U. S. Gov't Master Specification No. 3b

DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

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UNITED STATES GOVERNMENT MASTER SPECIFICATION FOR PNEUMATIC TIRES, SOLID TIRES, AND INNER TUBES [1]

FEDERAL SPECIFICATIONS BOARD SPECIFICATION No. 3b

[Revised March 28, 1925]

This specification was officially promulgated by the Federal Specifications Board on February 3, 1922, for the use of the Departments and Independent Establishments of the Government in the purchase of pneumatic tires, solid tires, and inner tubes.

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Part 1.—PNEUMATIC TIRES

I. TYPE

The tire shall be of a form adapted to inclose an inner tube containing air under pressure and shall properly fit a rim of corresponding size, inspected and approved by the Tire and Rim Association. It shall be of a type which has been used in actual service and recognized as a standard and shall consist of the following component parts:

1. Carcass.—This shall consist of plies of rubberized cotton fabric or cord fabric, as follows:

Minimum number of plies required

Size in inches	Minimum number of plies	Size in inches	Minimum number of plies
3 fabric	4	4½	6
3½ fabric	4	5 regular	6
3½ cord regular	4	5 heavy-duty [1]	8
3½ cord heavy-duty [1]	4	6	8
4 regular	4	7	10
4 heavy-duty [1]	6	8	10

[1] Heavy-duty tires shall be marked so as to be distinguished from regular tires.

2. Cushion.—This shall consist of a sheet of rubber compound placed around the outer circumference of the carcass.

3. Breaker.—This shall consist of one or more plies of open-weave cotton fabric coated on both sides with rubber compound and placed around the outer circumference of the cushion.

4. Tread.—The tread shall consist of rubber compound designed to resist abrasion and to protect the carcass from injury. It shall be rib or nonskid as ordered and of a thickness as shown in Table 3, and shall meet the requirements under "Tests."

5. Sidewall.—This shall consist of a suitable rubber compound to protect the carcass against abrasion and moisture. It shall meet the requirements under "Tests."

6. Bead.—The core of clincher beads shall consist of semihard rubber or a combination of rubber and cotton. The toe of clincher beads shall be tapered to a feather edge to prevent cutting of tube. For straight-side tires the bead shall be reinforced with steel wires or cables. The bead portion of the tire shall contain reinforcing and chafing strips, as shown in Table 1. Reinforcing strips may be omitted in 6-inch tires and smaller if one or more plies are carried around the bead and turned up into the side wall. These strips shall extend at least one-half inch above the flange of the rim, and when more than one are used the edges shall be stepped at least one-fourth inch apart.

Table 1.—*Minimum number of chafing and reinforcing strips*

	Number of strips	
	Chafing	Reinforcing
	Minimum	*Minimum*
Cord sizes 5-inch and smaller	1	1
Cord sizes 6-inch and larger	1	2
Fabric tires, except 3-inch	1	----------

7. Flap.—This shall consist of plies of cotton fabric of different widths frictioned together, the flap being thickest at the center and tapering symmetrically toward the edges. The flap shall be formed to a shape approximately the contour of the beads of the tire. The flaps of motor-cycle tires shall be cemented inside the casings.

II. TESTS

1. Endurance Test.—The complete tire shall be run at a speed of 30 miles per hour against a standard test wheel under the conditions shown in Table 2.

(*a*) *Standard test wheel.*—The standard test wheel is a flat-faced pulley 60 inches in diameter which is driven at a surface speed of 30 miles per hour. The tire is mounted on a wheel free to revolve on a spindle and carried on a movable carriage and pressed against the drum with the desired axle load. Three cleats are bolted to the face of this wheel at 45° left and right hand and at 90°, respectively. The inertia of the load applied is great enough to prevent any appreciable movement of the tire axle when the cleats strike the tire. The cleats are made by cutting longitudinal pieces three-fourth inch high from a 2⅞-inch diameter shaft or, what is equivalent, from a 2½-inch pipe.

TABLE 2.—*Axle load and air pressure for endurance tests*

Size of tire in inches	Axle load	Air pressure	Size of tire in inches	Axle load	Air pressure
	Pounds	*Lbs./in.²*		*Pounds*	*Lbs./in.²*
3 fabric	500	45	4½ cord	1,500	65
3½ fabric	700	55	5 cord regular	1,800	70
3½ cord	825	55	5 cord heavy-duty	1,800	70
3½ cord heavy-duty	900	60	6	See Section VII.	
4 cord regular	1,200	65	7		
4 cord heavy-duty	1,200	65	8		

The temperature of the surrounding air during the test shall not be less than 70° F. or more than 90° F. The machine shall be stopped after a run of one-half hour long enough to correct the inflation pressure. Thereafter the inflation pressure shall be checked at five-hour intervals. A new tube furnished or recommended by the manufacturer shall be used for such test. The rim on which the tire is tested shall be of standard dimensions and conform with a template approved by the Tire and Rim Association.

At the end of a run of 1,250 miles for a cord tire and 600 miles for a fabric tire it shall be removed from the rim for examination. There must be no tread separation, ply separation, broken threads or cords, or bead separation. Any indication of carcass weakness will be sufficient cause for rejection.

In some cases it is the practice to use a test wheel 1/300 of a mile in circumference (67.23 inches in diameter). With such a wheel the mileage figures shall be 1,350 and 660, respectively.

2. TREAD TESTS.—(*a*) *Material.*—The tread shall contain at least 70 per cent, by volume, of the best quality new wild or plantation rubber. If reclaimed rubber is used, it shall be in addition to the required amount of new rubber. No oil substitutes shall be used.

(*b*) *Thickness.*—See Table 3.

(*c*) *Tensile strength.*—Minimum, 2,400 lbs./in.²

(*d*) *Ultimate elongation.*—Minimum, 500 per cent (2 to 12 inches).

(*e*) *Set.*—Maximum, 25 per cent (stretch 400 per cent; 2 to 10 inches).

Tests shall be made after tire has been subjected to the endurance test.

TABLE 3.—*Thickness of tread*

Size of tire in inches	Total thickness in center of casing, minimum [1]	Thickness of tread exclusive ofnonskid portion, minimum	Factor *F*, minimum [2]	Size of tire in inches	Total thickness in center of casing, minimum [1]	Thickness of tread exclusive ofnonskid portion, minimum	Factor *F*, minimum [2]
	Inch	*Inch*			*Inch*	*Inch*	
3	0.21	0.09	0.21	5 heavy duty	0.46	0.16	
3½	.25	.10	.24	6	.53	.19	
4	.30	.10	.27	7	.62	.22	
4½	.35	.10	.31	8	.70	.25	
5 regular	.40	.11	.33				

[1] Measured from top of breaker.
[2] $F = t + 0.70\,(T - t)$ where T = Total thickness of tread,
t = thickness of tread exclusive of nonskid portion.

3. SIDE-WALL TESTS.—(*a*) *Thickness.*—Thickness of side wall of the tires shall be:

Size of tire in inches	Minimum average thickness	Size of tire in inches	Minimum average thickness
	Inch		*Inch*
3	0.04	5	0.06
3½	.05	6	.08
4	.06	7	.08
4½	.06	8	.10

(*b*) *Tensile strength.*—Minimum, 1,600 lbs./in.²

(*c*) *Ultimate elongation.*—Minimum, 500 per cent (2 to 12 inches).

(*d*) *Set.*—Maximum, 25 per cent (stretch 400 per cent; 2 to 10 inches).

4. HYDROSTATIC TEST.—Tires shall withstand, without any indication of failure, the following hydrostatic pressures:

Size of tire in inches	Hydrostatic pressure	Size of tire in inches	Hydrostatic pressure
	Lbs./in.²		*Lbs./in.²*
3 and 3½	200	5 heavy duty	320
4 regular	220	6	350
4 heavy duty	240	7	350
4½	240	8	350
5 regular	260		

5. CROSS SECTION OF TIRE.—See Table 4.

TABLE 4.—*Cross-sectional diameter of inflated tire*

Size of tire in inches	Inflation	Minimum cross section	Size of tire in inches	Inflation	Minimum cross section
	Lbs./in.²	*Inches*		*Lbs./in.²*	*Inches*
3 fabric motor cycle	35	2.90	4½ cord	70	4.95
3 fabric	45	3.00	5 cord	80	5.50
3½ fabric	55	3.35	6	90	6.30
3½ cord, regular	50	3.50	7	100	7.40
3½ cord, heavy duty	50	3.70	8	110	8.40
4 cord	60	4.40			

III. FABRICATION

Tires shall show no evidence of poor workmanship. All plies, including breaker, shall be smoothly and evenly laid and free from mold pinches, buckles, air pockets, or other imperfections.

IV. STANDARD TIRE AND RIM SIZES

TABLE 5.—*Standard tire and rim sizes and types of rim*

Nominal tire and rim sizes in inches	Oversize tire in inches	Tire seat diameter (rim)	Type of rim
		Inches	
26 by 3	27 by 3½	20	Clincher, motor cycle.
28 by 3	29 by 3½	22	Do.
30 by 3 [1]		24	Clincher.
30 by 3½	31 by 4	23	Clincher or straight side.
32 by 3½	33 by 4	25	Straight side.
31 by 4		23	Clincher or straight side.
32 by 4	33 by 4½	24	Straight side.
33 by 4	34 by 4½	25	Do.
32 by 4½	33 by 5	23	Do.
34 by 4½	35 by 5	25	Do.
34 by 5		24	Do.
36 by 6		24	Do.
38 by 7		24	Do.
40 by 8		24	Do.

[1] Not standard.

V. SAMPLING

On orders for 100 tires or less the manufacturer may submit one tire for test and analysis, if so requested by the purchaser. On orders for more than 100 tires the purchaser or his authorized representative shall select at random one tire from each 500 or fraction thereof, which shall be tested. If the tire fulfills all the requirements of the specification the lot of tires represented by it will be accepted, including the tire on which tests have been made. Failing to conform to the specification, the lot of tires represented by it, including the tire on which tests have been made, will be rejected. If, however, the maker of the tires demands a further test, two more tires from the lot rejected will be selected by the inspector, and if all the tests are found satisfactory the lot of tires represented by the tires subjected to test will be accepted, the manufacturer to bear the cost of the three tires upon which the tests have been conducted. If any tire fails in the latter tests the whole lot will be rejected.

VI. WARRANTY

Every tire shall be warranted against defects in material or workmanship developing within 90 days from date of first road wear. Any tire found defective as above shall be replaced by the contractor free of expense to the purchaser.

In lieu of the above 90 day warranty clause, any department or establishment may substitute a mileage guarantee based upon its service records.

VII. REQUIREMENTS FOR 6, 7, AND 8 INCH TIRES

The following requirements apply to 6, 7, and 8 inch tires only:

1. CARCASS.—The carcass shall consist of superimposed layers of cord fabric applied on a bias. The cord fabric shall be a standard cotton cord tire fabric, staple as commercially determined, to be not less than 1½ inch.

2. STRENGTH FACTOR.—The strength factor is taken as the product of the number of cords per inch measured at the tread at right angles to the direction of the cords, multiplied by the number of plies, multiplied by the average tensile strength of the rubberized cords taken from the casing. The strength factor (without correction for moisture) shall be:

Size of tire in inches	Minimum strength factor (pounds)
6	3, 000
7	3, 500
8	4, 000

3. FRICTION.—(*a*) *Adhesion between plies.*—Minimum, 18 pounds.

(*b*) *Adhesion between cushion and breaker strip.*—Minimum, 35 pounds.

(*c*) *Adhesion between cushion and carcass.*—Minimum, 20 pounds.

4. THICKNESS OF PLY.—The average thickness of one ply of coated fabric, measured on the finished tire at the side wall, shall be at least 0.045 inch.

5. FRICTION AND SKIM COAT COMPOUND.—The stock for frictioning the fabric used in the carcass and for skim coating shall contain at least 85 per cent, by volume, of the best new wild or plantation rubber. No oil substitutes shall be used.

6. CUSHION.—The cushion stock shall conform to the specification for friction compound given above. The width shall be not less than that of the breaker strip (see Table 6).

The thickness of the cushion shall be:

Size of tire in inches	Minimum thickness (inch) [2]
6	0. 06
7	. 07
8	. 09

7. BREAKER STRIP.—(*a*) *Material.*—Cotton fabric, open weave staple not less than 1⅛ inches long, as commercially determined, coated on both sides with rubber compound.

(*b*) *Width.*—See Table 6.

(*c*) *Weight.*—See Table 6.

[2] Measured between outside of carcass and inside of breaker strip. If more than one breaker strip is used, the distance between the outside breaker and the carcass is taken as the thickness of the cushion.

TABLE 6.—*Width and weight of breaker strip*

Size of tire in inches	Width, minimum	Weight, minimum
	Inches	*Ozs./yd²*
6	5	[1] 15
7	6	[1] 15
8	7	[1] 15

[1] If more than one breaker strip is used, the fabric shall weigh not less than 8 ounces per square yard.

(*d*) *Form.*—Strips shall be cut on the bias. There shall be no gaps at the splices in the finished tire.

(*e*) *Number of splices.*—Not more than three in one breaker strip.

(*f*) *Distance between splices.*—Not less than 6 inches measured around the tire.

VIII. GENERAL SPECIFICATIONS

The purchaser reserves the right to make any inspection, tests, or analyses necessary to insure that the product meets all requirements of the specification.

General Specifications for Rubber Goods, F. S. B. No. 59, in effect on date of issuance of proposal, shall form a part hereof, except when provisions above directly conflict. In such cases the word and meaning of this specification shall govern.

Part 2.—SOLID RUBBER TIRES

I. TYPE

Unless otherwise specified, tires shall be of the pressed-on type with channel base band conforming to the Tire and Rim Association standards adopted by the S. A. E.

II. DIMENSIONS

All dimensions and tolerances relating to metal or rubber parts shall conform to the latest recommendations of the Tire and Rim Association adopted by the S. A. E. for the size and type of tire specified. A full-size drawing showing the exact cross section of tire and base band shall be submitted with bid.

III. BASE BAND

1. MATERIAL.—Open-hearth steel, which shall conform to the following chemical requirements:

TABLE 7.—*Composition of base band*

	Carbon	Manganese	Phosphorus	Sulphur
	Per cent	*Per cent*	*Per cent*	*Per cent*
Minimum	0.10	0.30		
Maximum	.20	.60	0.045	0.050
Desired	.15	.45		

2. WELD.—Base bands are to be electrically welded. They shall be truly circular and free from appreciable warp. To determine the effectiveness of the welding process used, pieces of base-band metal not less than 8 inches long shall be welded end to end, and three such samples pulled in a testing machine. The ultimate tensile strength of these specimens shall be not less than 45,000 lbs./in.^{2} of cross section.

In order to determine if the base bands are being properly welded in production the inspector may from time to time require a weld on the finished steel base to be tested in the manner described above. The strength of the welds in production shall be not less than 45,000 lbs./in.^{2}

IV. HARD-RUBBER BASE

The manufacturer shall guarantee that the hard-rubber base will not separate from the base band or from the rubber tread stock in service when operated under standard Tire and Rim Association and S. A. E. ratings.

V. RUBBER TREAD STOCK

1. RUBBER COMPOUND.—The rubber compound shall contain not less than 65 per cent, by volume, of best new rubber. If reclaimed rubber or mineral rubber is used, it must be in addition to the 65 per cent of new rubber required. The use of "refined" or ground vulcanized rubber in the compound will not be permitted. Compound shall be free from saponifiable oils or anything made therefrom. The total sulphur must not exceed 8 per cent of the weight of new rubber.

2. TESTS.—(*a*) Tensile strength: Minimum, 2,000 lbs./in.^{2} (*b*) Ultimate elongation: Minimum, 450 per cent (2 to 11 inches). (*c*) Set: Maximum, 40 per cent, two minutes after break.

3. REBOUND.—The rebound shall be not less than 50 as measured on a Whitney rebound instrument. The tire under test shall be held at 70° F. for a period of 24 hours before testing, and the instrument shall be mounted rigidly in a vertical position. Tires shall be hung on a solid anvil below the instrument.

4. AREA OF CROSS SECTION.—The minimum cross section of tire, including tread stock and hard-rubber base, shall be as follows:

TABLE 8.—*Minimum cross section of tire*

Width of tire in inches	Minimum cross section	Width of tire in inches	Minimum cross section
	Sq. inches		*Sq. inches*
3½	6.75	8	19.75
4	7.75	10	25.75
5	10.75	12	31.75
6	13.75	14	37.75
7	16.75		

VI. SAMPLING

On orders for 200 tires or less the manufacturer may submit one tire for test and analysis, if so requested by the purchaser. On orders for more than 200 tires the purchaser or his authorized representative shall select at random one tire from each 1,000 or fraction thereof, which shall be tested. If the tire fulfills all the requirements of the specification the lot of tires represented by it will be accepted, including the tire on which tests have been made. Failing to conform to the specification in any particular, the lot of tires represented by it, including the tire on which tests have been made, will be rejected. If, however, the maker of the tires demands a further test, three more tires from the lot rejected will be selected by the inspector, and if all the tires are found satisfactory the lot of tires represented by the tires subjected to test will be accepted, the manufacturer to bear the cost of the four tires upon which the tests have been conducted. If any tire fails in the latter tests the whole lot will be rejected.

VII. GENERAL SPECIFICATIONS

The purchaser reserves the right to make any inspection, tests, or analyses necessary to insure that the product meets all the requirements of the specification.

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VIII. WARRANTY

Every tire shall be warranted against defects in material or workmanship developing within 180 days from date of first road wear. Any tire found defective as above shall be replaced by the contractor free of expense to the purchaser.

In lieu of the above 180 day warranty clause, any department or establishment may substitute a mileage guarantee based upon its service records.

Part 3.—INNER TUBES

I. TYPE

Tubes shall be of the endless type, except motor-cycle tubes, which shall be butt end, lap end, or endless, as ordered. Tubes of 6-inch diameter and larger sizes shall be cured to a ring shape.

II. MATERIAL

Class A represents what are commonly known as pure gum tubes; class B, antimony tubes; and class C, compounded tubes. The manufacturer may bid on class A or B tubes for sizes less than 6 inches and on class A, B, or C for sizes 6 inches and larger.

The rubber compound shall conform to the requirements given in Table 9.

III. DIMENSIONS

1. Pole (Inside) Diameter.—See Table 9.

2. Length.—The length of the tube is considered to be its finished length, which in the case of a tube vulcanized to ring shape is its mean circumference. (See Table 9.)

3. Thickness.—Tubes shall be of uniform thickness, except at the lap and splice. (See Table 9.)

Table 9.—*Diameter, length, and thickness of tubes*

Nominal size in inches	Pole (inside) diameter, minimum	Thickness, minimum	Length, minimum
	Inches	*Inch*	*Inches*
28 by 1½	1	0.035	79.0
26 by 3	1¾	.060	[1] 71.0
28 by 3	1¾	.060	[1] 76.0
30 by 3	1¾	.060	83.0
27 by 3½	2⅛	.070	[1] 71.0
29 by 3½	2⅛	.070	[1] 77.5
30 by 3½ regular	2⅛	.070	81.0
30 by 3½ heavy-duty	2¼	.080	82.0
32 by 3½	2¼	.070	87.0
31 by 4	2⅜	.080	83.0
32 by 4	2⅜	.080	86.0
33 by 4	2⅜	.080	89.0
32 by 4½	2¾	.090	84.5
33 by 4½	2¾	.090	87.5
34 by 4½	2¾	.090	90.5
33 by 5	3⅛	.105	87.0
34 by 5	3⅛	.105	90.0
35 by 5	3⅛	.105	93.0
36 by 6	[2] 3¾	[2] .120	92.0
38 by 7	[2] 4¼	[2] .140	97.0
40 by 8	[2] 5	[2] .160	100.0

[1] For butt-end tubes add 8 inches to this figure.
[2] For tubes of class C add 10 per cent to this figure.

IV. VALVE

Each tube shall be equipped with a complete Schrader or other air valve approved by the purchaser. Each valve shall be fitted with lock nut, rim nut, and valve cap. A spreader or bridge washer shall be furnished for all sizes up to and including 35 by 5 inches, according to the standard practice of the manufacturer supplying the tubes.

V. SAMPLING

On orders for 100 tubes or less the manufacturer may submit one tube for test and analysis, if so requested by the purchaser. On orders for more than 100 tubes the purchaser or his authorized representative shall select at random one tube from each 1,000 or fraction thereof, which shall be tested. If the tube fulfills all the require-

ments of the specification the lot of tubes represented by it will be accepted, including the tube on which tests have been made. Failing to conform to the specification, the lot of tubes represented by it, including the tube on which tests have been made, will be rejected. If, however, the maker of the tubes demands a further test, three more tubes from the lot rejected will be selected by the inspector, and if all the tubes are found satisfactory the lot of tubes represented by the tubes subjected to test will be accepted, the manufacturer to bear the cost of the four tubes upon which the tests have been conducted. If any tube fails in the latter tests the whole lot will be rejected.

VI. PHYSICAL AND CHEMICAL REQUIREMENTS

1. Tensile Strength.—See Table 10.
2. Ultimate Elongation.—See Table 10.
3. Set.—See Table 10.

Table 10.—*Physical and chemical requirements*

Class	Rubber, by volume, minimum	Organic acetone extract, maximum [1]	Tensile strength, minimum	Ultimate elongation, minimum	Set (stretch), 1 to 6 inches, maximum
	Per cent	*Per cent*	*Lbs./in.*[2]	*Per cent*	*Per cent*
A	90	5.0	1,800	750	8
B	85	5.0	2,000	725	10
C	80	5.0	2,500	600	15

[1] Based on the weight of rubber as compounded.

4. Aging Test.—After samples cut from the tube have been subjected to an accelerated aging test in air for 144 hours at a temperature of 70° C., the minimum requirements shall be as follows: Tensile strength, 1,000 lbs./in.,[2] elongation 600 per cent for class A and B tubes, 500 per cent for class C tubes.
5. Rubber by Volume.—See Table 10.
6. Acetone Extract.—See Table 10.

VII. INFLATION TEST

1. By Manufacturer.—Each tube with valve attached shall be subjected to an air inflation test by the manufacturer to disclose any defects of materials or workmanship. No tube showing any leakage after being inflated with air shall be offered for sale under this specification.

2. By Purchaser.—The tube shall be laid on a horizontal surface and inflated with air as indicated in Table 11. The tube shall expand uniformly at all points except at the splice and shall show no leakage after 24 hours.

TABLE 11.—*Diameters of tubes when inflated*

Nominal tube diameter in inches	Diameter of inflated tube	Nominal tube diameter in inches	Diameter of inflated tube
	Inches		*Inches*
1½	1⅜	5	4½
3	2⅜	6	4¾
3½	2¾	7	5¾
4	3¼	8	6½
4½	3½		

VIII. SPLICE

The splice shall be as strong as the body of the tube. The spliced ends shall be properly skived, so as to avoid an abrupt or unnecessary increase in the thickness of the tube at the splice, which shall be made in a neat and thoroughly workmanlike manner. The splice shall not fail when longitudinal strips one-half inch in width are gripped one-half inch from the splice edge on either side thereof and elongated to failure of the tube wall.

IX. GENERAL SPECIFICATIONS

The purchaser reserves the right to make any inspection, tests, or analyses necessary to insure that the product meets the requirements of the specification.

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