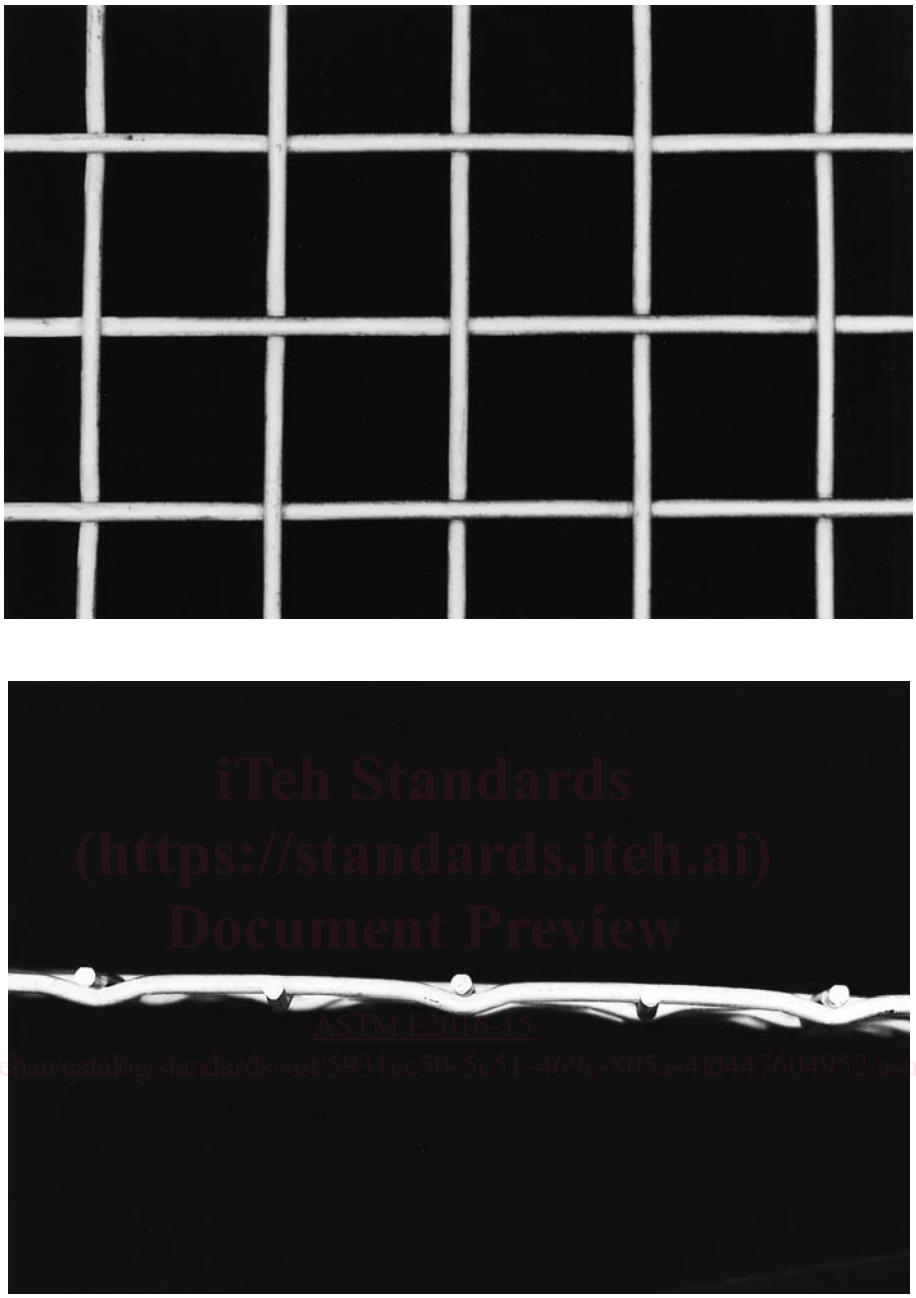


FIG. 6 Smooth Top

5.3.3 *Variation in Mesh*—An area of wire cloth with mesh count out of the tolerances shown in 5.2.3 shall be considered a defective area.

5.3.4 *Defective Opening*—An irregular opening in an area of wire cloth shall be considered a defect if the measured opening is out of tolerance as shown in Table 10 or Table 8 for space cloth.

5.4 *Delivery Requirements*—Except when specifically agreed to otherwise, the total quantity of wire cloth furnished shall be within ± 10 % of the quantity ordered. The invoice shall be based on the actual quantity furnished. Any finishing or fabrication specified to wire cloth may or may not affect its delivered quality and should be discussed with the supplier.

5.4.1 *Roll*—A standard roll shall be 100 linear feet (30.5 m) ± 10 linear feet (3 m), and may consist of up to three pieces, no piece less than 10 linear feet (3 m).

5.4.2 *Width*—Permissible tolerance in the width of standard wire cloth rolls, except when cut to specific dimension, shall be in accordance with Table 11. Unless otherwise specified, rolls of wire cloth may be delivered with or without selvage edges. The width tolerance of selvage edge cloth should be defined explicitly.

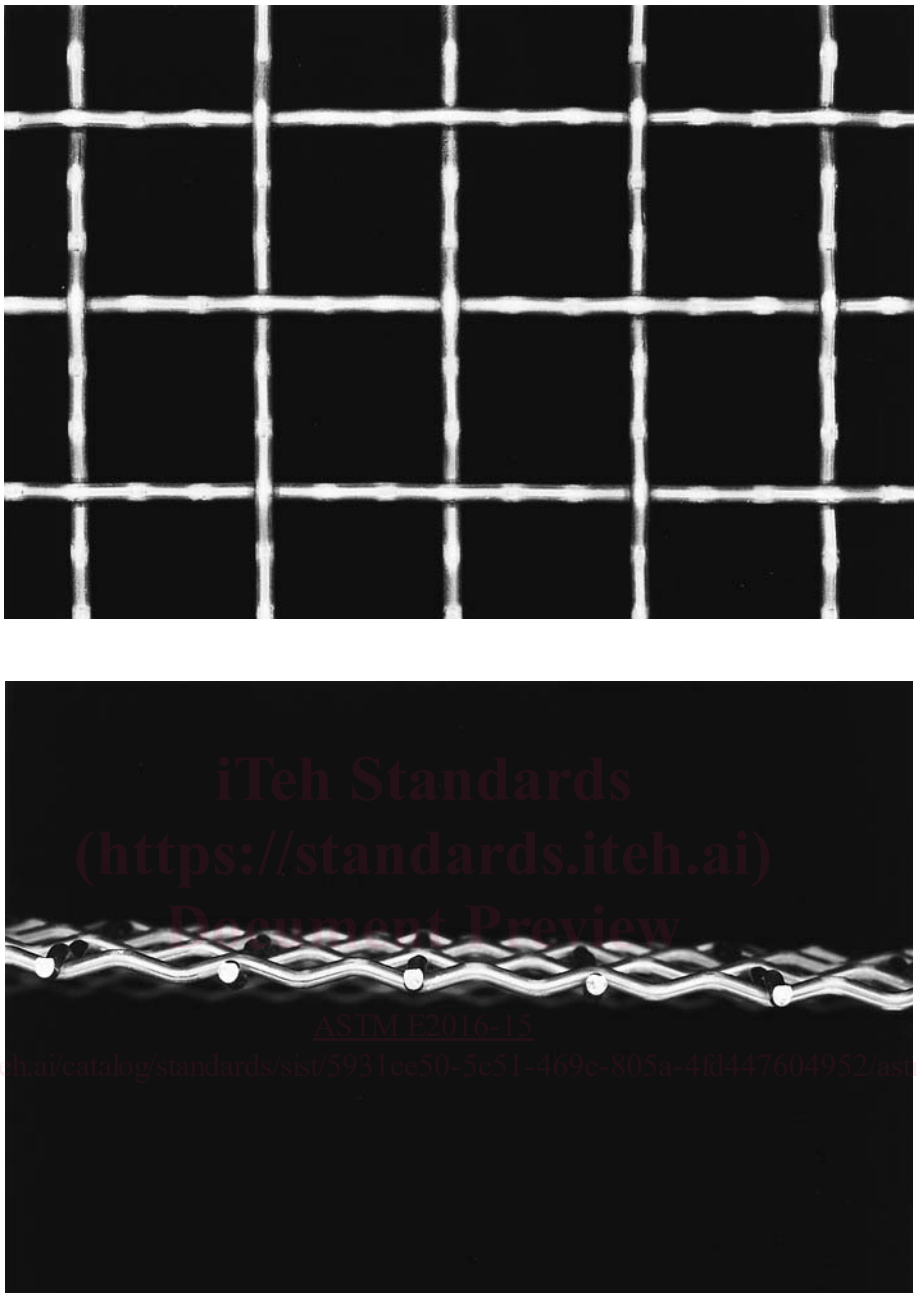


FIG. 7 Intermediate Crimp

5.4.3 *Flatness*—Woven wire cloth may be curled in either or both the warp or shute direction, unless specifically agreed to otherwise.

5.4.4 *Firmness*—Woven wire cloth should normally exhibit firmness.

5.4.5 *Squareness*—The warp and shute wires of woven wire cloth normally should be aligned such that they are perpendicular; however, ultralight or lighter grades may not always exhibit squareness due to their sleaziness.

5.4.6 *Surface Condition*—Woven wire cloth may be covered with a film of oil or other lubricant as a result of the manufacturing process. The wire may show traces of products used in the drawing process. Depending on the material, there may be traces of surface rust and corrosion, which should not affect functionality. The surface may show markings caused by the drawing or weaving processes. The depth of crimp generally differs between the warp and shute wires.

5.4.7 *Cut-to-Size Pieces*—The tolerances that can be held on cut pieces of wire cloth can be dependent on the piece size, the mesh and wire diameters, and the type of weave. These factors should be considered in the discussion of tolerances with the supplier.

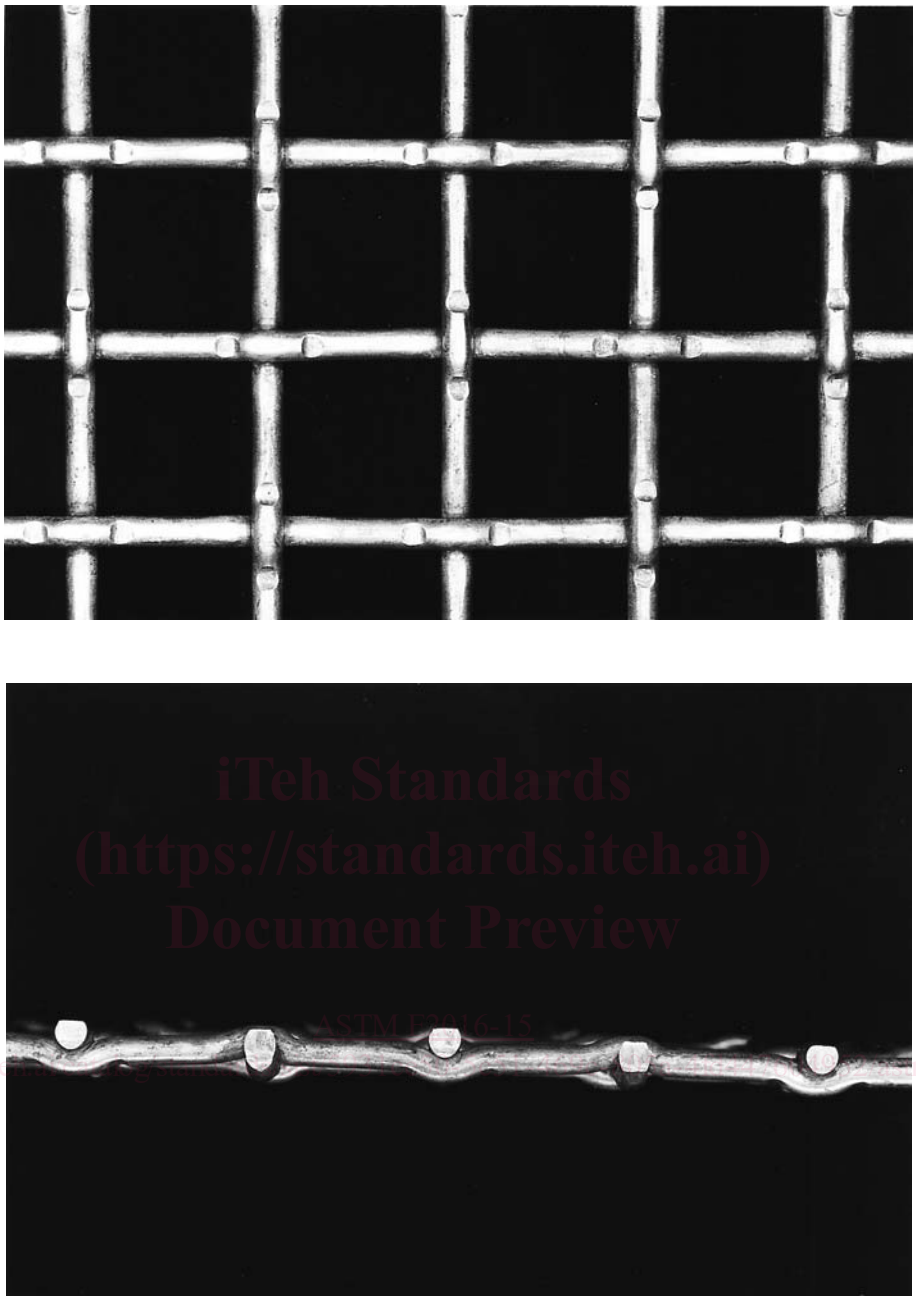
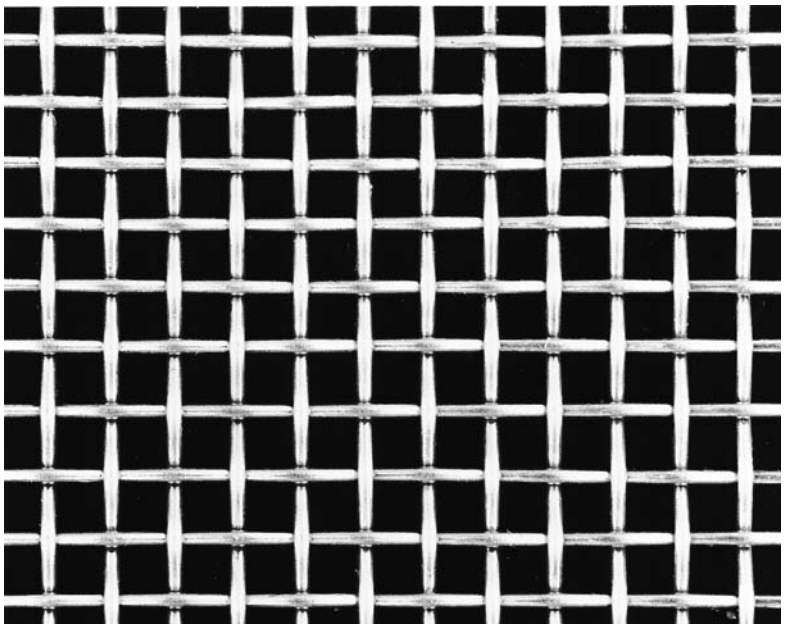


FIG. 8 Lock Crimp

5.4.8 *Slit Widths*—Slitting tolerances should be discussed with the supplier in accordance with 5.4.7, and it should be further noted that wires may or may not be jumped or crossed.

5.4.9 *Coatings*—The wire used for weaving wire cloth can be coated, plated, or in some other way finished prior to weaving, or wire cloth can be specified coated after weaving. Coatings applied to wire before weaving or coatings applied to wire cloth after weaving can impact the delivered condition of the wire cloth. Consult with a supplier as to the applicability of this specification. Depending on the specifications, the uniformity of coatings applied before weaving can be affected by the weaving process. Coatings applied after weaving may fill or partially fill some number of the openings of the wire cloth. Coatings also can significantly affect the firmness of the cloth. Additionally, tolerances on the width of opening cannot be applied since, after woven, coatings will effectively increase the wire diameter and decrease the opening. Examples of possible coatings include, but are not limited to, metallic



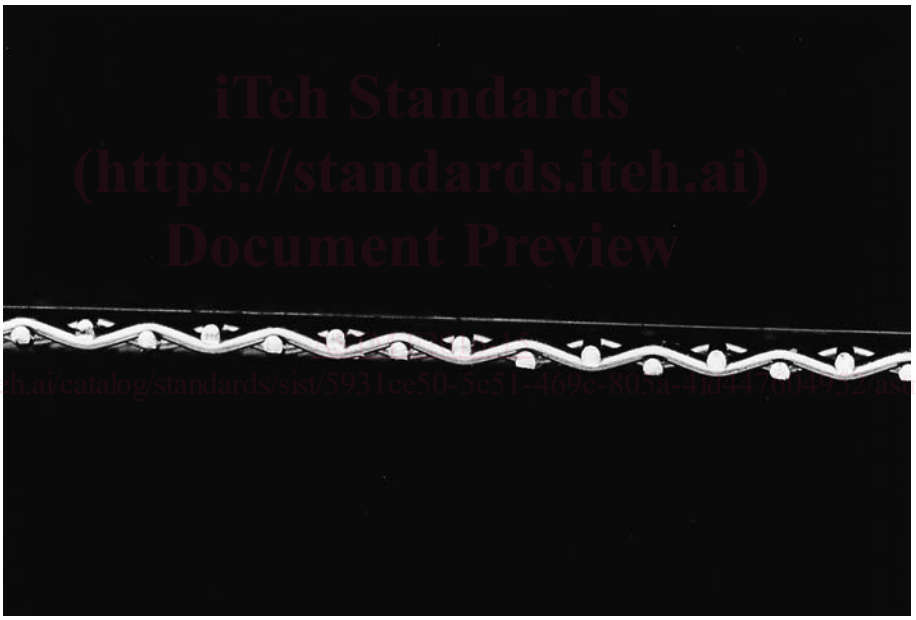


FIG. 9 Plain Square Weave

plated, such as, copper, nickel, tin, etc., painted, or epoxy-coated or galvanized-steel wire cloth that has been coated with zinc either before or after weaving.

5.4.10 *General*—The percentage of yield of the cloth shall be agreed on with the customer and will vary according to the specification and size of the product. If the quality or conformance to tolerances is disputed, the wire cloth may be returned to the supplier in delivered condition, that is, unprocessed and unused, and suitably packaged to avoid damage in transit, if allowed by the supplier in writing.

6. Testing Procedure

6.1 *Test Apparatus*—Test apparatus for either counting mesh or measuring irregular openings shall be compatible with the value of the tolerances. Examples of test apparatus to count mesh include a counting glass (see Fig. 11) and a standard metal rule (see Fig. 12). Examples of test apparatus to measure openings include a graduated magnifying device, a vernier inside caliper (see Fig. 13), and a standard metal rule. All test apparatus shall be calibrated against standards traceable to the National Institute of Standards and Technology.