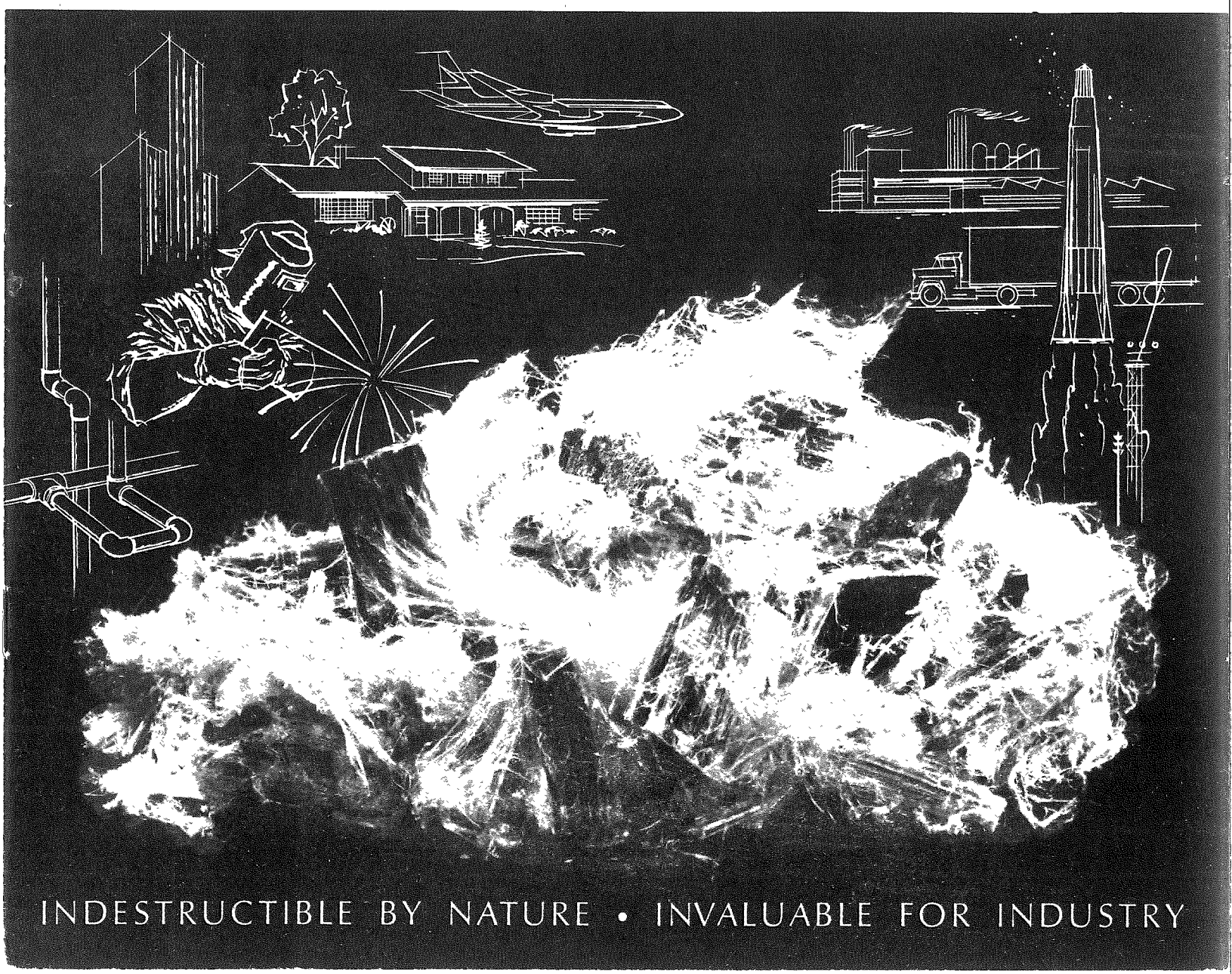
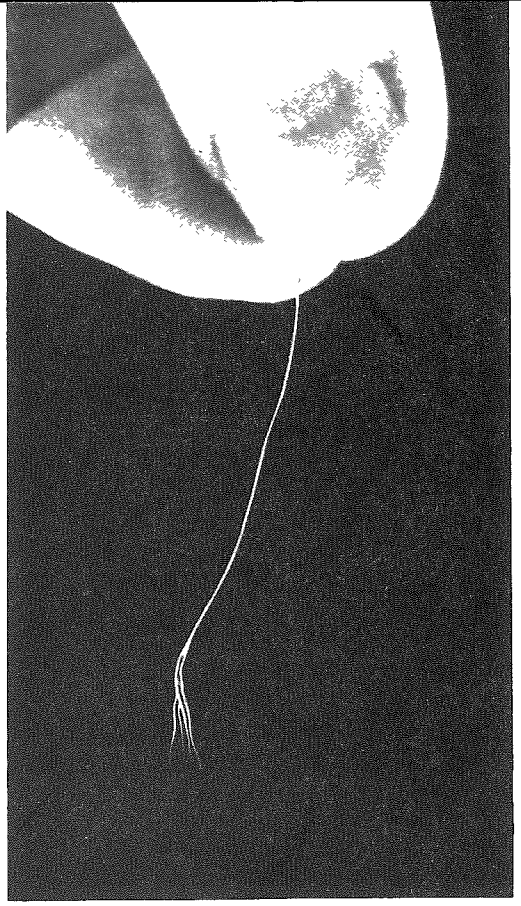


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JOHNS-MANVILLE ASBESTOS FIBER



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Although asbestos was known and used as far back as the Egyptian dynasties, until comparatively modern times it was a cause of awe and superstition. As recently as 1870 H. W. Johns, founder of what is now Johns-Manville, still astounded customers by harmlessly handling red-hot coals with a cloth glove made of asbestos.

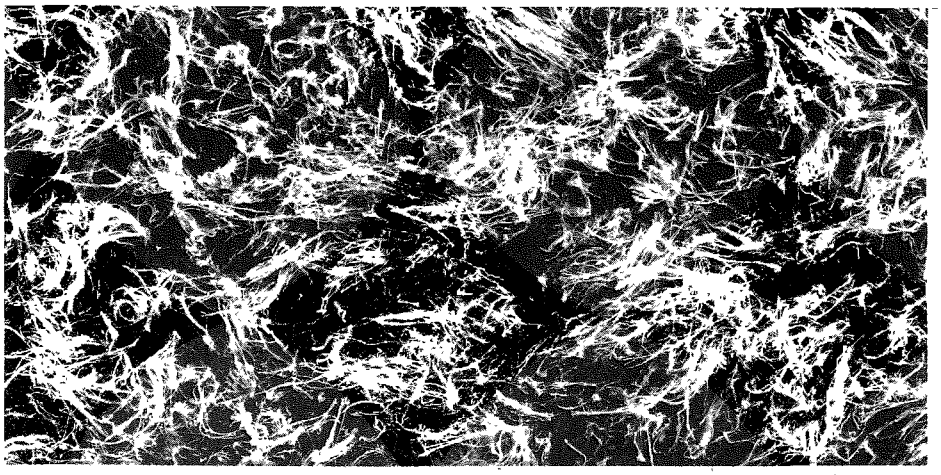
However, it was this same H. W. Johns who first took asbestos from behind its "Magic Curtain" and, through imaginative experimentation, incorporated it into modern science and industry. Since those Victorian times, asbestos, and its many facets and uses, has been exhaustively studied and documented. This process, a harmonious marriage of basic and applied research, is still being carried on. Johns-Manville takes no small pride in being the world's leader in contributing to this segment of man's growing knowledge of his environment and its uses.

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Versatile, fire-resistant ASBESTOS FIBER . . .

. . . strong as steel wire, durable as stone, and pliable as cloth

To the scientist, chrysotile asbestos is a hydrous magnesium silicate. What this means in terms of product quality can be said, simply, in one word: strength. While this is an over-simplification, it illustrates the key characteristic of Johns-Manville Asbestos Fiber.



THE MAGIC MINERAL

endowed by nature—
refined by science

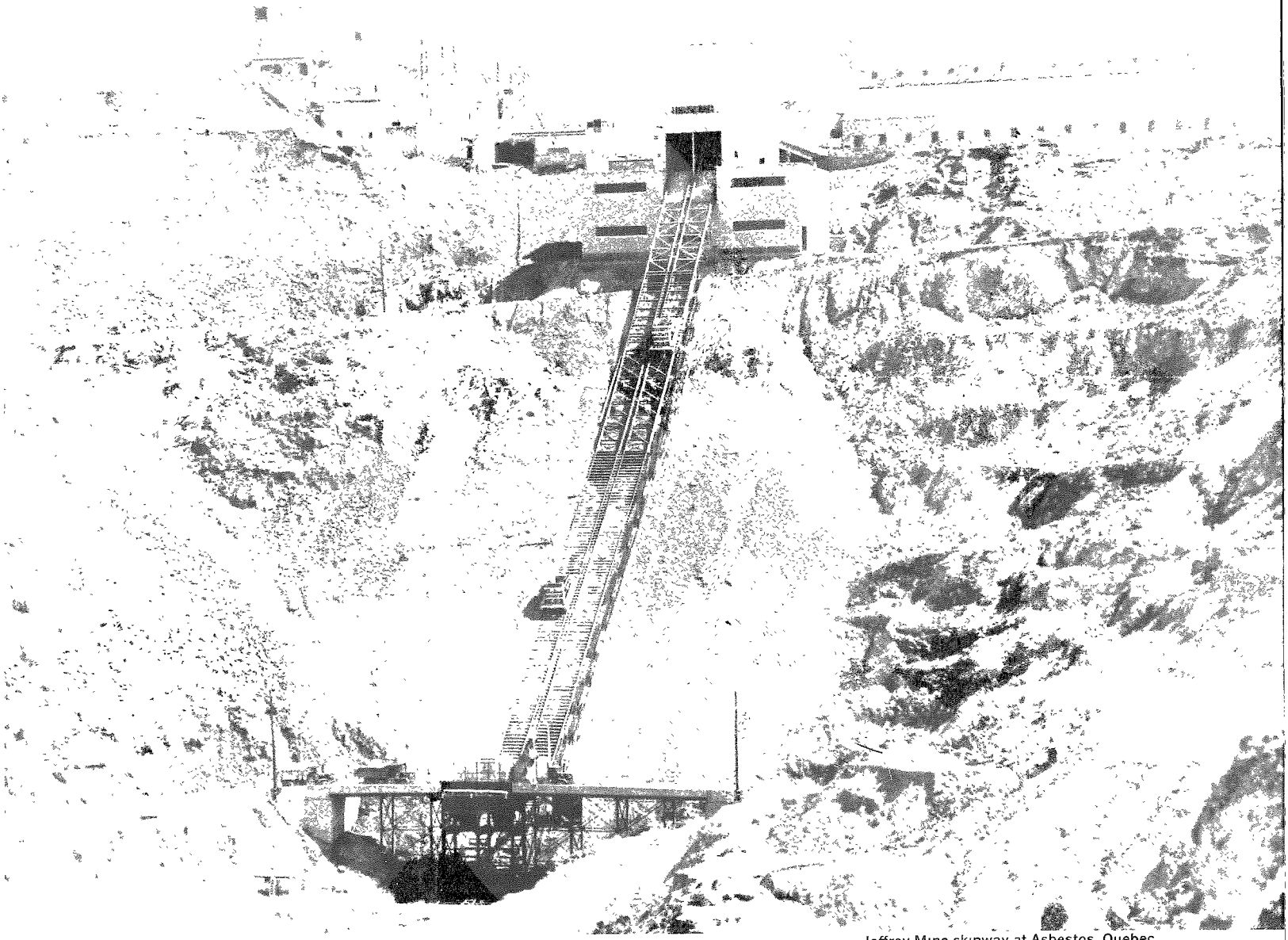
inorganic	bulks
fibrous	reinforces
strong	adds flexibility
flexible	provides dimensional stability
nonflammable	resists time, weather, fire

Because of its versatility, asbestos is applied to an amazing variety of products such as textiles, paper, plastics, cement products, friction materials, and floor tile, to mention a few. With the advent of new uses each year, the list is continually growing. This amazing mineral, capable of solving so many product formulation problems, is the heart of Johns-Manville.

For over a century, Johns-Manville has been perfecting the techniques of mining and milling chrysotile asbestos fiber in an effort to keep modern industry supplied in ever-increasing quantities.

The phenomenal increase in asbestos fiber production, generated by the demands of industry for this unique yet basic material, is reflected in the corresponding growth of Johns-Manville's asbestos fiber operations.

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Jeffrey Mine skipway at Asbestos. Quebec

In a little more than 35 years, the number of grades of fiber produced and processed has increased from six to over sixty and total capacity from 90,000 to 600,000 tons of fiber per year.

Johns-Manville operates asbestos mines in the Canadian provinces of Quebec, Ontario and Newfoundland, and at Coalinga, California, producing all of the grades of chrysotile asbestos fiber required by industry. Along with Johns-Manville, modern industry depends on these mines, and the processing techniques used there, for the fiber so necessary in the formulation of countless quality products.

As the demand for fiber increased throughout the world so did the need to find gradations in fiber quality and dimension. A constant program of research and development, coupled with expanding scientific and production facilities, enabled Johns-Manville to stimulate and lead this trend.

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A HUGE MINE...

a modern mill...

...a carefully graded, versatile material

While nature was generous when endowing asbestos, she was also devious. The precious, white silky fibers occur embedded in serpentine rock, having a chemical composition similar to the fiber itself. Tremendous tonnages of rock must be removed to recover relatively small amounts of the "magic mineral". To accomplish this, Johns-Manville operates the free world's largest mine and largest, most modern asbestos mill. It is here that the crude asbestos rock is painstakingly reduced to its useful fiber form.

THE MINE



Aerial view of Jeffrey Mine and Mill

THE MILL



Mill exterior (top). Below, interior of fan room where 3 million cubic feet of air are moved each minute (left) and pressure packed bags being automatically palletized (right).

Johns-Manville's principal mine is the Jeffrey Mine at Asbestos, Quebec.

All the ore necessary to feed the mammoth appetite of the mill is obtained from a huge open pit, from which material is removed at a rate in excess of 90,000 tons every day by a fleet of mining and earth-moving equipment. The open pit technique enables J-M to keep the mill supplied with pre-selected first class ore, because over-burden, barren rock and poor quality material are diverted and disposed of at the source.

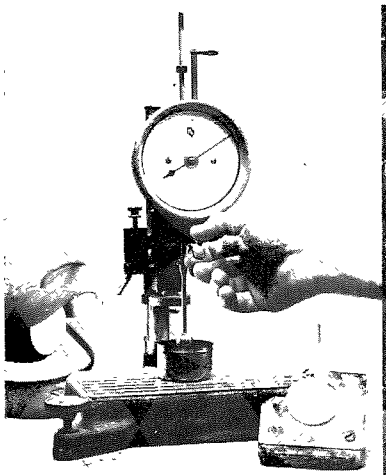
Separation of the fiber from the ore is accomplished in the J-M mill at Asbestos by a complex system of crushing, screening, and aspirating operations. Such is the size and versatility of this mill, that the production of over a dozen different grades can be carried on simultaneously.

Finished products are palletized automatically by high speed machinery before being loaded by fork-lift trucks into box cars and vans for prompt delivery to the customer.

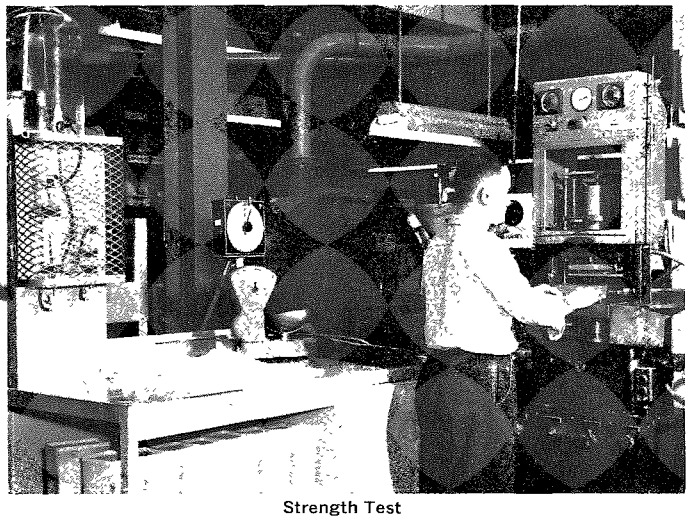
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Asbestos fiber is available in over 60 standard and special grades. Each designation defines a distinct grade that is suitable for certain industrial applications. These grades are further defined as to textural characteristics. Such specialization provides fiber grades which meet the requirements of many existing products. It also gives the Research and Development Engineer the confidence that he can depend on Johns-Manville Asbestos to provide a fiber to meet his requirements for new products. For details on Johns-Manville asbestos fiber classification, see chart on page 10.

The maintenance of quality and uniformity play a major role in the J-M operation. Samples are automatically collected during the production of every lot of asbestos fiber, permitting preliminary on-the-spot tests to be made concurrently with production. Minor adjustments can then be made, while processing continues, in order to ensure that quality is maintained within prescribed limits. Subsequently, representative samples are thoroughly tested to assure each lot meeting specification before being released for shipment.



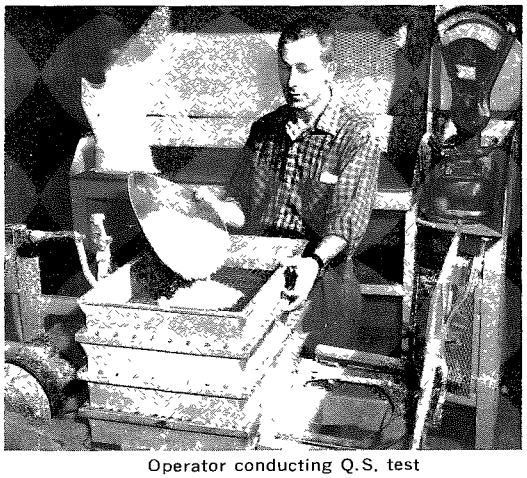
Determining fiber bulking characteristics



Strength Test

THE QUEBEC STANDARD TESTING METHOD

In the Quebec Standard Screen Test used for the classification of Jeffrey Mine products, a measure of the length distribution of the fiber is obtained by subjecting a 16 oz. sample to a dry screening operation. The equipment required for this purpose is the Quebec Standard Asbestos Testing Machine which consists essentially of a nest of 4 screen boxes measuring 24½" x 14¾" clamped to a motor driven shaker table. The bottoms of the three upper boxes are made from brass screen wire having openings of .500", .187" (4 mesh) and .053" (10 mesh) respectively, while the lowest box is a receptacle for fines which fall through the other three.



Operator conducting Q.S. test

To make a test, the prepared sample is placed in the uppermost box, the lid is clamped in position, and the machine is set in motion. At the end of 600 revolutions at 327 r.p.m. the motor stops automatically and the quantity of fiber retained on each screen is weighed and recorded in ounces.

The longer the fiber undergoing test, the greater will be the portions remaining upon the upper and larger meshes, and the higher the value.

For example a 3T designation indicates a grade with a minimum Q.S. value of 2-8-4-2, or 2 oz. retained upon the ½" screen, 8 oz. on the 4 mesh, 4 oz. on the 10 mesh, and 2 oz. falling through into the bottom box or pan.

This test, instituted by the Quebec Asbestos Mining Association, has gained world-wide acceptance as a standard for the classification and evaluation of asbestos fiber.

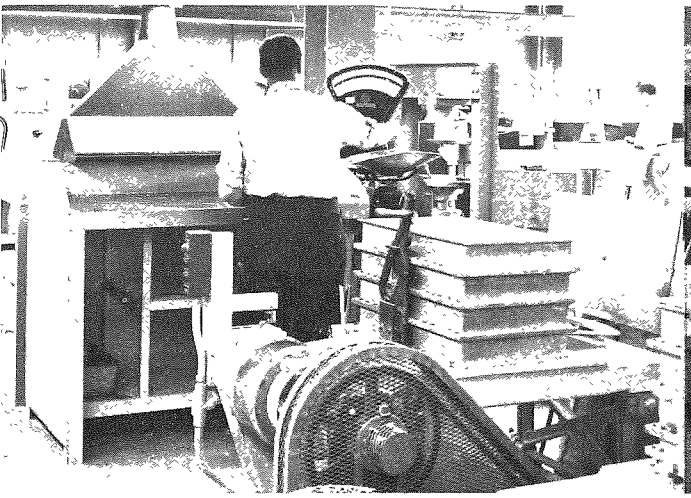
ONE TEST AFTER ANOTHER

In addition to the Quebec test outlined here, crude and milled fiber are continually subjected to tests in order to measure and maintain wet and dry volumes, adsorption characteristics, settling rates, grit content, density and degree of fiberization. It is this attention to control of product quality which gives Johns-Manville fiber the best quality-to-cost ratio in the asbestos fiber industry.

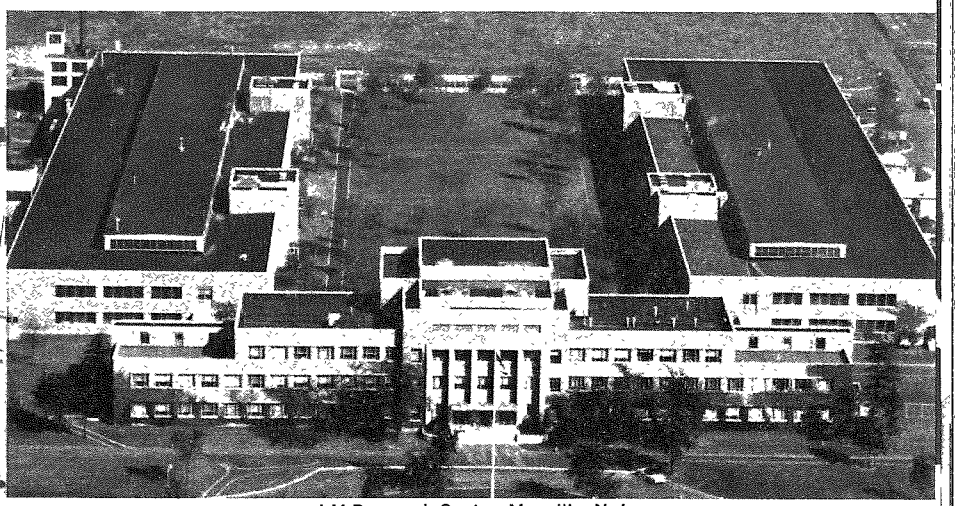
Johns-Manville Asbestos Fiber: Indestructible by Nature, Invaluable for Industry (1969)
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FIBER DEVELOPMENT

The Mill at Asbestos also houses the Fiber Development Department comprising some 35 skilled specialists and technicians who continually test new equipment and evaluate new and improved milling techniques. In accordance with their recommendations new machinery is installed and a continuous program of modernization is maintained. This Department operates a pilot plant within the Mill duplicating the essential items of equipment utilized in the full scale mill thus enabling bulk samples and small orders of special grades to be prepared under close supervision.



Fiber Development control lab, Asbestos, Quebec



J-M Research Center, Manville, N. J.

RESEARCH CENTER

The J-M Research & Engineering Center at Manville, New Jersey houses laboratories and staff devoted to basic research on the properties of asbestos, and applied research into the use of asbestos to meet industrial needs. Many innovations in the field of asbestos application, ranging from routine products for better homes to exotic aerospace discoveries, are a direct result of this extensive research program.

The aid of the Research & Engineering Center is frequently enlisted in the resolution of difficult customer problems and in the development of fiber grades suitable for applications where standard materials are not satisfactory.

SALES SERVICE

Asbestos Fibre Division Special Representatives, experienced in the application of asbestos in industry, are available throughout the United States and Canada. Your representative can assist in the selection of the grade best suited to your product or help resolve problems involving the use or the handling of asbestos.

In addition, J-M engineers and technologists at the Mines and Research Laboratories, trained in every phase of fiber development, production, utilization, and packaging, may be called upon to assist with major problems.

While the classification system provides a quick reference which can be used as a general guide in the selection of fiber grades, many users prefer to make their own evaluations and set standards to suit their particular requirements. Frequently, the choice of a fiber grade is the final outcome of an investigation made in the user's plant during which samples have been evaluated in pilot production or laboratory tests.

J-M engineers are available throughout such experimental periods to give advice and assistance. They are prepared to interpret the results of plant production trials, translate them into terms of fiber characteristics and finally, to set up asbestos fiber manufacturing specifications as may be required.

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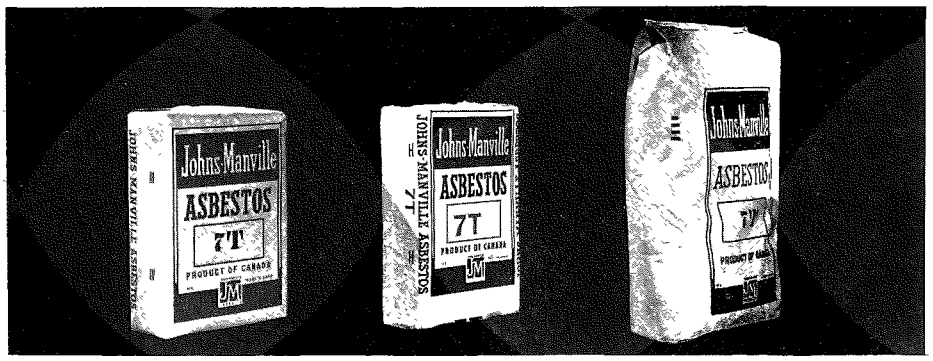
Flexibility of production facilities, experienced personnel, and continuous research are the essential ingredients of this effective approach to the solution of problems involving the use of asbestos fiber. They ensure that J-M customers get the grade best suited to their needs.

PACKAGING

Because of shipping distances, transportation and handling charges may account for a significant portion of the delivered cost of asbestos fiber. Correct selection of package type plus careful planning of car loading systems for maximum utilization of mechanical handling equipment, however, do much to minimize these costs.

J-M PACKAGES

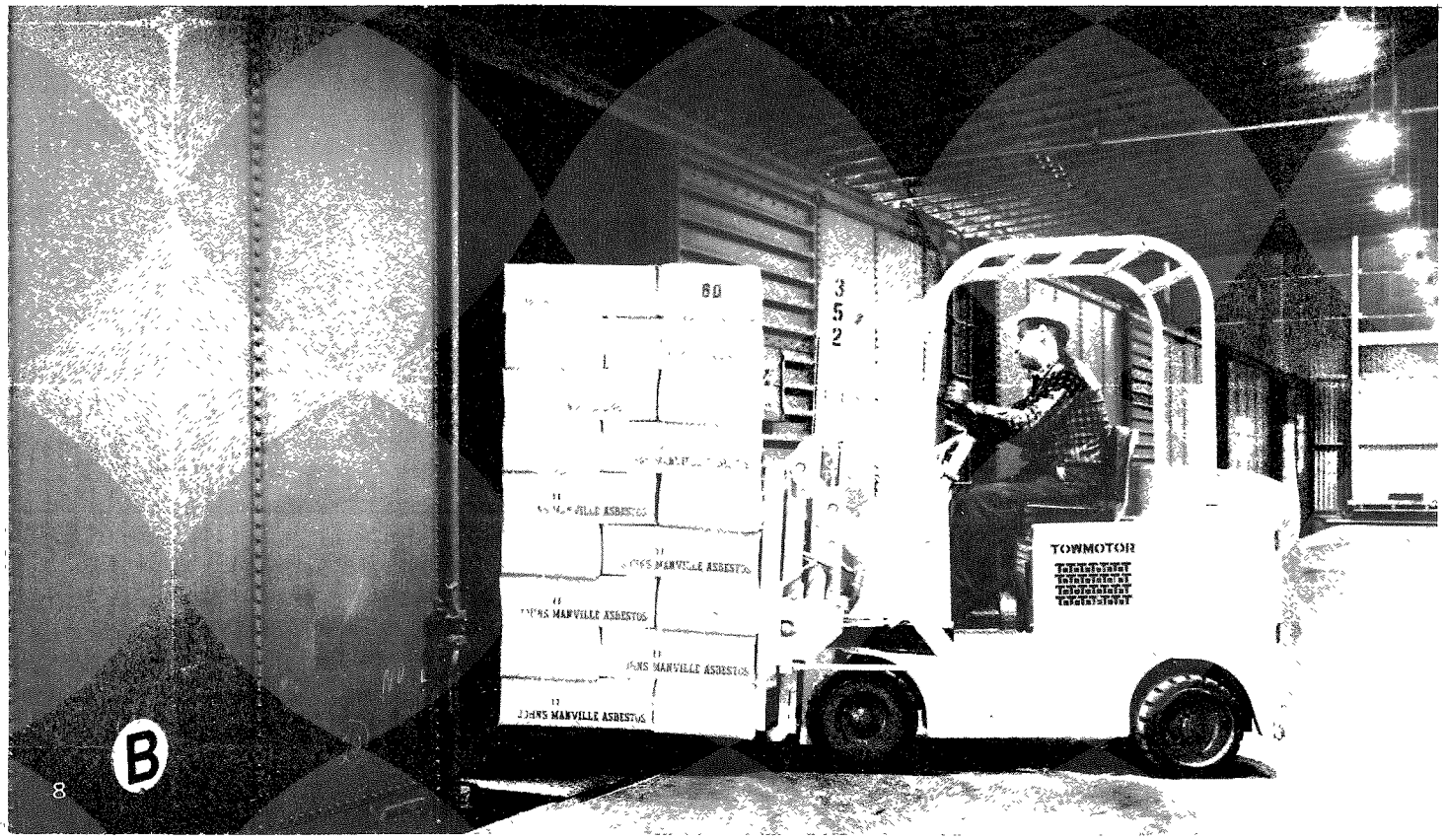
Pressure-packed paper, pressure-packed polyethylene, and loose valve-packed paper



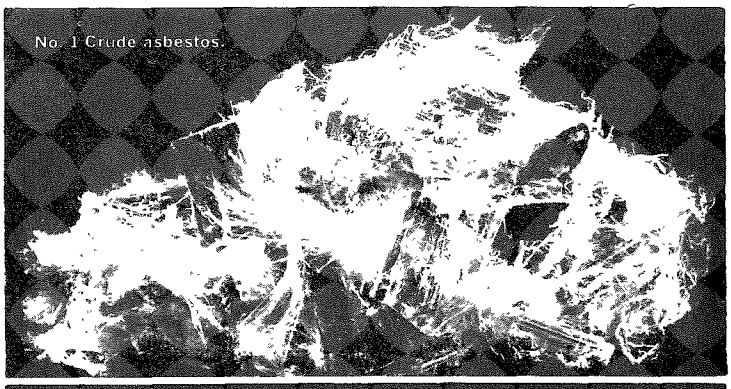
Many users prefer the standard pressure-packed multi-ply paper bag which is economical to warehouse and suited to mechanical handling. Various J-M grades are also available in a variety of bags, including: jute, valve-paper, and polyethylene.

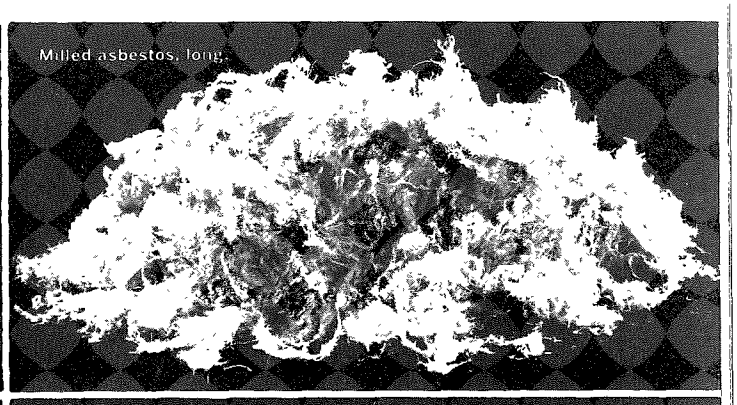
Johns-Manville engineers constantly evaluate packaging and shipping methods to make sure that orders are delivered intact and in a form that takes full advantage of current freight rates and unloading equipment. Where circumstances preclude the use of a standard loading system, special patterns are worked out to suit individual cases.

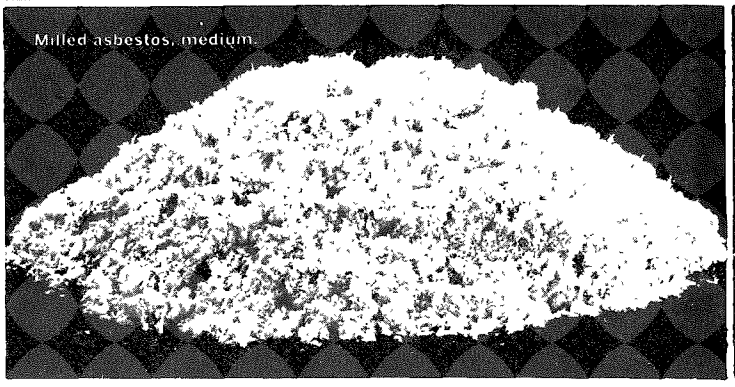
Loading pressure-packed unit

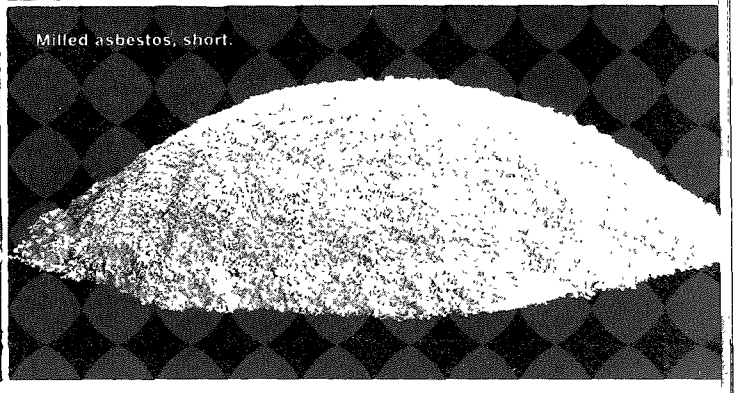


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All Canadian asbestos is divided into two classes, namely Crude Asbestos and Milled Asbestos.

CRUDE ASBESTOS

The name "crude" is applied to hand selected, cross-vein material, essentially in its native or unfiberized state, which requires mechanical treatment to reduce it to a usable form. It is subdivided into groups according to length.

ASBESTOS FIBER CLASSIFICATION

MILLED ASBESTOS

Initial classification of milled asbestos fiber is according to length distribution as determined by the Quebec Standard Screen Test. Within each standard grade designation there are several textural variations dependent on the degree of milling given the fiber and on different milling techniques. Grades containing a large number of spicules, or unopened fiber bundles are considered to be "crudy" while those in which the fiber bundles have been well subdivided or fiberized, are known as "opened" grades.

In the J-M system of nomenclature, the suffix following the standard grade designation identifies the texture. The following table gives a general outline of this system.

Long Fibers	Short Fibers
30, 28 Crudy	F1, F3 Very short, low grit
24, 21 Semi Crudy	19, 15 Low bulk and absorption
12, 08 Semi Opened	05, F5 Medium bulk and absorption
04, 02 Well Opened	S5, 02, High bulk and absorption

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QUEBEC STANDARD GRADING SYSTEM

Group 1 — No. 1 Crude — Consists basically of crude ¾" staple and longer.

Group 2 — No. 2 Crude — Consists basically of crude ⅜" staple up to ¾".

	Standard Grade Designation	Guaranteed Minimum Shipping Test				Standard Grades Available			
						Crudy	Semi-Crudy	Semi-Open	Open
Group 3	3F	10.5	3.9	1.3	0.3			3F12	
	3K	7	7	1.5	0.5			3K12	
	3R	4	7	4	1			3R12	
	3T	2	8	4	2			3T12	
	3Z	1	9	4	2			3Z12	
Group 4	4A	0	8	6	2			4A12	
	4D	0	7	6	3	4D28		4D12	
	4K	0	4	9	3	4K30		4K12	
	4M	0	4	8	4	4M28			
	4T	0	2	10	4	4T30		4T12	4T04
Group 5	5D	0	0.5	10.5	5			5D12	5D04
	5F	0	0	13	3				5F04
	5K	0	0	12	4	5K30		5K08	5K04
	5M	0	0	11	5	5M30			
	5R	0	0	10	6	5R28	5R21		5R04
Group 6	6D	0	0	7	9	6D30	6D24		6D04
						BULK AND ABSORPTION			
						Low	Medium		High
Group 7	7D	0	0	5	11	7D15	7D24	7D04	7D02
	7F	0	0	4	12	7F19		7F04	
	7H	0	0	3	13	7H19	7H05		
	7K	0	0	2	14	7K15	7K05		
	7M	0	0	1	15	7M15	7M05	7MF5	7M02
	7R	0	0	0	16	7R15	7R05	7RS5	7R02
	7T	0	0	0	16	7T15	7T05		7T02
Group 7 (floats)	7RF	0	0	0	16	7RF3	7RF1		7RF02
	7TF	0	0	0	16	7TF1		7TF02	

Group 8 — 8S — Under 50 pounds per cubic foot loose measure

8T — Under 75 pounds per cubic foot loose measure

Group 9 — 9T — Over 75 pounds per cubic foot loose measure

SPECIAL J-M GRADES

In addition to the Standard Grades shown above, J-M has developed Special Grades for use in certain applications.

These include Plastibest, Paperbestos, and Asbaltic fibers and Pro/Mesium from the Jeffrey Mine, for use in the plastics, paper, asphalt paving and fertilizer industries respectively; A-25 from Advocate Mine and R-25 and R-35 from the Reeves Mine for use in asbestos cement products; Ultrabestos grades from the Coalinga Mine, for use in floor tile; as well as many others.

If the Standard Grades do not fill your needs, you can arrange with your J-M Representative to have Johns-Manville develop a grade, custom tailored for your application.

MAJOR PHYSICAL AND CHEMICAL PROPERTIES OF ASBESTOS

Approximate Chemical Analysis

SiO_2	38-42
MgO	40-42
H_2O	12-15
FeO	Tr- 6
Fe_2O_3	Tr- 6
Al_2O_3	Tr- 3
CaO	0- 0.30

Comparison of Tensile Strength of Various Materials

Type of Material	Tensile Strength (lb./sq. in.)
Ingot Iron	45,000
Wrought Iron	48,000
Carbon Steel	155,000
Ni-Cr Steel	243,000
Cotton Fiber	73,000 to 89,000
Glass Fiber	100,000 to 200,000
Chrysotile Asbestos	80,000 to 100,000

Comparison of the Surface Area of Various Fibers

Type of Fiber	Surface area by N_2 Absorption (Sq. cm/gram)
Nylon	3,100
Acetate Rayon	3,800
Cotton	7,200
Silk	7,600
Wool	9,600
Viscose Rayon	9,800
Asbestos (Chrysotile)	130,000 to 220,000

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Listed below are a few of the major areas for asbestos fiber, and some typical fiber grades used. For specific applications, see your J-M representative.

Acetylene Cylinders
4T04, 5K08

Acoustical Plaster
7M05, 7M02

Adhesives
7M05, 7T05

Cements—Joint
7RF1, 7TF1, 7RF02

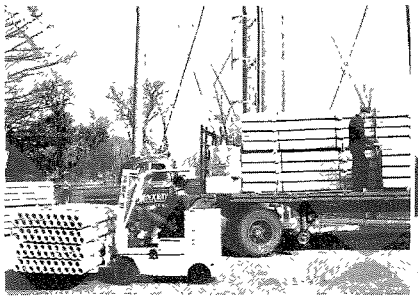
Chlorine Cells
3T12, 4T12, 4D12

Plastics (Reinforcement)
Plastibest, 7D28

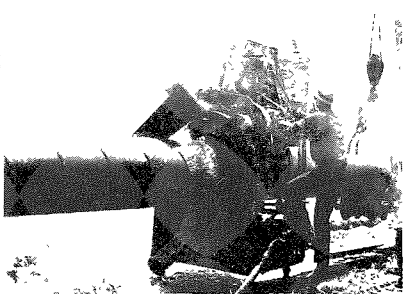
Sprayed Insulation
5D12, 7M05

Welding Rods
7R05

Latex Paper
Paperbestos



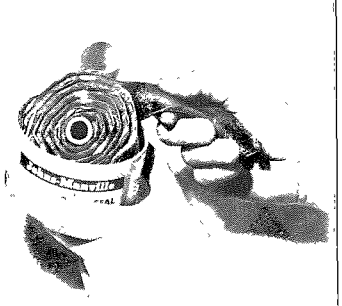
Asbestos Cement Products
4T30, 6D30



Asphalt Coatings and Cements
7MF5, 7T05



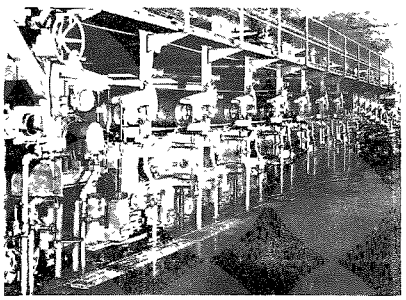
Asphalt Paving
Asbaltic Asbestos



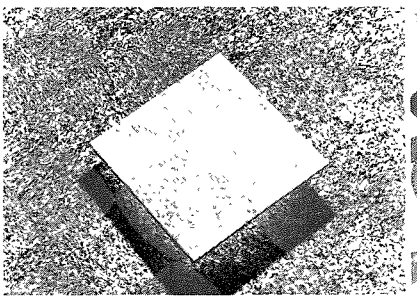
Caulking Compounds
7M15, 7TF1



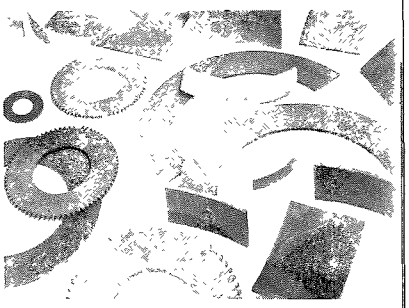
Cements—Insulating
7M13



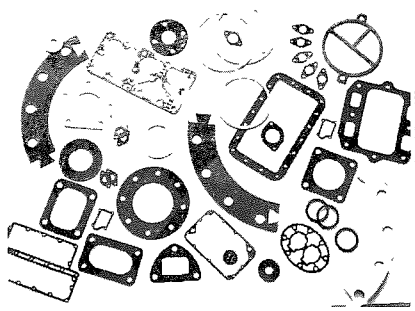
Paper
5K04, 6D04, 7D04, Paperbestos



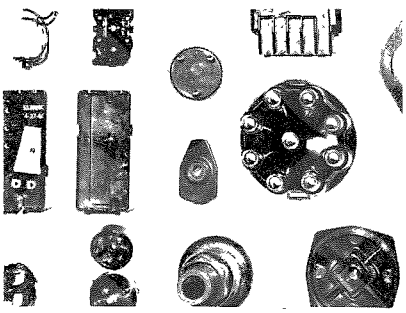
Floor Tile
7RS7, 7TS6



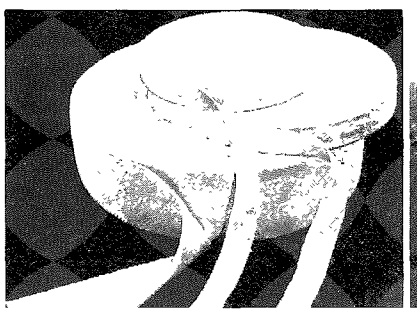
Friction Materials
5K04, 5R21, 7H19, 7M05



Gaskets
4T04, Paperbestos



Plastics (Filler)
7T15, 7TF1



Textiles
3R12, 3T12



Texture Paints
7RF1, 7TF1, 7RF02

Effect of Temperature on loss in Weight of Asbestos fibers*

Temp. °F	% of Loss in Weight Chrysotile
400	0.30
600	0.86
700	1.78
800	2.17
900	2.83
1000	3.99
1100	10.38
1200	12.75
1400	13.43
1600	13.62
1800	13.77

*Time: 2 hours

Effect of Heat on Tensile Strength of Canadian Chrysotile Crude

		Tensile Strength (lb./sq. in.)	% of Original Tensile Strength
Original crude—No heat		131,000	—
Heated 3 min. at	600° F	120,000	91.6
	800° F	96,000	73.3
	1000° F	78,000	59.5
	1200° F	42,000	32.0

Comparison of Approximate Fiber Diameters

Type of Fiber	Fiber Diameter in Inches	Fibers in One Linear Inch
Human Hair	0.00158	630
Ramie	0.000985	1,015
Wool	0.0008 to 0.0011	910-1,250
Cotton	0.0004	2,500
Rayons	0.0003	3,300
Nylon	0.0003	3,300
Glass	0.00026	3,840
Rock Wool	0.000142 to 0.000284	3,520-7,040
Asbestos (Chrysotile)	0.000000706 to 0.00000118	850,000-1,400,000

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