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BUREAU OF STANDARDS

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[2d ed., April 17, 1925]

UNITED STATES GOVERNMENT MASTER SPECIFICATION FOR  
COTTON RUBBER-LINED FIRE HOSE (COUPLINGS AND  
GASKETS)

## FEDERAL SPECIFICATIONS BOARD SPECIFICATION No. 38b

[Revised January 22, 1925]

This specification was officially promulgated by the Federal Specifications Board on September 15, 1922, for the use of the departments and independent establishments of the Government in the purchase of cotton rubber-lined fire hose (couplings and gaskets)

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## I. GRADE

Hose shall be of a single grade as hereinafter described.

## II. MATERIAL AND WORKMANSHIP

Hose shall be free from defects in material and workmanship. All materials shall be of good quality for the purpose, and without characteristics which would prove harmful to the life or functioning of the hose.

## III. GENERAL REQUIREMENTS

### 1. CONSTRUCTION

The hose shall be made of a rubber lining, a rubber backing, and a single, double, or triple cotton jacket, as specified. Each length shall be furnished with couplings attached.

### 2. RUBBER LINING (see also Section IV, 3)

(a) FORM.—The rubber lining shall be made from calendered sheets, not less than three plies vulcanized into one solid body.

The lap joint shall be as small as consistent with good manufacturing practice.

The lining shall be smooth and practically free from corrugations, pitting, and other imperfections.

(b) **THICKNESS.**—The rubber lining shall be of a uniform thickness within the limits shown in Table 1.

TABLE 1.—*Thickness of rubber lining exclusive of backing*

Size of hose (in inches)	Maximum	Minimum
1.5.....	<i>Inch</i> 0.065	<i>Inch</i> 0.049
2.5.....	.072	.058
3.....	.072	.058
3.5.....	.095	.072

### 3. RUBBER BACKING

The backing shall be made from calendered sheet. It shall be of a uniform thickness which, measured from the bottom of the impressions left by the jacket, shall be not greater than 0.028 inch.

### 4. COTTON JACKET

(a) **MATERIAL.**—The jacket shall be well, evenly, and firmly made from good cotton, as free from unsightly defects, dirt, knots, lumps, and irregularities of twist as is consistent with good manufacturing practice.

(b) **CONSTRUCTION.**—The jackets shall be seamless and woven around the hose throughout its length. The jackets shall be separate or interwoven. When separate the warps must cover the fillers.

### 5. COUPLINGS

(a) **MATERIAL.**—The couplings shall be made of an alloy of copper, tin, zinc, and lead, each within the proportion limits indicated in Table 2.

TABLE 2.—*Composition of couplings*

Metal	Minimum	Maximum
Copper.....	<i>Per cent</i> 83	<i>Per cent</i> .....
Tin.....	5	.....
Zinc.....	.....	7
Lead.....	.....	3

The metal shall be free from porosity and injurious defects.

(b) **FORM.**—The couplings shall be of the expansion-ring type and shall conform to the national standard for fire-hose couplings, as recommended by the National Fire Protection Association, unless otherwise specified, in which case full details and gauges shall be furnished by the purchaser. They shall be finished in a workman-like manner throughout. The edges of the expansion rings shall be smooth and well rounded.

(c) **THREAD DIMENSIONS.**—Thread dimensions, unless otherwise specified, shall conform to the standard adopted by the National Screw Thread Commission, August 19, 1924, and approved by the National Fire Protection Association. See Table 3.

TABLE 3.—*Thread dimensions*

## COUPLING THREAD

Nominal size in inches	Threads per inch	Pitch	Depth of thread	Major diameter		Pitch diameter		Minor diameter	
				Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
1.5-----	11.5	<i>Inch</i> 0.08696	<i>Inch</i> 0.05648	<i>Inches</i> 1.8888	<i>Inches</i> 1.8408	<i>Inches</i> 1.8323	<i>Inches</i> 1.7929	<i>Inches</i> 1.7929	<i>Inches</i> 1.7758
2.0-----	11.5	.08696	.05648	1.2 3628	2.3148	2.3063	2.2668	2.2668	2.2498
2.5-----	7.5	.13333	.08660	1.3 0836	3.0130	2.9970	2.9424	2.9424	2.9104
3.0-----	6.0	.16667	.10825+	1.3 6389	3.5486	3.5306	3.4583	3.4583	3.4223
3.5-----	6.0	.16667	.10825+	1.4 2639	4.1736	4.1556	4.0833	4.0833	4.0473

## NIPPLE THREAD

1.5-----	11.5	0.08696	0.05648	1.8783	1.8618	1.8223	1.8138	1.7658	-----
2.0-----	11.5	.08696	.05648	2.3528	2.3358	2.2963	2.2878	2.2398	-----
2.5-----	7.5	.13333	.08660	3.0656	3.0366	2.9820	2.9660	2.8954	-----
3.0-----	6.0	.16667	.10825+	3.6239	3.5879	3.5156	3.4976	3.4073	-----
3.5-----	6.0	.16667	.10825+	4.2439	4.2079	4.1356	4.1176	4.0273	-----

<sup>1</sup> Dimensions for the minimum major diameter of the coupling correspond to the basic flat ( $\frac{1}{4}$ ×the pitch) and the profile at the major diameter produced by a worn tool must not fall below the basic outline. The maximum major diameter of the coupling shall be that corresponding to a flat at the major diameter of the coupling equal to  $\frac{1}{4}$ ×the pitch.

<sup>2</sup> Dimensions given for the maximum minor diameter of the nipple are figured to the intersection of the worn tool arc with a center line through crest and root. The minimum minor diameter of the nipple shall be that corresponding to a flat at the minor diameter of the nipple equal to  $\frac{1}{4}$ ×the pitch.

(d) **ATTACHMENT OF COUPLINGS.**—The couplings shall be attached to the hose in a workmanlike manner without injury to the lining or to the jacket, and shall withstand the pressure tests hereinafter described without the use of tape, rubber tissue, or any filler.

(e) **GASKETS.**—Each set of couplings shall be provided with three rubber gaskets of a composition which meets the chemical requirements for hose lining. One gasket shall fit accurately the swivel of the coupling, and one (not less than one-eighth inch thick) shall be placed under the end of each expansion ring. When the coupling is made up snugly, as in service, the gasket in the swivel shall not be compressed to such an extent as to project beyond the inside surface of the coupling.

## 6. FINISHED HOSE

(a) **DIAMETER.**—The internal diameter of hose shall be not less than that indicated by the trade size. There shall be no contraction of diameter when the hose is under pressure. If the hose is noticeably elliptical under pressure, its maximum and minimum diameters shall be measured. The variation in diameter shall not exceed one-eighth inch.

(b) **LENGTH.**—Unless otherwise specified the hose shall be furnished in lengths averaging not less than 50 feet. No length before sampling shall be less than 48 feet.

(c) **WEIGHT.**—The weight of hose without couplings shall be in accordance with the requirements<sup>1</sup> of Table 4.

TABLE 4.—*Weight of 50 feet of hose without couplings*

Number of jackets, separate or interwoven	Size of hose	Weight	
		Maximum	Minimum
	<i>Inches</i>	<i>Pounds</i>	<i>Pounds</i>
1-----	1.5	-----	<sup>1</sup> 21
	2.5	43	35
2-----	1.5	1 42	-----
	2.5	60	-----
	3.0	80	-----
	3.5	110	-----
3-----	2.5	75	-----
	3.0	100	-----
	3.5	135	-----

<sup>1</sup> With couplings.

(d) **FLEXIBILITY.**—The hose shall be flexible and easily coiled. A 50-foot length of 2½-inch hose shall coil within a circle whose diameter is 28 inches.

#### IV. DETAIL REQUIREMENTS

##### 1. HYDROSTATIC TEST AT FACTORY

Each length of hose with couplings attached shall be subjected by the manufacturer to a hydrostatic pressure test for elongation, twist, warp, and rise. This test shall be made in the presence of the authorized inspector, unless it is specifically waived by written permission.

One length of hose in every 10 shall be subject to a kinking test and shall withstand the pressure indicated in Table 6, without any indication of weakness.

The above tests shall be conducted as described under Section IV, 2, (b) except that the maximum pressure shall be maintained only long enough for purposes of inspection.

Each length of hose after test shall be carefully drained and the cotton jacket thoroughly dried before shipment.

##### 2. HYDROSTATIC TESTS BY PURCHASER

These tests may be made at the factory if the purchaser so desires.

(a) **3-FOOT SAMPLE.**—The 3-foot sample shall show no sign of weakness when subjected to hydrostatic pressure increasing gradually at the approximate rate of 300 lbs./in.<sup>2</sup> per minute as shown in Table 5. The test shall be made first with the hose lying straight and second

with the hose held to a circular arc of 27-inch radius. The coupling remote from the source of water shall be closed with a cap or plug provided with a pet cock to permit the escape of air while the hose is being filled with water.

TABLE 5.—*Hydrostatic test pressures to be applied to 3-foot sample*

Kind of hose (number of jacket)	Test pressure
Single.....	<i>Lbs./in.<sup>2</sup></i> 500
Double.....	600
Triple.....	600

(b) 47-FOOT SAMPLE.—The hose shall be laid out straight on a smooth surface, such as a cement walk. One coupling is connected to the source of water supply, the other coupling being closed with a cap or plug provided with a pet cock for the escape of air while the hose is being filled with water. To insure the complete removal of air from the hose, the surface on which the hose rests should be slightly inclined toward the source of water supply, so that the pet cock may be at the highest point.

With a crayon or soft pencil make three marks around the hose jacket, dividing its length approximately into four equal parts. The circumference of the hose shall be measured at these marks during the test, as described later.

With the pet cock open, admit water into the hose gradually until the air has been expelled and the hose is completely filled with water. The pet cock shall then be closed and the pressure gradually increased until the gauge (which shall have been tested for accuracy) shows a pressure of 10 lbs./in.<sup>2</sup>, when the water supply shall be cut off and a mark made on the top surface of the hose jacket adjacent to the closed coupling. This mark is used as a means of measuring the amount of twist during the test.

With a steel tape measure the length of hose between backs of couplings, recording the result to the nearest one-quarter inch and with a small flexible steel tape measure the circumference of the hose at the three equidistant points above referred to, and record the results to the nearest one-thirty-second inch.

Water shall now be gradually admitted into the hose in such quantity as will increase the pressure per square inch at an approximate rate of 300 pounds per minute, and while the pressure is being increased the hose shall be carefully examined for leakage or other defects. When the test gauge indicates the pressure specified in Table 6, for the kind of hose being tested, the source of water supply shall be shut off and the hose shall be allowed to remain under this pressure for 10 minutes. When 8 minutes have elapsed, the following

measurements shall be taken and recorded: (1) The length of hose between the backs of couplings, following the contour of the hose, (2) the circumference of hose at the three equidistant points, (3) the amount of twist as indicated by the mark on the hose jacket adjacent to the closed coupling measured to the nearest one-eighth turn, (4) the amount of "warp" or deviation from a straight line as measured from a cord stretched from center to center of the backs of couplings, and (5) the rise from the surface on which the hose rests.

The pressure shall then be released and the hose doubled back on itself and tied so as to form a sharp kink at a point about 18 inches from the coupling remote from the pump. The pressure shall then be raised to the amount indicated in Table 6 and released after five seconds.

The hose while undergoing the above hydrostatic tests shall not leak, sweat, nor show any indication of weakness. There shall be no leakage at the couplings nor breaking of threads in the jacket.

Two pressure gauges should be provided for this test, one graduated from 0 to about 20 lbs./in.<sup>2</sup>, the other from 0 to about 1,000 lbs./in.<sup>2</sup> The low pressure gauge is used only to indicate the pressure of 10 lbs./in.<sup>2</sup>, at which the initial measurements are taken. It should be provided with a shut-off valve and relief cock to protect it against the higher pressures used in the test.

TABLE 6.—Requirements for hydrostatic test applied to full length

Nature of data	Numerical requirements for—				
	Single jacket		Double jacket		Triple jacket
	1½ inches	2½ inches	1½ inches	2½, 3, and 3½ inches	2½, 3, and 3½ inches
Test pressure for initial measurements.....lbs./in. <sup>2</sup> .....	10	10	10	10	10
Test pressure for elongation, expansion, twist, warp, and rise.....lbs./in. <sup>2</sup> .....	300	300	400	400	400
Test pressure for kinking.....do.....	250	250	300	300	300
Elongation.....maximum per cent.....	10	10	7	7	6
Expansion.....maximum per cent circumference.....	3	3	3	3	3
Twist <sup>1</sup> to right.....maximum degrees per foot.....	34	25	29	10	10
Twist <sup>1</sup> to left.....do.....	0	0	0	0	0
Warp, <sup>2</sup> maximum.....inches.....	20	20	20	20	20
Rise, maximum.....do.....	7	4	0	0	0

<sup>1</sup> A twist to the right (the direction that would tend to tighten the couplings) is indicated by a clockwise rotation of the coupling, looking from the hose toward the coupling. A twist to the left is indicated by a counterclockwise rotation. A maximum twist to the left of 2° per foot will be permitted while pressure is being raised, but any final twist must be to the right.

<sup>2</sup> Deviation from a straight line.

(1) *Elongation.*—The elongation from back to back of couplings shall be in accordance with the requirements of Table 6. There shall be no contraction or shortening of hose under pressure.

(2) *Expansion.*—The expansion or increase in circumference shall be in accordance with the requirements of Table 6.

(3) *Twist*.—The twist shall be in accordance with the requirements of Table 6.

(4) *Warp*.—The warp shall be in accordance with the requirements of Table 6.

(5) *Rise*.—The hose shall not rise from the surface on which it rests a greater distance than that stated in Table 6.

(6) *Kinking*.—See Section IV, 2 (b), and Table 6.

### 3. RUBBER LINING

(a) RUBBER CONTENT.—The rubber lining shall contain at least 75 per cent by volume of the best quality new wild or plantation rubber. It shall be free from oil substitutes and reclaimed rubber.

(b) ACETONE EXTRACT.—The acetone extract corrected for free sulphur shall not exceed 5 per cent of the weight of rubber as compounded.

(c) TOTAL SULPHUR.—The total sulphur content shall not exceed 8 per cent of the weight of rubber as compounded. Sulphur contained in barytes shall not be included in the allowable sulphur content.

(d) TENSILE STRENGTH.<sup>1</sup>—Minimum, 1,600 lbs./in.<sup>2</sup>, tested across the fold.

(e) ULTIMATE ELONGATION.<sup>1</sup>—Minimum, 500 per cent (2 to 12 inches).

(f) SET.<sup>1</sup>—Maximum, 25 per cent after a stretch of 400 per cent (2 to 10 inches) for 10 minutes with 10 minutes rest.

(g) STRENGTH OF LAP.—Minimum, 75 pounds per (linear) inch.

(h) LIFE TEST OF LINING.—The tensile strength of the lining as determined with test pieces 0.5 inch wide prepared from strips (cut transversely across the fold) which have been subjected to the action of dry heat at  $158 \pm 2^\circ$  F. for 96 hours shall be not less than 900 lbs./in.<sup>2</sup>

### 4. FRICTION<sup>2</sup>

The adhesion between backing and jacket, and between backing and lining, shall be such that a weight of 12 pounds suspended from a strip 1.5 inches wide will cause separation at a rate not greater than 1 inch per minute. This requirement is not intended to bar that construction wherein there is no adhesion between the jacket and lining along the fold, provided that the surface over which there is no adhesion is not greater than 35 per cent.

<sup>1</sup> Test pieces shall be 0.5 inch wide, cut transversely across the fold. It is necessary to buff the test pieces carefully in order to determine the tensile strength accurately.

<sup>2</sup> Test pieces are prepared as follows: With a soft pencil draw two parallel lines  $2\frac{1}{2}$  inches apart, following the filler strands around the circumference of the hose. Cut the hose at the lap and also along these lines so as to form a strip of a length equal to the circumference of the hose. This strip is laid out flat, and the rubber lining cut through to the jacket along parallel lines  $1\frac{1}{2}$  inches apart. The end of the central portion of the lining between these two cuts is separated from the jacket for a short distance.

## V. INSPECTION AND SAMPLING

One length of hose from each 50 lengths or fraction thereof shall be selected by the inspector or other authorized representative of the purchaser, for performing the tests for acceptance. A piece shall be cut from this hose and a coupling attached by the manufacturer to the cut end, the length being such as to measure 3 feet between the backs of the couplings. The manufacturer shall also attach a coupling to the cut end of the longer piece, which, if the hose is accepted, shall be paid for as a full 50-foot length.

The couplings on the 3-foot length shall remain the property of the manufacturer.

These two pieces of hose shall be subjected to hydrostatic tests by the purchaser, in accordance with the procedure described under Section IV, 2, (b), after which the couplings shall be removed from the 3-foot sample and examined for compliance with the specification. The 3-foot length of hose shall then be used in the preparation of samples for physical and chemical laboratory tests.

Failure of either the 3 or the 47 foot length of hose to meet all the requirements specified for the hydrostatic tests shall be cause for rejection of the 50 lengths of hose represented by these test pieces. If all the requirements of the hydrostatic test are met, physical and chemical laboratory tests shall be made.

## VI. PACKING AND MARKING

Packing shall be as specified in the proposal. Each length of hose passing the requirements shall be indelibly stenciled at the ends in letters 1 inch high with the manufacturer's name, the month and year of manufacture, and the words "Tested to — lbs./in.<sup>2</sup>" (the test pressure specified in Table 6). The lettering shall begin approximately 4 feet from the couplings.

## VII. ADDITIONAL INFORMATION

1. USE.—This specification is to cover the purchase of hose for fire-protection purposes, and in placing orders the following points should be borne in mind:

Single-jacketed hose is for use at fire hydrants, standpipes, and similar places. It will not withstand frequent service and is not suitable where the fabric will be subjected in service to chafing on rough or sharp surfaces.

Double and triple jacketed hose is for use on pumping engines and in places where service conditions require the additional protection against wear afforded by the extra cotton jackets.

2. BASIS OF PAYMENT.—Hose shall be paid for on the basis of 50 feet to the length. In no case shall the length be less than 48 feet and the average length shall be not less than 50 feet. Measurements shall be made from back to back of couplings with the hose rolled out straight and under a pressure of 10 lbs./in.<sup>2</sup>

Any length of hose found to be defective on delivery at destination shall be replaced by the contractor at his expense.

### VIII. GENERAL SPECIFICATIONS

All tests and analyses shall be made in accordance with the methods described in Federal Specifications Board, Specification No. 59, General Specification for Rubber Goods.

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