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BUREAU OF STANDARDS
George K. Burgess, Director

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UNITED STATES GOVERNMENT MASTER SPECIFICATION FOR
ASPHALT-SATURATED WOVEN COTTON FABRIC FOR WATER-
PROOFING

FEDERAL SPECIFICATIONS BOARD SPECIFICATION No. 294

This specification was officially promulgated by the Federal Specifications Board on May 20, 1925, for the use of the Departments and Independent Establishments of the Government in the purchase of asphalt-saturated woven cotton fabric for waterproofing.

[The latest date on which the technical and inspection requirements of this specification shall become mandatory for all Departments and Independent Establishments of the Government is August 20, 1925. They may be put into effect, however, at any earlier date after promulgation]

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I. TYPE

The asphalt-saturated woven cotton fabric shall be of a type suitable for use with asphalt for waterproofing and damp proofing. It is intended for use with asphalt as called for in United States Standard Specification No. 85 in the construction of membrane waterproofing.

II. MATERIAL

No details specified.

III. GENERAL REQUIREMENTS

No details specified.

IV. DETAIL REQUIREMENTS

1. APPEARANCE.—It must be free from visible external defects, such as ragged or untrue edges, breaks, rents, etc. The meshes of the fabric shall not be completely closed or sealed by the asphalt saturant. There shall be sufficient porosity to allow the moppings of asphalt plying cement to come through. The fabric shall not stick when unrolled at temperatures between 10° C. (50° F.) and 32° C. (90° F.) to such an extent as to cause tearing. The surface of the fabric shall be uniformly smooth and free from irregularities, folds, and knots. It shall not be coated with talc, Portland cement, or other substance which would tend to interfere with the adhesion between the fabric and the plying cement. The use of powdered silica or wood flour shall be permitted.

2. WIDTH.—30 to 38 inches.

3. SELVAGE.—The selvage shall not exceed three-sixteenths inch.

4. WEIGHT PER ROLL.—To be mutually agreed upon by the buyer and seller, but in no case more than 80 pounds.

5. WEIGHT PER SQUARE YARD.—Minimum, 11 ounces; maximum, 15 ounces.

6. WEIGHT OF SURFACING PER SQUARE YARD.—Maximum, 1½ ounces.

7. AVERAGE STRENGTH PER INCH AT 70° F.—In the direction of the warp, minimum, 50 pounds; in the direction of the filling, minimum, 40 pounds.

8. VOLATILE MATTER AT 105° C. (221° F.) FOR FIVE HOURS.—Maximum, 2 per cent.

9. PLIABILITY AT 0° C. (32° F.).—The fabric shall not crack when bent through an arc of 180° flat on itself in one direction and then through 360° flat on itself in the opposite direction.

10. AVERAGE WEIGHT OF MOISTURE-FREE DESATURATED FABRIC PER SQUARE YARD.—Minimum, 3½ ounces.

11. WEIGHT OF SATURANT PER SQUARE YARD.—Minimum, 200 per cent or two times the weight of the moisture-free desaturated fabric per square yard.

12. ASH OF MOISTURE-FREE DESATURATED FABRIC.—Maximum, 1 per cent.

13. THREAD COUNT PER INCH (BOTH IN THE DIRECTION OF THE WARP AND THE FILLING).—Minimum, 18; maximum, 36.

14. COTTON FIBER CONTENT.—100 per cent.

V. METHODS OF INSPECTION AND TESTING

If required, deliveries will, in general, be sampled and tested by the following methods, but the purchaser reserves the right to use any additional information to ascertain whether the material meets the specification.

1. SAMPLING AND DETERMINATION OF WEIGHT AND WIDTH

The weight per square yard and the width of the material can be most accurately determined by the inspector at the time he takes the samples for transmittal to the testing laboratory.

(a) From each shipment of more than 1,000 rolls take at random a number of rolls of fabric equivalent to one-half the cube root of the total number of rolls included in the lot. If the cube root as calculated proves to be a fractional number, express it as the next higher digit. From each shipment of 1,000 rolls or less take at random five rolls in each case.

(b) Remove wrappers and other packing material from each roll selected and weigh the roll and the packing materials, etc., separately to the nearest one-quarter pound, then unwind each roll and measure the length and width to the nearest one-quarter inch and observe the appearance of the material. Compute the area of each roll and the weights per square yard of each roll of fabric examined. At approximately 25 feet from the end of each roll cut two samples the full width of the roll and 40 inches long, label carefully, wrap, and transmit one to the testing laboratory. Retain the other sample for use in case of dispute.

2. LABORATORY EXAMINATION

(a) APPEARANCE.—Examine both sides of the sheet of saturated fabric and note the color and general appearance.

(b) WEIGHT.—Trim the sample so that it is 36 inches long and the full width of the roll, measure accurately to one-sixteenth inch, and weigh to the nearest gram (15 grains). From the measurements and weight so obtained compute the weight per square yard.

(c) PLIABILITY.—Cut five strips 1 inch wide and 6 inches long in the direction of the warp and immerse in a cooling mixture of ice and water at 0° C. (32° F.) for 10 to 15 minutes. The strips shall then be removed from the water and each strip bent flat upon itself through an arc of 180° at a uniform speed in approximately two seconds and then through 360° flat on itself in the opposite direction.

(d) BREAKING STRENGTH.—Cut 10 strips of the fabric 6 inches long by 4 inches wide, taking 5 in the direction of the warp and 5 in the direction of the filling, respectively. Care shall be taken that no two strips include the same threads. No sample for testing shall be taken at less than 8 inches from either selvage. If the width of the goods does not admit of cutting pieces as stated, they shall be taken as near the center as possible. Test both sets of strips at 21° C. (70° F.) in a Scott or similar testing machine of the inclination balance type, having a capacity of from 100 to 150 pounds. The 1 by 1 by 3 inch grab method of testing shall be used and is defined as follows: The lower half of each pair of jaws of the machine shall be 2 inches or

more in width and the upper half shall be 1 inch in width. The jaws shall be plain, smooth, and flat, with edges slightly rounded to prevent cutting. The initial length of the test pieces between the jaws of the testing machine shall be 3 inches, and the pulling jaw shall travel at a uniform rate of 12 inches per minute. In making the test if any strip breaks nearer than one-half inch to either jaw the reading shall be disregarded and an additional strip on the same threads, if possible, shall be tested in its place. The average of the five readings from strips cut in one direction shall be taken as the breaking strength of the sample in that direction.

(e) VOLATILE MATTER.—Cut two strips of asphalt-saturated fabric 6 inches wide and 12 inches long. Weigh each strip and suspend it for five hours in an oven maintained at 105° C. (221° F.) plus or minus 3° C. (5° F.), remove from the oven, cool in a desiccator, and weigh. Compute the loss in weight and average the two results.

(f) WEIGHT OF DESATURATED FABRIC.—Cut a 2-inch strip the full width of the sample, measure accurately, weigh, and extract with benzol¹ in a suitable extraction apparatus until the solvent runs through colorless. Remove the desaturated fabric from the extractor and allow to remain in air until the solvent has evaporated, brush off any adhering particles of surfacing and retain. Then place the desaturated fabric in a tared weighing bottle, dry at 100° C. (212° F.) for one-half hour, cool, and weigh. Compute the weight per square yard of the desaturated fabric. The desaturated fabric so obtained is in a moisture-free state.

(g) SURFACING MATERIAL.—Filter the extract obtained in V, 2 (f) through a tared Gooch crucible prepared with a mat of asbestos fiber, wash all sediment from the extraction apparatus into the Gooch crucible with benzol¹ and also transfer all surfacing brushed from the fabric above in V, 2 (f) into the Gooch crucible, wash the insoluble matter on the filter with benzol¹ until the washings run through colorless. Place the crucible with the contents in an oven at 100° C. (212° F.) for one-half hour, cool in a desiccator, weigh, and from the weight of the sample taken in V, 2 (f) and the weight of surfacing obtained compute the weight of surfacing per square yard.

(h) SATURATION OF FABRIC.—The saturation or weight of asphalt in the saturated fabric is the difference in weight between the original sample taken for extraction in V, 2 (f) and the sum of the weights of desaturated fabric obtained in V, 2 (f), plus the weights of the surfacing material obtained in V, 2 (f). The percentage saturation is obtained from the following formula:

$$\frac{\text{Weight of asphalt in the saturated fabric}}{\text{Weight of moisture-free desaturated fabric}} \times 100 = \begin{cases} \text{percentage of} \\ \text{saturation.} \end{cases}$$

¹ Carbon tetrachloride or carbon bisulphide will usually give the same results, but benzol shall be used in umpire tests in case of dispute.

(i) **THREAD COUNT.**—Count the number of threads to the inch in both the warp and filling at five different places. The average of these shall be taken as the threads per inch or thread count.

(j) **CHARACTER OF FIBER.**—Select 10 threads at random from the desaturated fabrics and separate the fibers in water on a microscope slide, so that the fibers are uniformly distributed. Now, dry the slides so prepared until all the water is removed, cool, and add a drop of zinc-chloriodide solution (Herzberg solution).²

Cover the stained fibers with a cover glass, draw off the excess stain, and examine under a microscope with a magnification of about 100 diameters. The fibers should all be stained a wine-red color.

VI. PACKING AND MARKING

Asphalt-saturated woven cotton fabric shall be put up in rolls weighing not more than 80 pounds. It shall be wound on wooden mandrels measuring approximately 2 by 2 inches and extending from 2 to 4 inches beyond the ends of the rolls. The rolls shall be properly wrapped and securely tied to prevent unrolling in transit. It shall be plainly marked with the manufacturer's name, approximate weight and area of the roll, and type of saturant.

VII. ADDITIONAL INFORMATION

No details specified.

VIII. GENERAL SPECIFICATIONS

No details specified.

² The Herzberg stain is made according to the following formula:

Solution A	{	20 g zinc chloride, 10 c c distilled water.
Solution B	{	2.1 g potassium iodide, 0.1 g iodine, 5.0 c c distilled water.

Dissolve solutions A and B separately, then mix and allow to stand several hours, or until all sediment has settled out. The clear liquid is then decanted into a dark colored bottle and is ready for use. The stain shall be kept in the dark and should be tested before use on known fibers.

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