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TECHNICAL SPECIFICATIONS

CERTAIN-TEED PRODUCTS CORPORATION ASBESTOS CEMENT PIPE	NUMBER: 1	PAGE 1
	SUPERSEDES:	DATE OF ISSUE: November 16, 1967

APPLICABLE TO:	CLASSIFICATION:
Standard Test Method TM-5	Technical Change Order

DESCRIPTION:

Water Displacement Density Test Method for A/C Products

TM 5

PURPOSE

1.0 The Standard Test Method (TM-5) being issued is intended to provide a means of A/C density determination for all pipe plants.

1.1 The adoption of the test method will give an accurate correlation of A/C product densities among the plants.

EFFECTIVE DATE OF CHANGE

2.0 Date of issue.

MISCELLANEOUS

3.0 It is recommended that the equipment and environmental conditions be obtained if suitable equipment and conditions are not currently available. Where non-standard testing conditions exist, a note listing these exceptions should be appended to density reports.

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TECHNICAL SPECIFICATIONS

CERTAIN-TEED PRODUCTS CORPORATION ASBESTOS CEMENT PIPE	NUMBER: TM-5	PAGE 1
	SUPERSEDES:	DATE OF ISSUE: November 16, 1967
APPLICABLE TO:	CLASSIFICATION: Standard Test Methods	

DESCRIPTION:

Water Displacement Density Test Method for A/C Products

1.0 OBJECTIVE

The purpose of this Test Method Specification is to provide a standardized, accurate and feasible Quality Control operation for the density determination of pipe, couplings and A/C irregular pieces.

2.0 SCOPE

This test method is designed primarily for pipe and coupling density determinations. Pieces or chunks of A/C may be tested also. The A/C material tested must be in the after autoclaved state.

3.0 APPARATUS AND SUPPLIES REQUIRED

3.1 Weighing Balance

A balance that has a weighing range in grams which will allow the A/C piece to be weighed to the nearest 1/100 gram with an absolute accuracy of ±.1% of the true weight of the A/C piece. Note: an acceptable balance for the smaller pipe sizes is the #1969 OHAUS Triple Beam Balance with a set of #1969G extra weights. For large pipe sizes, an acceptable balance is the OHAUS Heavy Duty Solution Balance, Model 1119 (20 kilogram capacity, from OHAUS SCALE CORPORATION, 1050 Commerce Street, Union, New Jersey).

3.2 Water Tank

This may be metal or plastic and should be noncorrosive. The container must be big enough so that the A/C pieces will be completely submerged in the water and not touch the bottom or sides of container. Note: an acceptable tank design is shown in Figure 1. This tank is fabricated of corrosion resistant galvanized iron.

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3.3 Force Air Convection Oven

The oven should have a temperature control able to maintain 250° ± 10°F. temperature for any length of time. The volume of the oven should be 10 times the volume of the A/C pieces to be dried. An acceptable oven is the Hotpack Oven, Model 1203, 230 V., 4400 W., 35-260°C., Interior 24" W. x 20" D. x 30" H., Exterior 41" W. x 28" D. x 63" H. from Hotpack Corporation.

3.4 Mechanical Saw

The saw must be capable of cutting A/C pipe and coupling ring sections.

3.5 Clock

For timing oven piece drying and room draining time intervals.

3.6 Workroom

The room temperature should be controlled within a range of 75° ± 10°F.

4.0 PROCEDURE FOR TESTING

4.1 A typical schematic diagram of the density testing set up is given in Figure 2.

4.2 Place the rings in the drying oven with the rings preferably not touching or stacked on top of one another. If the rings must be stacked, use thin 1/16" thick (minimum) spacers to allow circulation between the pieces. Dry the rings for time intervals according to the following schedule. The spacers may be of any non-charable, chemically stable material.

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TECHNICAL SPECIFICATIONS

CERTAIN-TEED PRODUCTS CORPORATION ASBESTOS CEMENT PIPE	NUMBER: TM-5	PAGE 3
	SUPERSEDES:	DATE OF ISSUE: November 16, 1967
APPLICABLE TO:	CLASSIFICATION: Standard Test Methods	

DESCRIPTION:

Water Displacement Density Test Method for A/C Products

1" Wide Ring

Thickness of Piece	Minimum Time	Maximum Time
0.00 to 0.49"	16 hours	24 hours
0.50 to 0.74"	20 hours	26 hours
0.75 to 0.99"	26 hours	32 hours
1.00 to 1.49"	34 hours	40 hours
1.50 and up	45 hours	55 hours

2" Wide Ring

Thickness of Piece	Minimum Time	Maximum Time
0.00 to 0.49"	26 hours	34 hours
0.50 to 0.74"	32 hours	38 hours
0.75 to 0.99"	35 hours	45 hours
1.00 to 1.24"	45 hours	60 hours
1.25 to 1.49"	60 hours	75 hours
1.50 to 1.99"	75 hours	95 hours
2.00 and up	95 hours	115 hours

Note: 1. If the above drying times for 1" wide rings cannot be adhered to, then follow the following less accurate time intervals:

0 to .99" thick rings - 26 hours.
1" and above thick rings - 42 hours.

2. For 2" wide ring, above schedule must be adhered to.

3. If 1" and 2" wide rings are included in one oven consignment, select rings of various thicknesses so that 1" wide maximum drying times overlap 2" wide minimum times.

4. If the rings are too large to handle conveniently, the ring may be cut in half and the densities determined for each half and the two values then averaged.

It is not permissible to cut a section from the ring and merely determine the density of the section.

5. The preferred ring thickness is 1" ± 3/16".

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TECHNICAL SPECIFICATIONS

CERTAIN-TEED PRODUCTS CORPORATION ASBESTOS CEMENT PIPE	NUMBER: TM-5	PAGE 4
	SUPERSEDES:	DATE OF ISSUE: November 16, 196[illegible]
APPLICABLE TO:	CLASSIFICATION: Standard Test Methods	

DESCRIPTION

Water Displacement Density Test Method for A/C Products

4.3 Remove the pieces from the oven according to the recommended log time entry previously made and weigh the A/C pieces between 15 and 30 minutes after removal. Record these dry weights on the log sheet.

4.4 Place the rings in the water tank. The water temperature should be 75° ± 10°F. Temperature of the room should be 75° ± 10°F. also. The rings must be allowed to soak (completely submerged in the water) between 8 and not more than 20 hours. This includes either 1" or 2" wide rings of any wall thickness. If pieces or chunks of A/C material are to be tested, make certain the length is ten times the width of the piece regardless of the piece thickness.

4.5 Weigh the A/C pieces in the water soak. Do not remove the pieces from the water soak until the submerged weight has been obtained. The submerged weight is determined by taring the balance while the suspending wire and hook are dangling in the water (at a depth which will insure complete submersion of the piece when it is placed on the hook). Place the A/C piece on the hook, bring the balance to equilibrium, making certain the A/C pieces and the wire or hook are not touching the bottom or sides of the water tank and check to see that the A/C piece is completely submerged. Enter weight in log sheet. Specimen surface should be free of air bubbles.

4.6 Remove the A/C pieces from the water tank and shake vigorously four times to remove excess water. Support the A/C piece at an angle of 45° to 60° on a rack to obtain maximum and uniform surface exposure. Keep the A/C pieces away from excessive drafts and do not allow them to be in contact with any absorbent surface. Weigh the pieces after 5 minutes of draining on the rack, but not after more than 20 minutes. This is the saturated weight. Enter the weight in the log sheet.

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TECHNICAL SPECIFICATIONS

CERTAIN-TEED PRODUCTS CORPORATION ASBESTOS CEMENT PIPE	NUMBER: TM-5	PAGE 5
	SUPERSEDES:	DATE OF ISSUE: November 16, 1967
APPLICABLE TO:	CLASSIFICATION: Standard Test Methods	

DESCRIPTION:

Water Displacement Density Test Method for A/C Products

5.0 PROCEDURE FOR CALCULATING DENSITY

Density is defined as $\frac{\text{weight of object}}{\text{volume of object}}$. If we measure volume in cubic inches, the density of A/C pipe is reported as pounds per cubic inch (p.c.i.) of A/C material. Because of tiny voids or pores in A/C material, (it is not a fused solid substance) the following calculations must be made to obtain the true density of A/C pipe.

a) $\frac{\text{Saturated Weight, Gms.}}{\text{Dry Weight, Gms.}}$ = Saturated Ratio

b) $\frac{\text{Submerged Weight, Gms.}}{\text{Dry Weight, Gms.}}$ = Submerged Ratio

$$\text{p.c.i.} = \frac{0.0362}{\text{Saturated Ratio} - \text{Submerged Ratio}}$$

In this equation $\frac{1}{\text{Saturated Ratio} - \text{Submerged Ratio}}$ = A/C Specific Gravity or $\frac{\text{grams}}{\text{cubic centimeter}}$ and the factor 0.0362 converts $\frac{\text{grams}}{\text{cubic centimeter}}$ to $\frac{\text{pounds}}{\text{cubic inch}}$.

Notes:
1. All data and calculations are to remain in the daily log sheets.
2. Particular effort should be made to periodically examine and calibrate the weighing balance used in this Test Method Procedure.
3. It must be emphasized that the balance must be capable of measuring the weight of the A/C rings with an accuracy of at least ± 0.1%.
4. This density Test Method is based on the following Certain-teed, Ambler R&D reports.

   A-6504 Density Determination, Phase I: Drying of Density Rings, W. R. Seipt, May 20, 1965.

   Assignment 0004-65, Density Determination Method, Phase II Report, W. R. Seipt, February 4, 1966.

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TECHNICAL SPECIFICATIONS

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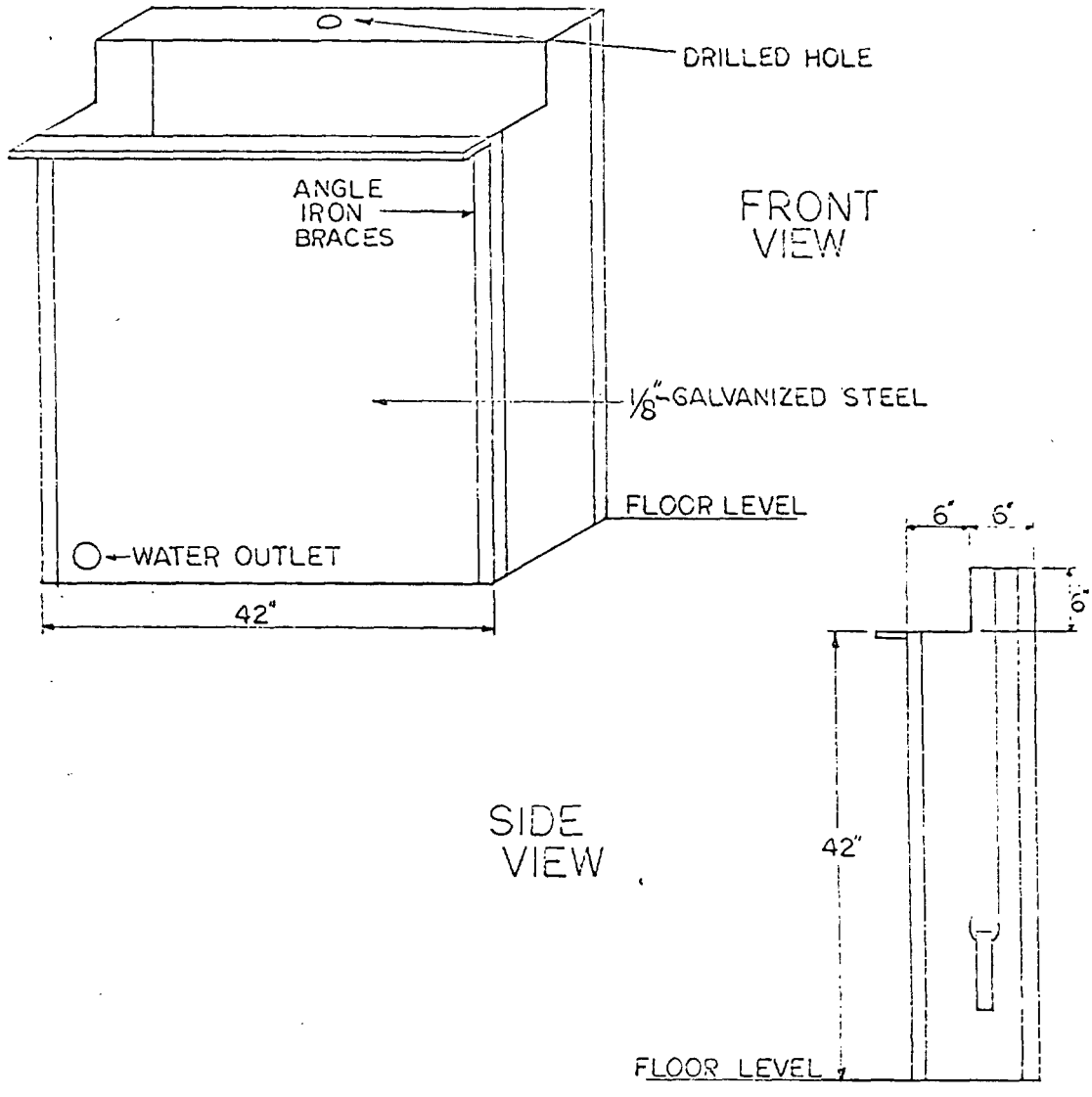
APPLICABLE TO:	CLASSIFICATION: Standard Test Methods	

DESCRIPTION:

Water Displacement Density Test Method for A/C Products

FIGURE 1



WATER IMMERSION TANK

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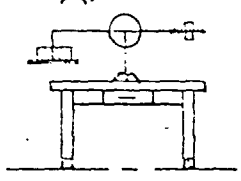
CERTAIN-TEED PRODUCTS CORPORATION ASBESTOS CEMENT PIPE	NUMBER: TM-5	PAGE 7
	SUPERSEDES:	DATE OF ISSUE: November 16, 196
APPLICABLE TO:	CLASSIFICATION: Standard Test Methods	

DESCRIPTION:

Water Displacement Density Test Method for A/C Products

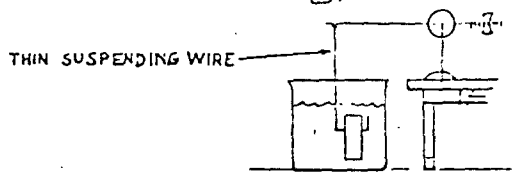
FIGURE 2

A.



Dry Weight Measurement of A/C Ring after coming from drying oven. (measure to nearest hundredth of gm.)

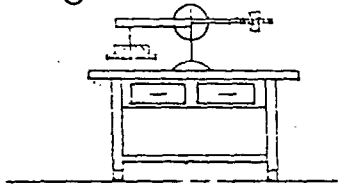
B.



Submerged Weight Measurement

1. Tare the thin suspending wire when submerged in the water in the tank.
2. Then add the A/C ring and measure its submerged weight.
3. Measure to nearest hundredth of a gm.
4. Make certain the wire, A/C ring and supporting pan are not touching the sides of the tank and that the ring is completely submerged.

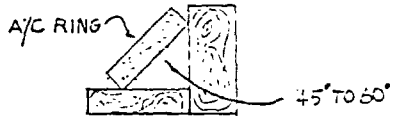
C



Wet Weight Measurement

1. Measure to the nearest hundredth of a gm. Do not weigh before 5 minutes or after 20 minutes of setting on the drain rack.

D DRAIN RACK



Allowable drain time of A/C ring is between 5 and 20 minutes.

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APPENDIX A

Sampling and Sample Preparation

The method of sampling and sample preparation techniques for a given evaluation program are dependent upon the quantity of fiber available for test and the status of the fiber with regard to its degree of acceptability. Three specific plans are recognized: 1. Hand Sampling, 2. Trial Run Sampling and 3. Standard Evaluation Sampling.

Hand Sample

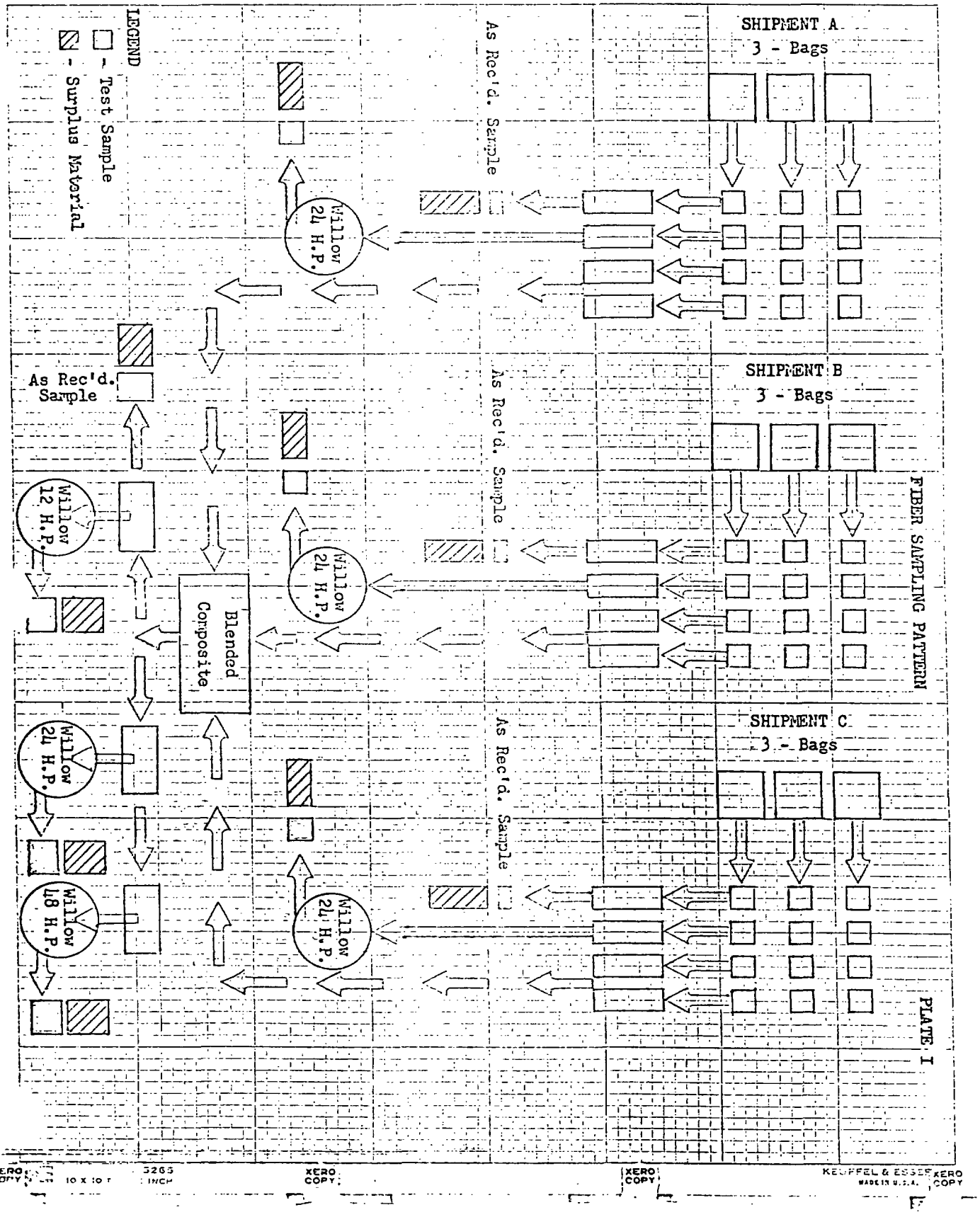
A hand sample normally consists of not more than 5-10 pounds of fiber and is tested as a Fan-Opened material. In this method, the total "As Received" sample is spread out at a uniform thickness on a surface sufficiently large to accommodate all of the material. It is then blended by overlaying scoopfuls to achieve a symmetrical cone which is subsequently quartered. After opposite quarters have been combined and blended, the resultant halves are reworked together and gathered again into a cone. As a final step, this cone is quartered and each quarter placed in individual plastic bags for further processing.

From the four samples, one of the samples is retained in the "As Received" state, while the remaining three are processed by Fan Opening under three different sets of conditions - 2, 3 and 5 passes at 100% fan speed. The three degrees of opening achieved are comparable to the opening which would be produced by willowing at 12, 24 and 48 hairpin configurations. After processing, the three samples are individually bagged and set aside with the "As Received" sample for testing.

Trial Shipment Sample

The trial shipment sample is representative of a 5 to 10 ton lot shipment of fiber. This shipment of fiber will normally be requested following a satisfactory appraisal of properties based upon the "Hand Sample" evaluation and is used for a trial run at the plant level. The making particulars for such a run are based upon the data established from a sample forwarded to R&D for evaluation.

The sample selection from the 5 to 10 ton shipment is 3 bags randomly chosen from the lot. The three bags of fiber are carefully blended in accordance with a specified procedure and


LEGEND
- Test Sample
- Surplus Material
SHIPMENT A
3 - Bags
SHIPMENT B
3 - Bags
SHIPMENT C
3 - Bags
As Rec'd. Sample
As Rec'd. Sample
As Rec'd. Sample
As Rec'd. Sample
Willow 24 H.P.
Willow 24 H.P.
Willow 24 H.P.
Willow 12 H.P.
Willow 24 H.P.
Willow 48 H.P.
Blended Composite
FIBER SAMPLING PATTERN
PLATE I

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then quartered. The procedure followed is in accordance with the "one shipment" handling of the fiber as discussed in the following section under "Standard Evaluation Sample" and set forth in Plate I. Three of the quarters from the composite lot are processed to varying degrees of openness by willowing at hairpin configurations of 12, 24 and 48 hairpins. The fourth quarter is retained in the "As Received" condition. The four lots resulting from this division and processing serve as the basis for the evaluation program.

Standard Evaluation Sample

A standard evaluation program is periodically conducted on all fibers normally used in A/C pipe blends. In such a program, samples are collected from three plants where the fiber under test is normally used as a regular component and is received in lot shipments ranging from 50 to several hundred tons per shipment. The sample selection for the test is made up of three bags of fiber randomly taken from a different lot shipment at each of the three plants. The nine bags of fiber are then sent to the Fiber Testing facility at the Research and Development Center for processing and testing.

The total "source sample" as received at R&D amounts to 900 to 1125 pounds of fiber depending upon whether the bag weights are 100 pounds as for Cassiar and Canadian Quebec fibers or 125 pounds as for the African Chrysotile and Blue fibers. This selection of fiber, which is considered a representative composite of the fiber grade and quality originating from a given mine, is carefully blended, quartered, processed and sampled to yield working samples for laboratory investigation.

Plate I shows the pattern for fiber blending and sample accumulation to be followed in preparing the source sample for willow processing and individual sample procurement. The three bag lots received from each of the three plants are identified as Shipments A, B and C. In the first step, each individual shipment is blended and quartered to produce four sets of samples. The first set provides a 10 pound "As Received" sample, the second set a 75 pound sample for willowing at 24 hairpins, while the third and fourth sets provide two 75 pound samples of fiber which are set aside with similar samples (six in total) from the remaining two shipments. After collection of the six 75 pound samples (two from each shipment), they are blended and quartered

again to provide four 110 pound samples of blended composite for further processing. One of the quarters provides the composite "As Received" sample while the remaining three quarters are willow processed at 12, 24 and 48 hairpin configurations respectively.

Upon conclusion of these steps, the following samples are available for test.

1. 3 - "As Received" Samples - 10 pounds for each shipment.
2. 3 - Willowed Samples - 25 pounds for each shipment.
3. 1 - "As Received" Sample - 25 pounds composite.
4. 1 - Willowed - 12 Hairpin Composite - 40 pounds.
5. 1 - Willowed - 24 Hairpin Composite - 40 pounds.
6. 1 - Willowed - 48 Hairpin Composite - 40 pounds.

The surplus fiber resulting from each sampling operation is bagged, combining all of the "As Received" materials together and all of each of the separately willowed fibers according to treatment. Each bag is properly labeled to identify the fiber, the grade and the extent of treatment if any. The total excess fiber is then placed in Plant 58 fiber storage for use at their discretion.

APPENDIX B

TEST METHODS USED TO EVALUATE ASBESTOS FIBERS

The test methods that are used to determine the significant properties of asbestos fibers serve to establish the adaptability of a particular fiber as an A/C pipe blend component on the basis of a variety of inherent characteristics. Each test has been devised and developed, in many cases, over a period of time often measured in years, to provide reliable and reproducible information related to one particular property or habit of a fiber. An evaluation and full analysis of a given fiber requires that the several individual property values obtained from each of the test procedures be considered as a composite of that fiber's capabilities. The reports offered in the main body of this presentation are such composite considerations.

All of the test methods that are currently used exhibit a high degree of reproducibility and the information resulting from a representative evaluation program is usually directly applicable to the definition of the performance capabilities of a fiber under study to pipe machine operation.

The test methods here set forth include those that are now used in all evaluation studies and by means of which the data in the reports here presented was procured. In addition, however, for reference and historical purposes, certain test methods are also included that are not now used, but from which certain bits of useful data has been obtained in the past and to which some reference may still be made.

It is not intended that a detailed working knowledge of each test is necessary to affect a proper analysis or understanding of the data related to each fiber as here reported. Rather, the purpose is to establish and make a record of the specific methods followed at this time so that if, at some future date, a change or revision may be brought into being, this record will historically establish the validity of the current data and may well serve as a basis upon which data differences, induced by later procedural or apparatus changes, may be accounted for and justified.