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BUREAU OF STANDARDS  
George K. Burgess, Director

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STANDARDS FOR PAPER TOWELS

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# STANDARDS FOR PAPER TOWELS<sup>1</sup>

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## ABSTRACT

Results are given of an investigation made for development of specifications for purchase of paper towels. A wide range of products covering all grades available was tested and a study made of the methods of marketing. The fibrous raw materials used in paper towels range from repulped waste papers up to fibers prepared from wood by chemical processes. The properties of prime importance in toweling are rapid absorption, high strength, and cleanliness. Absorbency is tested by placing 0.1 cc of water on the surface and noting time required for complete absorption. The bursting test is considered suitable for measuring the strength. Recommendations are made in respect to simplification of sizes, basis for expression of weight, unit of purchase, and unit of packaging. Specifications are suggested for towels suitable for general use.

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## CONTENTS

	Page
I. Introduction.....	1
II. Composition of paper towels.....	1
III. Considerations involved in evaluation of quality.....	2
IV. Recommended methods of testing quality.....	3
V. Weight, size, and packing.....	4
VI. Specifications.....	4

## I. INTRODUCTION

At the request of the Federal Specifications Board the Bureau of Standards made an investigation for the purpose of developing specifications to be used for purchase of paper towels by the Government departments. Although this paper product has come into extensive use, there are few data available with respect to considerations involved in judging quality. There is also a lack of uniformity in the methods of marketing. It is thought, therefore, that the results of the investigation, which was conducted with the cooperation of manufacturers and consumers, may be of assistance in the direction of a standardization beneficial to all concerned.

## II. COMPOSITION OF PAPER TOWELS

Whereas wood fiber is the basic raw material universally used for making paper towels, there is an extensive variation in the quality of the fiber. The common fiber constituents are ground wood and

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<sup>1</sup> Prepared by B. W. Scribner, chief of paper section, Bureau of Standards.

sulphite. In some towels these fibers have been secured wholly or in part from repulped waste papers. Other towels are made entirely of virgin wood fibers, which are produced by chemical pulping processes and sometimes bleached. Fibers produced by both the sulphite and the sulphate pulping processes are commonly used, and some development is being made in the direction of utilization of long-fibered soda pulp, such as that produced from pine and gum woods. Modifications of the usual fiber treatment are employed in making such towels to obtain the peculiar characteristics desirable in this particular product. In some cases rosin size is used in towels to increase their resistance to disintegration during use.

### III. CONSIDERATIONS INVOLVED IN EVALUATION OF QUALITY

Paper towels come under the classification of bibulous papers, which are characterized by their absorbency, loose formation, and softness. Blotting paper is a well-known example of a paper in this group. Towel and blotting papers are similar in their absorptive requirements, but the former, in addition to good absorbency, must possess much greater strength than blotting paper. Unlike the latter, they must be comparatively thin to have the required flexibility, and yet must possess much greater strength than blotting paper so that they will not break under the severe conditions of usage. A good grade of paper toweling has two or three times the strength of blotting paper of the same fiber composition. In evaluating paper towels, therefore, the main consideration, in addition to degree of absorbency, is the strength.

As is usually the case, the two desired properties are difficult to obtain in the same sheet of paper. The natural softness and absorbency of the wood fiber are considerably lessened by the usual treatment given to develop its maximum strength for paper making. Generally speaking, therefore, a towel having extremely high absorbency lacks strength, while the very strong towels are deficient in absorbency. Those of the first class must be used as a blotter, or they will disintegrate during use, while those of the second class require considerable rubbing to complete the drying operation. Either extreme is undesirable, as time is an important factor in the use of towels, and the care taken to avoid breaking of the very absorbent towels or the prolonged rubbing required by the less absorbent but stronger towels consumes more time than is desirable. It is true that some towels have the two desirable properties of high absorbency and great strength combined, but such towels are usually relatively high priced. Everything considered, a towel possessing a medium degree of both absorbency and strength is satisfactory for

general use where little care as regards economy in usage will be exercised.

Cleanliness, of course, is necessary. Fiber composition and color are of minor importance. The use of repulped paper stock is somewhat objectionable from sanitary considerations, and while it would seem that the use of miscellaneous waste papers from unknown sources is undesirable there can be no valid objection to the use of clean waste papers, such as overruns of newspapers secured directly from the publishers. As regards color, although a high, white color is generally associated with purity, from a practical standpoint color is of little importance, and any natural fiber color should be acceptable. Towels are generally creped, and this is desirable since it lends much additional resistance to the strains incident to use. Rosin size is not detrimental to the quality except that if used in excessive amount it tends to make the toweling harsh. From these considerations visual inspection of the towel as regards cleanliness and tests of absorbency and strength should be sufficient for determination of quality.

#### IV. RECOMMENDED METHODS OF TESTING QUALITY

As no standard test methods for paper towels were available, representative samples were secured from various manufacturers for research as regards development of methods of test. For the determination of strength, in order to simulate conditions of usage, an attempt was made to measure the tensile strength of the paper after wetting it, but owing to the loose formation and weakness of many towels it was impossible to obtain consistent results by such a method. It was found that the bursting-strength test of the dry paper grades the towels satisfactorily, and therefore this method of test is recommended. The absorbency may be determined by the following modification of Reed's pipette method<sup>2</sup> for testing blotting paper, this modification being evolved by F. T. Carson, of this bureau.

Place one thickness of the towel on a 4-mesh wire screen. Fill a 1 cc measuring pipette<sup>3</sup> with water (25° C.), hold at an angle of about 30° with the horizontal, the tip being very near the surface of the paper, and allow 0.1 cc of water to flow on the towel. While the water is flowing let the tip of the pipette remain in the drop as it forms on the surface of the towel. The absorbency is the time in seconds from the contact of the water with the towel until the drop is completely absorbed, as indicated by no further reflection of light from it. The average of 10 tests shall be reported as the absorbency.

<sup>2</sup> Determining the Absorbency of Paper, E. O. Reed, Paper, 21, No. 19; Jan. 16, 1918.

<sup>3</sup> The abbreviation cc is used in this paper for 0.001 liter.

## V. WEIGHT, SIZE, AND PACKING

In addition to the properties which determine quality, weight and size are of importance. Lightness tends to decrease both transportation and storage cost. As there is no common basis for the expression of weight, this could conveniently be expressed in terms of pounds per 500 sheets, 25 by 40 inches in size, this basis having been generally adopted by the paper industry for all papers.

There is considerable variation in sizes, but the differences are not great. The economy that would be effected by adoption of a standard size can readily be appreciated. A size of 11 by 13 inches is convenient and would probably require fewer changes from existing sizes than any other. However, as some machinery in use is probably not adapted to producing towels of this size economically, this size can probably be only approximated in some cases at the present time.

A satisfactory unit of purchase is 1,000 towels, this unit being used quite generally for converted paper products. If this unit were used, the towels could be packaged conveniently in cartons of 1,000 or multiples of this number. Adoption of one suitable size, of a basis for expression of weight, and of a unit basis for payment and packaging would greatly simplify present practice and benefit all concerned.

## VI. SPECIFICATIONS

For the purpose of developing purchase specifications tests were made of towels representative of the range of products on the market. In Table 1, giving the test data, the bursting strength test results are given not only as obtained but also converted to a common weight of paper to facilitate comparison. Where the absorbency data are marked 600+ seconds, this indicates the test was discontinued at the end of this time.

TABLE 1.—Tests of paper towels

Bureau of Standards number	Weight, 500 sheets, 25 by 40 inches	Size	Area	Absorbency	Bursting strength	Bursting strength 42-pound basis	Fiber composition	
							Sulphite	Ground wood
	<i>Pounds</i>	<i>Inches</i>	<i>Square inches</i>	<i>Seconds</i>	<i>Points</i>	<i>Points</i>	<i>Per cent</i>	<i>Per cent</i>
9851.....	46.3	10.7 by 13.34	142.7	600+	10.5	9.5	65	35
9852.....	45.2	10.72 by 11.07	118.7	600+	11.0	10.2	55	45
9853.....	41.8	10.87 by 15.02	163.3	4	8.2	8.2	100	-----
9854.....	38.0	11.26 by 14.73	165.9	35	9.0	9.9	95	5
9855.....	40.9	11.3 by 14.85	167.8	104	9.5	9.8	50	50
9856.....	42.4	10.67 by 13.3	141.9	480	8.5	8.4	50	50
9857.....	40.4	10.6 by 13.27	140.7	164	7.7	8.0	45	55
9858.....	50.4	10.84 by 10.96	118.8	264	10.4	8.7	45	55
9859.....	45.5	10.63 by 11.02	117.1	458	9.4	8.7	50	50
9860.....	32.3	11.42 by 13.5	154.2	23	6.9	9.0	25	75
9861.....	45.0	10.40 by 11.37	118.2	350	9.7	9.1	55	45
9862.....	40.7	11.06 by 11.54	127.6	600+	9.2	9.5	45	55
9863.....	39.4	10.05 by 14.9	149.8	9	32.7	34.9	(1)	(1)
9864.....	46.6	10.83 by 13.0	140.8	23	9.7	8.7	30	70

<sup>1</sup> 100 per cent sulphate fiber.

The variation in properties of the different towels is considerable not only in respect to size and weight but in composition, strength, and absorbency. From service trials of the various towels and consideration of the test data it is believed that the minimum requirements of towels for general use may be specified as follows:

**WEIGHT.**—Shall weigh not more than 42 pounds, basis 500 sheets, 25 by 40 inches each.

**ABSORBENCY.**—Time of absorption of 0.1 cc water at 25° C. shall not exceed 180 seconds.

**BURSTING STRENGTH.**—The bursting strength of the dry paper shall be not less than 8 points.

It need hardly be pointed out that the quality defined in these specifications is much below that of the best grade obtainable. It is believed, however, that towels conforming to these specifications are of sufficiently good quality for use in public toilets where the consumption is greatest. While it is true that theoretically a less number of the better grade towels is actually required, in practice the full value of such towels is generally not utilized. Unless, therefore, economy in use is assured or satisfaction in use is the main consideration, it is believed that towels of the quality defined will give good results.



