THICKNESS -- ASBESTOS CLOTH AND TAPE

Introduction

The thickness of an asbestos cloth or tape may or may not be significant when defining the characteristics of such materials but will depend upon the use to which they are to be put. Certain electrical tape applications and some packing and gasket applications have space limitations which make thickness an important consideration. However, there are other applications where the thickness requirements are not critical but these dimensions are specified for procurement or purchasing purposes as a means of controlling and assuring product uniformity of the materials so covered.

The consideration of thickness on this occasion is not concerned primarily with the question as to whether or not the inclusion of such properties in a given specification is desirable or essential, but rather is related to the method by means of which such data is obtained. For many years the asbestos textile industry has assumed the A.S.T.M. method for such determination, as covered by the method set forth in Designation D 39-49 and using the gage as described in Designation D 76-53, to be the universally accepted method. However, recent considerations in connection with the revision of several Federal specifications have revealed that the test method applicable for the thickness determination of the textile materials covered in the subject specifications and apparently all Federal specifications must conform to that set up in CCC-T-191b, Method 5030.

A review of the two methods and the results of a comparative investigation by both techniques is here offered.

Test Methods

The two test methods with which we are here concerned follow:

ASTM Designation: D 39 - 49 .... Thickness

5. (a) Gage. - The gage used for the measurement of thickness of woven fabrics shall conform to the requirements prescribed in Section 12 of the Standard Specifications for Textile Testing Machines (ASTM Designation: D 76).

(b) Procedure. - Place the fabric upon the anvil of the gage, smoothly but without tension. Lower the presser foot upon the fabric gradually (without impact), allow to rest upon it for 10 sec, and then observe the reading of the dial. Make similar measurements at not less than five different places, uniformly distributed over the surface of the fabric exclusive of the area adjacent to either selvage, and within one tenth the width of the fabric or within 3 yd of either end of a role or piece. Report the average of the five or more measurements as the average thickness.

ASTM Designation: D 76 - 53 .... Thickness Gage

12. (a) The gage used for measuring thickness of textile materials shall conform to the requirements set forth in Paragraphs (b) and (c), unless otherwise specified.

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(b) The gage shall be of the dead-weight type equipped with a dial graduated to read directly to 0.001 in. The presser foot shall be circular with a diameter of 0.375 ± 0.001 in. The presser foot and moving parts connected therewith shall be weighted so as to apply a total load of 6 ± 0.1 oz. (equivalent to a pressure of 3.4 psi.) to the specimen. The presser foot and anvil surfaces shall be plane to within 0.0001 in. and parallel to each other to within 0.0001 in.

Method 5030 ..... Thickness of Cloth CCC-T-191b

1. Scope.
1.1 This method is intended for determining the thickness of woven or knitted cloth. It is not suitable for pile or napped cloth.
2. Test Specimen
2.1 The test specimen shall be a suitably located (see 4.1) area of the cloth at least as large as the presser foot of the gage (see 3.1), free from knots, lumps, creases, folds, or other raised places which are not representative of the cloth surface.
3. Apparatus
3.1 Gage of the dead-weight type equipped with a dial graduated to read directly to 0.001 inch. Unless otherwise specified in the material specification, the presser foot shall be circular with a diameter of 1.129 inches ± 0.001 inch, and with the moving parts connected therewith weighted so as to apply a total load of 10 ounces ± 0.1 ounce to the specimen. The anvil shall be not less than 1.129 inches in diameter. The presser foot and anvil surface shall be plane to within 0.0001 inch, and shall be parallel to each other to within 0.0001 inch.
4. Procedure
4.1 No measurement shall be taken within one-tenth the width of the cloth from either edge when possible. Narrow cloth shall be measured along the center line. The measurement of a roll of cloth shall not be within 3 yards of either end.
4.2 The specimen shall be placed upon the anvil of the gage, smoothly but without tension. The presser foot shall be lowered upon the specimen gradually and without impact, allowed to rest upon it for 10 seconds, and the dial reading taken to the nearest 0.001 inch.
5. Report
5.1 Unless otherwise specified in the material specification, five specimens shall be tested from each Unit-of-Product.
5.2 The thickness of the Unit-of-Product shall be the average of the results obtained from the specimens tested and shall be reported to the nearest 0.001 inch.

Thickness Gage Brands:

ASTM - Federal Products Corp.
Providence, R. I.

CCC-T-191b - Randall & Stickney
Waltham, Mass.

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An analysis of the two gages reveals that the instrument used in the CCC-T-191b method provides a 10 ounce load on a one square inch area or a load of 0.625 pounds per square inch during measurement, while the ASTM method provides a 6 ounce load on a .11 square inch area or a load of 3.4 pounds per square inch during the period of measurement.

On the ASTM gage the area of contact is approximately 1/9 that of the CCC-T-191b gage and the load, per unit area, applied during measurement on the ASTM gage is approximately 5 times that on the CCC-T-191b gage. Obviously then, the resultant thickness measurements for materials that exhibit any compressibility, as do most textiles, will be lower when measured by the ASTM method than when measured by the CCC-T-191b method.

Comparative Thickness Determinations

In an effort to determine the significant differences that would be obtained when both techniques are pursued, samples of asbestos textiles of recent manufacture were obtained from several of our member companies and simultaneous tests were pursued. In this work, five samples, 4" x 6", were taken across the full width of the roll of cloth and three measurements by both techniques were obtained on each of the five samples.

The results of these determinations are set forth in Table I.

Results

It will be observed that in all cases the thicknesses determined by the ASTM method are less than those obtained by the CCC-T-191b method. The average differences between the results obtained by the two methods are fairly constant reflecting the influence of greater area and lesser unit load in the case of the CCC-T-191b method.

In this investigation, only two cloths were studied that had a yarn cut as high as 24, two 17P24 cloths being measured; two cloths in style 22P16 with 16 cut yarns were included and five 26P14 style cloths with 14 cut yarn were also included. In the 17P24 cloths the difference between the two methods showed a variation of from .003" to .004", while in the 22P16 cloth the range was from .005" to .006", and in the 26P14 cloths the range over five samples was from .004" to .006". The ranges in those cloths having 8, 10 and 12 cut yarns were from .006" to .009". These observations merely serve to point out the influence of yarn construction upon the resultant cloth thickness properties.

The greatest variations in thicknesses were induced by calendering. Whether or not the cloth was calendered and the extent to which this operation was pursued seemed to be the primary means of establishing the thicknesses of the cloths here studied. Particular attention is called to style 36P10 cloths in Commercial grade and in Grade AA. In the case of the Commercial grade cloths one sample was found to have an average thickness of .070" when measured by the ASTM method while the second sample measured .088". The same cloths measured by the CCC-T-191b method showed thicknesses of .076" and .093" respectively. In the case of the 36P10, Grade AA cloths, the ASTM readings were .060", .080" and .091" and the CCC-T-191b method readings were .066", .087" and .098"

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respectively. The standard cloth list, based upon the ASTM method sets forth .070" as the approved thickness.

The accepted tolerances on thickness for cloths, again based upon the ASTM method, are:

For cloths 0.050 and under ± 0.005

For cloths over 0.050 + 0.010
− 0.005

It will be observed that the permissable tolerances, when considered only on the basis of A.S.T.M. measurements, are exceeded in many instances, as in styles 34P10, 36P10, 40P10 and 53 T12.

Since the conditions of test under the CCC-T-191b method are different it is reasonable to assume that the standards to be proposed for each cloth under this latter method will mecessarily have to be proportionately higher and the establishment of acceptable standards for this latter method is therefor the subject of concern at this point.

Conclusions

The subjects with which we have been here concerned have been related to 1) the thicknesses of those cloths listed in the several Federal Specifications when tested in accordance with Federal Specification CCC-T-191b, Method 5030, and 2) determining the relative merits of the ASTM method when compared with the CCC-T-191b method.

1) We have set forth in Table I, column 7, recommended thicknesses based on the CCC-T-191b, Method 5030, for those cloths included in this work and which were representative of current materials of manufacturer. Two exceptions are noted, namely style 36P10, C.G. and 36P10, Grade AA. It would seem that an industry-wide consideration of the variations found in the two above noted groups should be given attention in an effort to bring these figures within tolerable limits.

It should also be observed that the figures obtained on the basis of the ASTM method measurements exceed the tolerable limits in the cases of 36P10, C.G.; 36P10, U.G.; 36P10, AA; 40P10, C.G.; 40P10, AAA and 53T12.

2) With regard to the relative merits of the two methods of test, it would seem that the test method set forth in CCC-T-191b, wherein the gage with the larger foot is utilized, should contribute to more reproduceability than is afforded by the ASTM gage with the smaller foot and anvil. The data accumulated to date would seem to bear out this observation.

The question that now presents itself is -- should consideration be given to the possibility of revising all of the data related to thickness that has been accumulated over the years, in conformance with the CCC-T-191b method or should two sets of standards be recognized?

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Table I

Style	Grade	Number of Samples	Method of Measure A.S.T.M.	Method of Measure CCC-T-191b	Recommended Thickness A.S.T.M. Standard Cloth List	Recommended Thickness CCC-T-191b Proposed
17P24	U.G.	2	.031 .037	.034 .041	.035	.038
21P10	C.G.	1	.060	.065	.055	.062
22P16	AAA	2	.059 .047	.064 .053	.051	.056
22P10G	U.G.	4	.057 .052 .058 .059	.062 .060 .066 .066	.052	.062
26P14	U.G.	4	.051 .056 .057 .056	.055 .062 .062 .062	.053	.056
26P14	AA	1	.052	.058	.053	.056
34P10	U.G.	1	.084	.092	.062	.090
36P10	C.G.	2	.088 .070	.093 .076	.070	?
36P10	U.G.	5	.086 .072 .080 .077 .081	.092 .079 .088 .084 .089	.070	.083
36P10	AA	3	.091 .080 .060	.098 .087 .066	.070	?
36P10	AAA	3	.087 .091 .081	.092 .097 .088	.070	.091
38P12	AAA	1	.074	.079	.065	.080
40P10	C.G.	2	.090 .085	.097 .093	.075	.093

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Thickness — Asbestos Cloth and Tape

Table I -- Continued.

Style	Grade	Number of Samples	Method of Measure A.S.T.M.	Method of Measure CCC-T-191b	Recommended Thickness A.S.T.M. Standard Cloth List	Recommended Thickness CCC-T-191b Proposed
40P10	U.G.	4	.081 .075 .074 .083	.086 .080 .079 .091	.075	.083
40P10	AA	2	.071 .081	.077 .086	.075	.090
40P10	AAA	1	.088	.095	.075	.090
53T12	AAA	1	.092	.099	.080	.095
56T8	---	1	.106	.115		.115
59T12	AAAA	1	.087	.094	.080	.090

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