



TEST REPORT

PRODUCT TESTING LABORATORIES
FIBERGLAS TECHNICAL CENTER
GRANVILLE, OHIO

PLAINTIFF'S
EXHIBIT

K-71

KAYLO HANDLEABILITY VS.
COMPETITIVE HIGH TEMP.
INDUSTRIAL INSULATION BLOCKS

REPORT NO.: 20853-1

DATE: March 27, 1961

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The purpose of this report is to review the problem of handleability and to set forth criteria against which Kaylo and competitive products may be compared in the future. See Test Report 20745 (12/28/60) for work done leading to this study.

RECOMMENDATIONS:

It is recommended that the ball impact test be used as a handleability measuring device. For 1-1/2" thick block or 3"x 1-1/2" pipe covering a criteria of 14 inches to the first crack (avg. of 5 pieces) should be the minimum for an acceptable material.

It is also apparent from this study that dustiness is a major factor in evaluating the handleability or pleasantness of an industrial insulation. Because of this dust problem, a method must be developed to evaluate the amount of dust on a given sample. It is recommended that the Product Testing Laboratories start this investigation as soon as possible.

The Handleability Index (Modulus of Resilience divided by density - see T. R. 20745 for details) also appears to be a good measure of handleability, but it is much more time-consuming than the ball impact test. This method is applicable only to block. An acceptable 1-1/2" thick block should have an index no less than 20 in. The block tested for this report will be cut down to 1" thick to determine the effect of a different thickness on the test data.

HANDLEABILITY PANEL:

On February 7, a meeting was held at the Berlin Plant to evaluate subjectively the following products:

O-CF Laylo
Johns-Manville Thermobestos
Ruberoid Calsilite
Union Asbestos & Rubber Company Unibestos
Philip Carey Careytemp
Baldwin-Ehret-Hill Thermafil
Keasbey & Mattison Kaytherm
Philip Carey Calcium Silicate Block (which is Kaytherm purchased from E & M)

Of these products, all are calcium silicates with the exception of Unibestos and Careytemp. Samples consisted of cartons of 1-1/2" thick block, 3" x 1" pipe covering, 3" x 1-1/2" pipe covering, 6" x 1" pipe covering, and 10" x 1-1/2" pipe covering.

The following people comprised the panel:

R. W. Henry
G. L. Kalousek
William A. Lotz
J. B. Rhoads
E. C. Shuman
H. V. Smith
2 union members of the insulators local in Philadelphia
(J. D. Simkins evaluated the materials after they arrived at Granville.)

The panel defined good handleability as follows:

"A product that is able to withstand normal abuse during shipping and application." Workability - ease of fabricating - also plays a part in handleability. It was agreed that the major problem boiled down to producing a material with high impact resistance.

Each member of the panel filled in a data form (Insulation Handleability Data, sample form attached) after conducting his own manual tests of a given material. He rated the product 1 to 5 according to his personal opinion based on the handling tests. These tests consisted of dropping the material on the floor, feeling, cutting, sawing, breaking the insulation with his hands, etc. The samples were then shipped to P.T.L. for testing.

The panel rated the materials as follows:

<u>Avg. Rating</u>	<u>Product</u>	<u>No. of Samples</u>
1.2	Thermobestos	6
2.0	Kaylo	4
2.5	Calcilite	2
2.7	-Unibestos	3
2.9	-Careytemp	2
3.2	Thermasil	6
3.7	Kaytherm	
	*plus Carey calcium silicate	6
	TOTAL	29

Note: 1 is excellent
 3 is average
 5 is poor.

In summarizing the panel ratings, the following items are of interest:

1. Each panel member rated various materials from good to bad, that is, nobody rated all materials average, etc.
2. There was good agreement that J-M Thermobestos was the best material.
3. There was good agreement that K & M Kaytherm was the worst product evaluated.
4. The widest variation in opinion was on Unibestos (1 to 5). The products that had an average rating generally had the wider variation in opinion (R. T. Sage states this is typical in surveys).

In reviewing the test data, it is noted that the modulus of rupture has no correlation with the handleability rating of the panel. Strength tests do not give the complete story, as can be seen in the summary of panel members' comments. Items such as appearance and dustiness affected the ratings.

Although the Ruberoid material generally had better strength than Kaylo, it rated slightly lower probably mostly due to the relative dustiness of the two plus the presence of air holes in the Ruberoid Calcilite.

Two of the B.-E.-E. Thermasil samples and two of the K & M Kaytherm samples arrived at Granville so badly broken they could not be tested. This is quite significant, as resistance to shipping damage was defined as one of the major facets of handleability. Incidentally, these two products were rated lowest by the panel.

One unexplained aspect of the survey is that two materials (Eaylo and Calsilite) which were rated high by the panel had relatively poor hinging, and Kaytherm (rated lowest) was among the best in hinging.

The attached comments by the panel members provide an interesting insight into the problems of evaluating handleability.


William A. Lotz
Product Testing Laboratories

VAL:psd

att. 9

INSULATION HANDLEABILITY DATA

Product Name _____ Date _____
 Manufacturer _____ Block _____ Size _____
 Pipe _____

Rating (1 to 5) 1 - excellent, 5 - poor

Reason for Rating* _____

*Hinges after cracking, cuts readily, doesn't break when dropped,
 hard, soft, etc.

What test or tests did you use to determine rating?

Name of Evaluator _____

WAL
 1/25/61

Test Summary - Ball Impact
Panel Rating

U/D - E

Sample 1.0 2.0 3.0 4.0 5.0
Block - 1-1/2"

4. E & M			10-8 6.9-14		
22. E & M				15-8 16-8.4	
24. Carey C.-S.				11-4 7.6-13	
5. J-M	18-11 26-3.4				
9. J-M	20-15 36-3.0				
6. Ruberoid		15-2 13-2.4			
7. B-E-E		12-4 21-3.0			
21. B-E-E			12-2 10-4.2		
12. O-CF		15-1 17-2.0			

P/C	1	2	3	4	5
1. J-M 3 x 1		15-200			
2. Careytemp 3 x 1			13-3		
3. E & M 3 x 1				10-3	
13. O-CF 3 x 1		9-2			
25. Unarco 3 x 1			14-20		
26. B-E-E 3 x 1				7-3	
27. B-E-E 3 x 1-1/2			14-4		
27. Ruberoid 3 x 1-1/2			15-20		
28. J-M 3 x 1-1/2		25-20			
30. O-CF 3 x 1-1/2			15-3		
10. O-CF 6 x 1				7-1	
11. Unarco 6 x 1				13-5	
14. Careytemp 6 x 1				8-3	
20. J-M 8 x 1		12-20			
16. Unarco Dulbestos 10 x 1-1/2			26-20		

TEST RESULTS:

Block 1-1/2" thick.	Ball Impact Test		Panel Rating (range)	Flexural Strength - Special Evaluation Method					
	Inches to First Crack	No. of Blows		Density, pcf	M. R., psi	Modulus of Elast. psi	Modulus of Resil. in lbs./ cu. in.	Index, inches	Absorption Index
4. K & M Kaytherm	10	5	2.7 (2-4)	13.7	31	5620	0.05	6.9	14.
5. J-M Thermobestos	18	11	1.0 ---	13.2	88	18,900	0.19	26	3.5
6. Ruberoid Calsilite	15	2	2.6 (2-3)	13.1	64	18,400	0.10	13	2.4
7. D-E-II Thermasil	12	4	2.6 (2-4)	13.2	60	11,700	0.15	21	3.0
9. J-M Thermobestos	20	15	1.1 (1-2)	14.0	101	16,300	0.28	36	3.0
12. O-CF Kaylo	15	1	1.9 (1-3)	12.2	70	20,800	0.12	17	2.0
21. D-E-II Thermasil	12	2	3.3 (3-5)	12.6	37	8,800	0.08	10	4.2
22. K & M Kaytherm	15	8	3.8 (3-4)	14.1	55	8,900	0.12	16	8.7
24. Carey Calcium Silicate (Same as Kaytherm)	11	4	3.8 (3-5)	13.5	35	5760	0.06	7.8	13.

TEST RESULTS:

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Attachment 4

	Product P/C	Size	Ball Impact Test		Density, pcf	Modulus of Rupture, psi	Panel Rating (range)
			Inches to First Crack	No. of Blows			
1.	J-M Thermobestos	3 x 1	15	Over 200	12.8	90	1.7 (1-3)
2.	P-C Careytemp	3 x 1	13	3	12.8	89	2.7 (2-4)
3.	K & M Kaytherm	3 x 1	10	3	13.8	71	3.6 (2-4)
5 & 29.	B-E-H Thermasil	3 x 1-1/2	14	4	12.9	64	2.8 (2-3)
10.	O-CF Kaylo	6 x 1	7	1	12.7	91	2.5 (1-3)
11.	Unarco Unibestos	6 x 1	13	6	18.2	89	3.0 (2-5)
13.	O-CF Kaylo	3 x 1	9	2	12.5	112	1.8 (1-3)
14.	P-C Careytemp	6 x 1	8	3	13.0	64	3.1 (2.5-4)
15.	B-E-H Thermasil	10 x 1-1/2	All cracked		12.8	—	3.2 (2-5)
17.	Unarco Unibestos	10 x 1-1/2	26	Over 20	18.8	—	2.6 (1-5)
	K & M Kaytherm	10 x 1-1/2	Cracked badly		—	—	4.6 (4-5)
18.	J-M Thermobestos	10 x 1-1/2	23	Over 20	14.5	—	1.0 —
19.	B-E-H Thermasil	6 x 1	All cracked		12.7	43	4.3 (3-5)
20.	J-M Thermobestos	6 x 1	12	Over 20	14.0	78	1.3 (1-2)
23.	K & M Kaytherm	6 x 1	All cracked badly		—	—	3.4 (2-5)
25.	Unarco Unibestos	3 x 1	14	Over 20	14.9	75	2.5 (2-3)
26.	B-E-H Thermasil	3 x 1	7	3	12.4	53	3.2 (2-4)
27.	Ruberoid Calsilite	3 x 1-1/2	15	20	13.0	60	2.3 (2-3)
28.	J-M Thermobestos	3 x 1-1/2	25	Over 20	13.4	108	1.3 (1-2)
30.	O-CF Kaylo	3 x 1-1/2	15	3	13.0	96	1.8 (1-2)

COMMENTS FROM INSULATION HANDLEABILITY DATA
SHEETS MADE OUT BY THE HANDLEABILITY PANEL

Johns Manville Thermostones

Sample 1 -- 3" x 1" pipe covering

Very little dust.
Rigid.
Does not break when handled.
Strong.
Clean.
Doesn't crumble readily.
Rigid.
Good hinging.

Sample 5 - Johns Manville Block
1-1/2" x 6"

No dust.
Rigid.
Hard.
Cuts good.
Doesn't break when dropped.
Cuts readily.
Very little dust.
Very good hinging.
Doesn't break when dropped.
Hard.
Square edges.
Clean edges.
Good impact resistance.
Good looking.
Saws readily.
Very good dimensions.

Sample 9 - block, 1-1/2" x 12"

Rigid.
Very little dust.
Hard.
Hinges well.
Excellent appearance.
Hard.
No voids.
Square edges.
Good hinging.
Very little dusting.
Beautiful appearance.
Good hinging.
Tough.
Easy to fabricate.
Does not break readily.

Sample 18

No dust.
Rigid.
Good hinging.
Strong.

Sample 20

Hard.
Cuts readily.
Very little dust.
Rigid.
Strong.
Hard and strong.
Free of voids.
Good impact resistance.
Very little dust.
Not crumbly.
Strong.
Fair hinging.

Philip Carey Careytemp

Sample 2 -- 3" x 1" pipe covering

Several were damaged in shipping, ends and edges cracked.

Very dusty.
Cuts very well.
Hinges well.
Crumbles readily.
Reasonably clean.
Cuts well.
Good surface appearance.
Easy to fabricate.
Hinging fair.
Impact resistance poor.
Brittle.
Hard.
Cuts well.
Hinges good.
Edges damaged.
Good appearance.
Good hinging.

Sample 14 -- 6" x 1" pipe covering

Several pieces broken.
Very dusty.
Good hinging.
Crumbly.
Breaks easily.

Kearsey and Mattison Kaytherm

Sample 3 -- 3" x 1" pipe covering

Several were cracked down center.
Soft.
Very dusty.
Soft but strong.
Cracks easily.
Soft.
Crumbly.
Dirty.
Very dusty.
Good hinging.

Sample 4 -- 1-1/2" x 12" block.

Half of the blocks were cracked
or chipped.
Soft.
Very dusty.
Good hinging.
Breaks readily.
Very dusty

Sample 17 -- 10" x 1-1/2" pipe covering.

Very dusty.
Soft.
Badly broken.
Very long fibers.
Cuts poorly.
Dirty.
Sheds.
Feel bothers me.
Breaks readily.
Crumbly.
Dusty.
Good hinging.
Not nice to handle.
Very soft.
Good hinging.
Long fibers.

Sample 22 -- 1-1/2" x 6" block

Very dusty.

Several blocks were damaged.
Hinges good due to long fibers.
Very dusty.
Breaks easily.
Cuts poorly.
Dirty.
Crumbly.
Breaks in hand.
Very dirty.
Good hinging.
Dusty.
Soft.

Sample 23 -- 6" x 1" pipe covering.

Very dusty.
All pieces were broken through
the middle.
Soft.
Cuts poorly.
Dusty.
Excellent hinging.
Soft.
Dusty.
Breaks readily.
Crumbly.
Good hinging.

Ruberoid Calzilit

1-1/2" x 12" block.

Easy to handle.
Edges chip readily.
Little dusty.
Dusty.
Soft.
Voids on surface.
Cuts easily.
Dirty.
Fabricates well.
Does not break readily.
Cuts well.
Good hinging.
Good hinging.

Sample 27 -- 3" x 1-1/2" pipe covering.

Moderately hard.
Cuts readily.
Easy to work.
Good hinging.
Hard to break.
Dusty.
Hard.

Fabricates well.
Moderately dusty.
Good hinging.
Good impact resistance.
Long fibers.

Crumbly.
Good surface.
Fair hinging.
Long fibers.
Good appearance.
Fair hinging.
Smooth surface.

Baldwin-Ehret-Hill Thermasil

Sample 7 -- 1-1/2" x 6" block

Rigid.
Very little dust.
Several pieces broken
in shipping.
Soft.
Fairly weak.
Poor hinging.
Cuts well.
Good hinging.
Good corners.
Edges crumbly.
Saws readily.
Cuts well.
Good hinging.
Good strength.
Good surface.

Sample No. 8 and 29 --
3" x 1-1/2" pipe covering

Very little dust.
Soft.
Fairly rigid.
Several pieces broken
in shipping.
Very little dust.
Soft.
Dusty.
Moderate impact strength.
Crumbly edges.
Soft.

Sample 15 -- 10" x 1-1/2"
pipe covering.

Rigid.
Little dust.
Both pieces cracked.
Soft.
Breaks when dropped.
Crumbles easily.
Excellent hinging.

Sample 19 -- 6" x 1" pipe covering

All pieces were cracked.
Dusty.
Weak.
Little hinging.
Crumbly.
Saws poorly.
Poor hinging.
Smooth surface.

Sample 21 -- 1-1/2" x 12" block.

Rigid.
Full of voids.
Dusty.
Cuts readily.
Dusty.
Good appearance.
Fair hinging.
Air holes.
Not too strong.
Dusty.
Breaks easily.
Good hinging.
Cuts well.
Soft.
Crumbly.
Soft.
Fair hinging.

Sample 26 -- 3" x 1" pipe covering:

Soft.
Not much dust.
Soft.
Moderate impact strength.
Soft.
Breaks but hinges well.
Many voids.
Cuts poorly.
Hinging very good.
Dusty.

O-CF Kaylo

Sample 10 -- 6" x 1" pipe covering. Poor hinging.
 Good appearance.
 Rigid.
 No dust.
 Very little dust.
 Rigid.
 Average strength.
 Good appearance.
 Breaks when dropped.
 Hard.
 No hinging.
 Hard.
 Voids.
 Clean.
 Cuts very well.
 No hinging.
 Hard.
 Cuts well.
 Clean.
 Shatters when dropped.
 Does not crumble.
 Very good strength.
 Breaks fairly readily on dropping.
 Hinging fair.
 Shatters when dropped.
 Good appearance.
 Saws well.
 Cuts cleanly.
 Poor hinging.

Union Asbestos and Rubber Co.
Unibestos

Sample 12 -- 1-1/2" x 6" block.

Rigid.
 Very little dust.
 Hard.
 Cuts easily.
 Doesn't break when dropped.
 Hard.
 No hinging.
 Good sharp corners.
 Little hinging.
 Hard.
 Cuts well.
 Square edges.
 No hinging.
 Fabricates easily.
 Fragile.
 No hinging.
 Good strength.
 Cuts well.
 Poor hinging.

Sample 11 -- 6" x 1" pipe covering.

Damages easily.
 Very little dust.
 Very hard on the outside.
 Tough.
 Ends mashed.
 Tough

Sample 16 -- 10" x 1-1/2" pipe covering.

Rigid.
 Very little dust.
 Heavy.
 Hard to break.
 Hard to cut.
 No breakage in carton.
 Strong.
 Tough.
 Does not saw readily.
 Tough.
 Hard to fabricate

Sample 13 -- 3" x 1" pipe covering.

Rigid.
 Very little dust.
 Hard.
 No dust.
 Easy to handle.
 Clean.
 Hard.
 No hinging.
 Good saving.
 No hinging.
 Low impact resistance.

Sample 25 -- 3" x 1" pipe covering.

Easy to damage.
 No dust.
 Soft inside.
 Very little breakage.
 Excellent hinging.
 Hard to cut.

Union Asbestos & Rubber Co.
Unibestos, Sample 25 continued

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Attachment 9

Fabricates okay.
Does not break.
Can be crumbled in hand.
Tough.
Cuts poorly with saw.
Strong.