NATIONAL BUREAU OF STANDARDS REPORT

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TESTS OF CIVIL DEFENSE MATERIALS AFTER STORAGE

I. Plaster of Paris Impregnated
Cotton Bandages

By

James F. Hoag, Jr., Emanuel Horowitz,
Russell J. Capott and Mary N. Steel

Technical Report

to

Department of Health, Education and Welfare
Public Health Service
Washington 25, D. C.

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

THE NATIONAL BUREAU OF STANDARDS

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I. Plaster of Paris Impregnated Cotton Bandages

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Testing and Specifications Section
Organic and Fibrous Materials Division

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U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

I. Plaster of Paris Impregnated Cotton Bandages

Summary

Cotton bandages impregnated with plaster of paris have been in storage since 1953 in various warehouses throughout the United States as part of the materiel for Civil Defense. The Department of Health, Education and Welfare decided to ascertain the condition of these bandages after approximately 8 years of storage. For this purpose, samples were taken in accordance with a statistical plan from a number of warehouses and tested, insofar as practicable, for compliance with requirements of the specifications under which they were originally purchased.

All the bandages tested in accordance with Federal Specification GG-B-107, Type 1, Class 1, dated June 21, 1951 complied with the specification requirements for bandage weight, cast strength and weight loss. Only two bandages of 88 tested exceeded the requirement for setting time. Thus it appears that storage has not adversely affected the properties of these bandages judging by their compliance with the specification requirements.

Additional samples of bandages were taken for test under procedures given in Federal Specification GG-B-101c, dated June 26, 1956. Satisfactory specimens for setting time could not be obtained using the method outlined in this specification. Therefore, the normal consistency procedure reported by the American Ceramic Society and referenced in Federal Specification SS-P-402 was used in this test. All of the specimens tested complied with the requirement for setting time, but exceeded the maximum requirement for weight of plaster of paris. This condition would not appear to limit the usefulness of the bandages. It was concluded that this group of bandages, like the ones tested for compliance with Federal Specification GG-B-107 did not appear to be adversely affected by storage.

Part I. Tests Under Federal Specification GG-B-107, Type 1, Class 1, Dated June 21, 1951

Reference: Department of Health, Education and Welfare
letter dated April 7, 1961
DHM-SMB
Stock No. 6510-201-2002
CD No. V-162

Sample Identification:

Type of Warehouse Storage	Warehouse Location	Shipping No.	Box Nos.	No. of Boxes
Bulk	Romulus, N. Y.	19297	A 1-2	2
Bulk	Somerville, N. J.	19449	B 11-16	6
Bulk	Jeffersonville, Ind.	19280	C 5-10	6
Bulk	Seneca, Ill.	19286	D 5-10	6
1953 Model Hospital	Romulus, N. Y.	19279	E 1-120	120

One hundred and forty (140) boxes were received from four warehouses, each box containing 12 individual bandages sealed in polyethylene bags.

The individual specimens tested were sampled for test in the following manner: Two bandages from each box labeled A, B, C, and D, were picked at random for test purposes. For the 120 boxes labeled E, one out of every five boxes was chosen at random and two bandages were then taken at random from each of these 24 boxes. In all, 88 bandages were taken for test.

All bandages tested failed to meet the requirement that they be nondusting. In handling the rolls considerable amounts of plaster of paris separated from the bandage. The test of the crinoline was not performed as no uncoated crinoline was submitted. In all cases, the plaster of paris was free of dirt and foreign material. Only one of the 88 bandages was not a continuous piece of textile; specimen No. E 38-7 had two holes in the fabric, each approximately 1/2" x 1/2". All the specimens but one, B 16-5, were uniformly coated. With respect to pinking, some of the severed yarns cut in the pinking process had come loose from the bandage. All the bandages were neatly and evenly rolled with a central core provided.

All bandages passed the water penetration test. The following three bandages failed to meet the dimensional requirement of 3 inches ± 1/8 by 3 yards ± 2 percent (108 inches ± 2 inches): D 6-12, 3" x 102"; D 6-6, 3" x 112"; and E 87-3, 3" x 105".

The test results for weight, percent loss in weight, setting time, and cast strength are given in Table 1. All of the bandages tested complied with the requirement of 74 grams minimum weight; the values ranged from 84 grams to 117 grams. Two of the bandages failed to meet the setting time requirement of 4 to 9 minutes. Specimens E 13-12 and E 18-7 each gave values of 10 minutes. The results for setting time for the remaining bandages ranged from

5 to 8 minutes. All of the bandages complied with the cast strength requirement of 60 pounds, minimum. The results ranged from 79 to 187 pounds. Each of the bandages tested met the loss in weight requirement of 10% maximum. The highest value obtained in this test was 3.1%, while one specimen showed no apparent loss in weight.

Table 2 summarizes the results by warehouses for bandage weight, setting time, cast strength and weight loss. Also included are the grand averages for each of these tests based on 88 specimens. These data indicate that the average results obtained for the bandages meet the requirements of the specification for the above properties.

Table 3 presents the measures of variability for the tests listed in Table 1 in terms of the differences observed within boxes, between boxes in the same warehouse and between warehouses. The numbers listed are components of variance corresponding to these three classifications. Also listed are the standard deviations and percent coefficients of variation for specimens selected completely at random.

It is interesting to note that the major source of variability is due to differences between specimens within a given box. Additional box to box variability exists but is quite small as compared to the former. There is also relatively little further variability due to differences between warehouses. One may infer from these data that the bandages in all the warehouses are essentially the same.

Part II. Tests Under Federal Specification GG-B-101c, Dated June 26, 1956

Reference: Department of Health, Education and Welfare
letter dated April 7, 1961
DHM-SMB
Stock No. 6510-201-2001
CD No. V-162

Sample Identification:

Type of Warehouse Storage	Warehouse Location	Shipping No.	Box Nos.	No. of Boxes
Bulk	Romulus, N. Y.	19297	A 3-7	5
Bulk	Somerville, N. J.	19449	B 1-10	10
Bulk	Jeffersonville, Ind.	19280	C 1-4	4
Bulk	Seneca, Ill.	19286	D 1-4	4

Samples of plaster of paris impregnated cotton bandages, 3 inches by 3 yards, were tested for compliance with Federal Specification GG-B-101c, dated June 26, 1956, insofar as practicable. The samples, received from four warehouses consisted of 23 boxes, each containing 12 individual bandages sealed in polyethylene bags.

Except for setting time the individual specimens tested were sampled for test in the following manner. Two bandages were taken at random from each of the 23 boxes and tested. With regard to setting time, sufficient bandages were taken from each box to yield 200 grams of plaster of paris. The setting time values therefore represent the results obtained on a composite sample of plaster of paris from a given box. The test for setting time was performed according to Federal Specification SS-P-402 dated May 5, 1945 because it was not possible to conduct the test as described in Federal Specification GG-B-101c. The amount of water to be added to the plaster of paris was determined by the method of normal consistency referenced in both Federal Specification SS-P-402 and the American Ceramic Society Bulletin No. IGL-308. The normal consistency was attained when 100 milliliters of water were added to 100 grams of plaster of paris.

Plaster of paris from each of the boxes was sieved through a No. 30 sieve. Essentially all of the plaster passed through the sieve, thus meeting the specification requirement. While only a few random specimens were tested on a No. 200 sieve, approximately 50 percent of the plaster did not pass through the sieve. The specification requires that 90 percent of the specimen under test pass through the No. 200 sieve. However, it was observed that the size of the plaster particles was influenced by the manner in which the plaster was removed from the bandage.

None of the bandages showed any signs of leakage after being completely immersed in water at room temperature for 4 hours. All bandages tested were 3 inches wide and 3 yards ± 2% in length. The test of the crinoline or plain gauze was not performed as no uncoated crinoline or plain gauze was submitted. All the bandages tested were made of one continuous piece of textile and were free from loose threads and ravelings. None of the bandages tested had the entire fabric completely coated with plaster of paris as is required in paragraph 3.2.1 of Federal Specification GG-B-101c. Many small areas the size of the fabric mesh were found in each bandage that were devoid of plaster. This was also true for the bandages tested under Federal Specification GG-B-107 which did not have such a requirement. In any case this condition did not have a detrimental affect on any of the properties tested. The layer of plaster of paris was uniformly

distributed on both surfaces of all the bandages.

The results for weight of plaster of paris in each bandage and the setting time are given in Table 4. It can be seen that all of the specimens tested complied with the 6 to 15 minutes specification requirement for setting time. The values ranged from 7 3/4 to 11 1/2 minutes. All the specimens tested failed to comply with the 60 to 81 gram requirement for the weight of the plaster in the bandage. For the 46 specimens tested, the results ranged from 88 to 101 grams. It should be pointed out that the weight of the plaster of paris in each bandage was not restricted by a maximum requirement in Federal Specification GG-B-107. Table 5 gives the average results by warehouses for weight of the plaster of paris per bandage and the setting time. The average values for weight of the plaster were in good agreement and ranged from 93 to 98 grams. The average results for setting time ranged from 8 1/4 to 10 3/4 minutes. Also given are the grand averages of all the specimens tested; 96 grams for weight of plaster per bandage and 9 3/4 minutes for setting time.

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Table 1. Individual Results for Specimens Tested
(Stock No. 6510-201-2002)

Box No.		Specimen No.	Bandage weight, g	Setting time, minutes	Cast strength, lb	Specimen No.	Loss in weight, %
Specification requirement:			74 min	4 - 9	60 min		10 max
A	1	12	100	8	141	5	1.4
A	1	3	102	8	139	6	1.8
A	2	7	105	8	154	2	0.3
A	2	5	112	8	168	4	1.8
B	11	8	97	7	135	3	0.8
B	11	10	103	7	137	7	0.5
B	12	6	101	6	148	2	1.2
B	12	11	103	6	157	3	2.3
B	13	9	105	8	155	3	1.0
B	13	12	106	7	152	7	0.3
B	14	3	104	8	141	4	1.7
B	14	7	105	7	141	9	1.5
B	15	3	106	6	144	1	1.8
B	15	7	97	6	117	5	1.2
B	16	5	107	7	150	1	1.4
B	16	7	100	6	144	4	0.9
C	5	5	103	6	143	3	0.0
C	5	4	102	5	152	11	0.9
C	6	5	114	6	187	2	1.0
C	6	8	109	7	173	7	0.8
C	7	3	111	6	153	2	1.2
C	7	5	105	7	79	4	0.6
C	8	3	105	6	150	2	1.1
C	8	5	111	6	163	4	1.4
C	9	12	98	6	140	1	1.1
C	9	3	101	6	139	7	0.6
C	10	4	102	6	149	2	0.8
C	10	9	103	7	143	6	0.8
D	5	4	103	8	134	2	1.3
D	5	8	104	7	156	6	0.8
D	6	12	84	6	93	5	1.3
D	6	6	106	6	158	7	1.1
D	7	10	104	6	154	1	2.3
D	7	4	106	5	162	6	0.0
D	8	6	106	6	145	9	0.8
D	8	10	102	6	153	12	1.3
D	9	6	109	7	164	7	1.6
D	9	12	108	6	164	9	1.5
D	10	6	103	6	144	4	1.5
D	10	5	110	5	168	12	1.0
E	1	3	106	5	142	1	1.8
E	1	6	106	8	149	4	1.0

Table 1. Individual Results for Specimens Tested (Cont'd)

Box No.	Specimen No.	Bandage weight, g	Setting time, minutes	Cast strength, lb	Specimen No.	Loss in weight, %
Specification requirement:		74 min	4 - 9	60 min		10 max
E 7	3	108	7	154	1	1.8
E 7	8	109	7	179	6	1.6
E 13	8	117	7	144	5	2.3
E 13	12	108	10*	149	10	1.2
E 18	7	110	10*	151	4	1.2
E 18	8	113	6	157	12	1.4
E 22	2	110	8	150	1	1.3
E 22	3	105	8	145	6	0.7
E 28	9	109	8	150	2	2.0
E 28	5	111	8	163	3	2.0
E 32	2	107	7	152	1	2.6
E 32	6	108	8	162	7	0.6
E 38	7	105	6	140	1	1.8
E 38	9	114	8	163	3	3.0
E 43	8	109	7	158	3	0.2
E 43	2	109	8	147	7	0.7
E 46	6	107	7	146	7	1.6
E 46	1	111	8	153	8	1.2
E 52	9	111	7	148	7	1.4
E 52	5	115	7	169	8	1.5
E 57	11	115	7	165	3	1.5
E 57	9	110	7	158	5	1.2
E 65	9	114	6	170	3	1.2
E 65	6	108	7	157	8	0.8
E 67	4	116	7	157	3	1.7
E 67	5	112	7	145	9	1.4
E 71	10	111	7	157	3	2.4
E 71	8	110	8	160	12	1.5
E 76	8	105	8	134	7	1.4
E 76	11	106	7	140	10	1.5
E 84	8	108	7	156	10	2.0
E 84	1	107	7	157	12	3.1
E 87	11	106	6	142	7	2.9
E 87	3	105	7	132	12	2.2
E 91	12	107	6	143	8	2.2
E 91	6	109	7	143	9	1.6
E 96	5	113	7	154	4	1.7
E 96	6	109	7	152	8	1.6
E 103	7	105	6	147	3	1.6
E 103	12	105	6	146	9	1.6
E 108	10	102	7	140	3	1.9
E 108	6	103	7	135	11	1.6

Table 1. Individual Results for Specimens Tested (Cont'd)

Box No.	Specimen No.	Bandage weight, g	Setting time, minutes	Cast strength, lb	Specimen No.	Loss in weight, %
Specification requirement:		74 min	4 - 9	60 min		10 max
E 114	7	108	6	149	3	1.9
E 114	10	103	7	139	8	2.0
E 117	4	98	6	126	1	1.4
E 117	12	101	7	138	6	1.4

*Fails to meet the requirements of the specification.

Table 2. Average Results for Warehouses
(Stock No. 6510-201-2002)

Warehouse	Bandage weight, g	Setting time, minutes	Cast strength, lb	Weight loss, %
Romulus (A1-2)	104.8	8.00	150.5	1.32
Somerville	102.8	6.75	143.4	1.22
Jeffersonville	105.3	6.17	147.6	.86
Seneca	103.8	6.17	149.6	1.21
Romulus (E1-120)	108.4	7.12	150.3	1.63
Grand average (88 specimens):	106.4	6.85	148.9	1.40

Table 3. Components of Variability

	Bandage weight	Setting time	Cast strength	Weight loss
	g^2	$minutes^2$	lb^2	$\%^2$
Specimens within box	14.3	0.67	175	0.27
Box within warehouse	6.6	0.04	57	0.05
Warehouse	6.1	0.30	0	0.10
Total* variance	27.0	1.01	232	0.42
	g	minutes	lb	%
Total* standard deviation	5.2	1.0	15.2	0.65
	%	%	%	%
Total* coefficient of variation	4.9	14.6	10.2	46

*Variability of specimens taken from boxes out of warehouses, all picked at random.

(Stock No. 6510-201-2002)

Table 4. Individual Results for Weight of Plaster and Setting Time
(Stock No. 6510-201-2001)

Box No.	Specimen No.	Weight of plaster, g	Setting time, minutes
	Specification requirement:	60 - 81	6 - 15
A 3	12	93*	8-1/4
A 3	4	94*	
A 4	5	91*	8-1/4
A 4	6	93*	
A 5	12	96*	8
A 5	5	92*	
A 6	8	88*	8
A 6	9	94*	
A 7	6	91*	8-1/4
A 7	9	94*	
B 1	1	98*	11-1/2
B 1	10	96*	
B 2	8	98*	10-3/4
B 2	2	101*	
B 3	6	94*	11-1/2
B 3	1	100*	
B 4	6	90*	10-1/2
B 4	2	87*	
B 5	4	99*	10-1/2
B 5	10	100*	
B 6	7	100*	11-1/4
B 6	8	99*	
B 7	9	100*	9-3/4
B 7	8	97*	
B 8	10	98*	8-1/2
B 8	8	100*	
B 9	10	101*	8-1/2
B 9	11	101*	
B 10	8	96*	11-1/2
B 10	5	97*	
C 1	1	97*	10-1/2
C 1	7	95*	
C 2	7	97*	8-1/4
C 2	6	97*	
C 3	12	99*	8-1/4
C 3	9	93*	
C 4	12	93*	7-3/4
C 4	4	93*	

Table 4. Individual Results for Weight of Plaster and Setting Time (Cont'd)

Box No.	Specimen No.	Weight of plaster, g	Setting time, minutes
	Specification requirement:	60 - 81	6 - 15
D 1	8	95*	11-1/4
D 1	4	101*	
D 2	2	95*	11-1/4
D 2	11	95*	
D 3	5	93*	10-1/2
D 3	3	99*	
D 4	6	96*	10-1/4
D 4	10	97*	

*Fails to meet the requirements of the specification.

Table 5. Average Results by Warehouses
(Stock No. 6510-201-2001)

Warehouse	Weight of plaster, g	Setting time, minutes
Romulus	93	8-1/4
Somerville	98	10-1/2
Jeffersonville	96	8-3/4
Seneca	96	10-3/4
Grand average (of all specimens tested):	96	9-3/4

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THE NATIONAL BUREAU OF STANDARDS

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