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Specification.
No. 37.

DEPARTMENT OF COMMERCE.
BUREAU OF STANDARDS.
George K. Burgess, Director.

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UNITED STATES GOVERNMENT SPECIFICATION FOR
LEATHER BELTING.

FEDERAL SPECIFICATIONS BOARD.

STANDARD SPECIFICATION NO. 37.

This Specification was officially adopted by the Federal Specifications Board on July 3, 1922, for the use of the Departments and Independent Establishments of the Government in the purchase of leather belting.

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I. MATERIAL COVERED.

This specification is for use as the basis of purchase for miscellaneous sizes, single and double ply, of first quality vegetable-tanned (so-called oak tanned) leather belting for general use; also waterproof dressed and waterproof leather belting.

II. STANDARD SPECIFICATION.

1. QUALITY OF THE LEATHER.

(a) HIDES.—All belting leather shall be made from green salted hides and be free from brands, soft or spongy spots, and open

grub holes, excepting that when made into belting 30 per cent of the strips in any belt or roll of belting may contain a maximum of three open grub holes in each of such strips.

(b) TANNING.—The hides shall be tanned with oak bark or a combination of vegetable tanning materials.

(c) CURRYING.—*Stuffing*.—Animal oils and greases shall be used for stuffing the leather, or a mixture of these and mineral oils in such proportion as will provide maximum strength and pliability.

Adulteration.—The use of Epsom salts, glucose, barium chloride, or other materials for weighting the leather is prohibited. The presence of a greater amount of stuffing content than hereinafter specified shall be considered as adulteration.

(d) MANUFACTURE.—*Stretching*.—All leather after stuffing shall be thoroughly stretched while still damp, and left under tension until dry. All belt pieces shall have the stretcher marks cut off.

Finish.—The grain, or hair side, shall be finished smooth and the leather shall be thoroughly fleshed.

Cutting.—All strips shall be cut from the center portion of the hide at such distance from the backbone as to include only firm stock, and exclude second-quality leather, and at such distance from the root of the tail as will exclude all shoulder stock, provided that the length of the strips shall be as hereinafter specified.

2. CONSTRUCTION OF THE BELTING.

(a) STRIPS.—*Length*.—No sectional strip shall be more than 54 inches in length, including the lap. The minimum length of any strip shall be 36 inches, including the lap, excepting that in double belts $\frac{1}{8}$ of the total number of pieces may be between 20 inches and 36 inches, provided that these short pieces do not occur consecutively. The minimum length shall not apply to the end pieces of rolls or cut lengths.

Joining.—In single belting the strips shall be joined shoulder end to shoulder end, and butt end to butt end. In double belting the strips shall be joined shoulder end to butt end.

Selection.—In all single belts 8 inches and over in width backbone center strips shall be used. The backbone mark must appear running lengthwise approximately in the center of each strip. In all double belts from 8-inch up to 10-inch width, backbone center strips shall be used in one ply and the backbone mark shall appear running lengthwise approximately in the center of each strip. The other ply shall be cut from the location pre-

scribed for first-quality stock. In all double belts 10 inches and over in width, both plies shall be made from backbone center strips and the backbone mark shall appear running lengthwise approximately in the center of each strip. The same quality of leather shall be used in both plies of all double belting.

(b) LAPS.—*Length.*—The length of laps shall be within the following limits:

TABLE 1.—Length of Laps (in Inches).

| Ply. | Thickness. | Length of laps. | |
|-------------|---------------------|--------------------------------|-----------------------------------|
| | | Belts under 6 inches in width. | Belts 6 inches and over in width. |
| Single..... | Under 10/64..... | 2½ to 6..... | 3 to 8. |
| | 10/64 and over..... | 3 to 8..... | 3½ to 10. |
| Double..... | Up to 17/64..... | 2¾ to 3½..... | 3 to 4. |
| | 19/64 and over..... | 3 to 4..... | 3 to 5. |

Location.—The minimum distance between any two laps in the separate plies of double belting shall be 8 inches.

Point of lap.—The points of all laps shall be at right angles to the edge of the belt.

Direction.—All laps shall run in the same direction.

(c) CEMENTING.—The laps of both single and double belts and the plies of double belts shall be thoroughly cemented together. When pulled apart the cemented surface shall not appear glazed or shiny.

(d) WIDTH.—*Standard widths.*—The standard widths of belt shall be from ½ inch to 72 inches, increasing by ¼ inch up to 3 inches, ½ inch up to 6 inches, 1 inch up to 10 inches, and 2 inches above 10 inches.

The maximum variation from the nominal width shall be in accordance with the following:

TABLE 2.—Tolerance from Nominal Width.

| Width of belting (in inches). | Tolerance. |
|-------------------------------|-------------------------|
| Under 2..... | Not less than nominal. |
| 2 to 24, inclusive..... | 1 per cent. |
| Above 24..... | One-half of 1 per cent. |

(e) THICKNESS.—The thicknesses for the different grades of belting shall be in accordance with the following table:

TABLE 3.—Thicknesses and Grades.

| Grade. | Average thicknesses (in inches). | |
|-------------|----------------------------------|-----------------|
| | Single ply. | Double ply. |
| Light..... | 8/64 up to 10/64..... | 15/64 to 17/64. |
| Medium..... | 10/64 up to 12/64..... | 19/64 to 21/64. |
| Heavy..... | 12/64 up to 14/64..... | 23/64 to 25/64. |

The average thickness shall be determined by measuring the thickness of 20 plies of the belt when rolled and dividing this value by the number of plies measured.

Uniformity.—No point in either single or double belting shall be more than $2/64$ inch thicker nor more than $2/64$ inch thinner than the average thickness.

Leveling and filling.—The excessive use of shims and filler strips and excessive splitting or leveling is prohibited.

(f) MARKING.—All belting shall be stamped on grain side with the maker's name and brand and a stamp indicating the direction in which the belting is to run. Each stamp shall be repeated every 10 feet throughout the entire length of the belting.

(g) WATERPROOF BELTING.—*Waterproof dressed belting.*—This type of belting shall conform to all the requirements of this specification. In addition, it shall be treated with a waterproof dressing.

24. *Waterproof belting.*—This type of belting shall conform to all the requirements of this specification. In addition, it shall be treated with a waterproof dressing. The laps and plies shall be cemented with a waterproof cement.

III. TECHNICAL TESTS.

1. PHYSICAL TESTS.

(a) TENSILE STRENGTH.—*Leather.*—All leather shall have a minimum tensile strength of 3,000 pounds per square inch of cross section, and an average tensile strength for single belts of 3,750 pounds per square inch and for double belts of 3,500 pounds per square inch. The average shall be determined with five test specimens cut continuously lengthwise of the sample, omitting the lap. Test specimens of the shape and size shown in Figure 1 shall be cut with a metal die. The edges of the test specimen

shall be cut perpendicularly. The minimum thickness inside the gauge marks shall be used in determining the area of the cross section of the test specimen.

Laps and plies.—The laps of both single and double belting shall not open and the plies of double belting shall not separate when subjected to a tensile stress of 2,500 pounds per square inch. The opening of the laps shall be determined by testing two specimens cut across the point of the lap lengthwise of the sample. For double belting the test shall be made on the single ply.

(b) PERCENTAGE ELONGATION.—*Elongation.*—The average elongation at a tensile stress of 2,500 pounds per square inch shall not exceed 15 per cent. The average shall be determined with the same five test specimens used for determining the tensile strength.

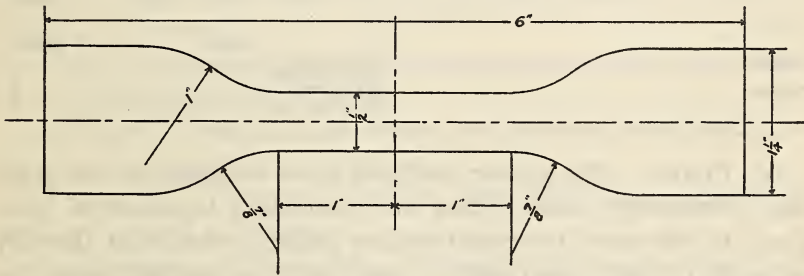


FIG. 1.—Test specimen for strength and elongation.

To determine the amount of elongation, parallel gauge marks 2 inches apart shall be placed upon the restricted portion of the test specimens. The distance between the gauge marks shall be measured with a pair of spring dividers at a tensile stress of 2,500 pounds per square inch. The amount of stretch shall then be determined by measuring the opening of the dividers on a scale. This test will be made on each lot of 2,000 feet or fraction thereof.

The following stretch test shall be made on the finished belting up to and including 6 inches in width. Any section of a roll or belt shall be selected (which shall not be cut) on which gauge marks shall be placed 10 feet apart. Suitable clamps shall be attached on the marks so that the distance between the clamps shall be 10 feet. The section shall then be suspended in a vertical position from one of the clamps. Sufficient weight, including the weight of the clamps, shall be attached to the lower clamp to produce a tensile stress of 750 pounds per square inch of the average cross section of the section being tested. The section, after being subjected to this tension for 15 minutes, shall show a

length between the gauge marks not to exceed 10 feet 7.2 inches (6 per cent stretch).

Measure of elasticity.—The clamps shall then be removed, and the section allowed to lie loosely on the floor for 17 hours, after which time the length between the gauge marks shall not exceed 10 feet 1.6 inches ($1\frac{1}{3}$ per cent stretch).

(c) **CRACKING.**—The leather shall not crack on the grain side and the laps shall not open at the points when the belting is bent through angles of 180° , grain side out, over forms as specified below for the different grades and thicknesses.

TABLE 4.—Forms for Cracking Test.

| Belt. | Average thickness, belting. | Diameter form. |
|-------------|-----------------------------|----------------|
| | Inches. | Inches. |
| Single..... | Under 10/64..... | 1 |
| | 10/64 and over..... | 1½ |
| Double..... | Up to 17/64..... | 3 |
| | 19/64 and over..... | 4 |

(d) **PIPING.**—The leather shall not show wrinkles on the grain side (commonly called piping and indicating looseness of fiber found in side stock or second-quality belting) when bent through an angle of 180° , grain side in, over forms as specified below for the different grades and thicknesses.

TABLE 5.—Forms for Piping Test.

| Belt. | Average thickness, belting. | Diameter form. |
|-------------|-----------------------------|----------------|
| | Inches. | Inches. |
| Single..... | All..... | 2 |
| Double..... | Up to 17/64..... | 4 |
| | 19/64 and over..... | 6 |

(e) **WATER ABSORPTION TEST.**—A sample waterproof dressed or waterproof belting, 12 inches long shall be weighed and then immersed in water at room temperature for five hours. When removed from the water the sample shall be wiped and again weighed. The percentage of water absorbed shall not exceed 8 per cent. This test shall be made on every lot of 2,000 feet or fraction thereof.

(f) **TESTING OF WATERPROOF CEMENT.**—The sample of waterproof belting tested for water absorption shall be again immersed in water until the total period of immersion is 24 hours. The sample, after removal, shall be allowed to dry under room con-

ditions for 24 hours. The laps and plies shall not open when the sample is bent around the proper form as specified in paragraph (c) "Cracking."

2. CHEMICAL TESTS.

(a) **METHODS.**—The chemical analysis shall be made in accordance with the standard methods of the American Leather Chemists' Association, and percentages calculated on the basis of moisture-free leather.

(b) **STUFFING CONTENT.**—The stuffing content shall not exceed 18 per cent nor be less than 8 per cent of the weight of the finished leather. The currying mixture shall not contain more than 35 per cent of unsaponifiable matter. In the case of belting that has been waterproof dressed, the grease content shall not exceed 25 per cent, and the unsaponifiable matter shall not exceed 35 per cent.

(c) **ASH.**—The total ash shall not exceed 1 per cent of the weight of the finished leather.

(d) **FREE MINERAL ACID.**—The free mineral acid shall not exceed three-fourths of 1 per cent.

(e) **GLUCOSE.**—Glucose resulting from the tanning materials shall not exceed 2 per cent.

(f) **SAMPLES.**—A representative sample from each size of all shipments of 2,000 feet, or fraction thereof, 36-inch length and including at least one lap, shall be selected by the Government inspector for physical and chemical tests.

IV. GENERAL.

1. REQUEST FOR BIDS.

When bids are requested, the buyer shall specify the ply, length, width, and grade desired on each item, and if the belting shall be waterproof dressed or waterproof belting, it shall be so stated.

2. PACKING, MARKING, AND SHIPPING.

Unless otherwise specified, the belting shall be packed in accordance with the standard practice of the manufacturer. It shall be marked:

Name of contractor.

Type and size of belting.

Contract number.

Requisition number or schedule number.

The belting shall be shipped in accordance with the instructions of the purchaser.

(a) INSPECTION.—All inspections shall be at point of manufacture wherever possible, but the Government reserves the right to inspect at point of delivery, in which case material, if rejected, shall be removed by contractor at his own expense.

3. METHODS FOR CHEMICAL ANALYSIS.

(a) PREPARATION OF SAMPLE.—The sample of leather for analysis shall be reduced to as fine a state of division as practicable, either by cutting or grinding.

(b) MOISTURE.—Dry 10 g of leather for 16 hours at a temperature between 95–100° C.

(c) FATS.—Extract 5 to 10 g of air-dry leather in a Soxhlet apparatus until free from grease, using petroleum ether boiling below 80° C. Evaporate off ether, and dry to approximately constant weight.

(d) ASH.—Incinerate 10 to 15 g of leather in a tared dish at a dull, red heat until carbon is consumed. If it is difficult to burn off all the carbon, treat the ash with hot water, filter through an ashless filter, ignite filter and residue. Add the filtrate, evaporate to dryness, and ignite.

(e) WATER-SOLUBLE MATERIAL.—Digest 30 g of leather in a percolator over night, then extract with water at 50° C. for three hours. The total volume of solution to be 2 liters.

(f) GLUCOSE.—Place 200 cc of leather extract of analytical strength in a ½-liter flask, add 25 cc of a saturated solution of normal lead acetate, shake frequently (5–10 minutes), and filter. (The funnels and beakers must be kept covered to prevent evaporation.) Add to the filtrate an excess of solid potassium oxalate. Mix frequently for 15 minutes and filter, returning the filtrate until clear. Pipette 150 cc of this filtrate into a 600 cc Erlenmeyer flask, add 5 cc of concentrated HCL, and boil under a reflux condenser for two hours. Cool, neutralize (place a small piece of litmus paper in the flask) with anhydrous sodium carbonate, transfer to a 200 cc graduated flask, and make to volume. Filter through a double filter. (Filtrate must be clear.) Determine the dextrose immediately in 500 cc of the solution according to the Munson and Walker method,¹ and report in percentage on leather.

¹ This method may be found in the following references: J. A. C. S., 28, pp. 663–686; 1906; Bureau of Chemistry Bulletin 107; Methods of Analysis of the A. O. A. C., 1920 edition; and A. I. C. A. Methods of Analysis for Vegetable Tanned Leather; 1921.

(g) FREE MINERAL ACID, PROCTOR AND SEARLE METHOD.—Moisten 2 or 3 g of the leather in a platinum basin with 25 cc N/10 Na_2CO_3 , and evaporate to dryness on the water bath. The mass is carbonized at a dull, red heat, pulverized with a glass rod, and washed out with boiling water, the soluble portion being filtered through a quantitative filter paper into a conical flask. The insoluble portion in the filter paper is returned to the basin, ignited thoroughly, the ash taken up with 25 cc N/10 HCL and added to the portion previously washed out. The solution is titrated back with N/10 alkali, using methyl red or methyl orange as indicator, and the amount calculated to mineral acid as sulphuric. If the solution is alkaline no further titration is necessary.

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