

San Francisco, California
February 8, 1974

Evaluation of
Insulation Materials

MEMO TO FILE:

In an attempt to arrive at a rational answer to OSHA restrictions on use of asbestos-containing insulation, we recently revised our list of acceptable insulation brands. Our initial recommendations on approved brands was transmitted on September 7, 1973 in the form of Drawing GT-D-25673-0 (Standard Insulation Item Numbers). Since that time we have run laboratory tests on a variety of insulation brands. As a result, several additional insulation brands are now regarded as acceptable. Also, we have a more rational basis upon which to judge relative performance and limitations of specific brands. This information is summarized in the attached Materials Laboratory report.

One additional brand of calcium silicate, Keene Company "Thermasil", has been tested and is regarded as acceptable. In addition, a perlite insulation (Carytemp 1500) has also been evaluated and approved. This material may be used as an alternate to calcium silicate in the intermediate and high temperature categories. It offers the additional advantages of better resistance to breakage, less dusting when cut, and a higher temperature limit (1500F vs. 1200F for the calcium silicates). Although Carytemp 1500 is not specifically a calcium silicate, it is treated as such in subsequent discussions because of the general similarity.

Note that laboratory tests do not support the 1500F temperature limit claimed by Johns-Manville for their Thermo 12. All brands of asbestos-free calcium silicate should be limited to 1200F maximum. This represents an increase over the 1100F temperature limit shown in GT-D-25673-0. Tests also show distinct differences in mechanical properties between the various brands of calcium silicate. It will be necessary to consider these differences in addition to cost and delivery, in arriving at a specific brand selection.

All brands of calcium silicate, and also the Carytemp 1500, are available as both block and sectional pipe insulation. However, we should be aware that the situation with mineral wool is somewhat more complicated. Mineral wool is available in four major forms:

- 1). Block - Intended for column and vessel insulation.
- 2). Blanket - This is not covered in GT-D-25673-0. It is assumed that columns and vessels will generally not utilize blanket insulation.

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- 3). Preformed pipe insulation - available in Epitherm 1200 (Eagle Pitcher Co.) only.
- 4). Segmental pipe insulation - Available in MF Pipe Insulation (Forty-Eight Insulations, Inc.) only.

Note from the above that MF pipe insulation is made in segmental form, and Epitherm 1200 is preformed. Thus, the two brands of mineral wool pipe insulation require different methods of installation, particularly in terms of the way elbows and other fittings are handled.

An additional confusing factor is that with mineral wool, the same trade names are not used for block and pipe insulation. For example, Epitherm 1200 and MF pipe insulation are not available as block, at least under the same trade name. Eagle-Pitcher does not make a block insulation exactly equivalent to Epitherm 1200. Forty-Eight Insulations does make a block (called N-1200) which is roughly equivalent to their MF Pipe Insulation, though it is slightly more dense. None of the mineral wool block insulations has yet been subjected to laboratory test, but such tests will be initiated soon. No test data are presented on blanket insulations. It is generally intended that block rather than blanket be used on columns and vessels.

We see no information of real significance in the pH tests. All of the insulations examined may be regarded as acceptable in this respect.

The chloride leaching tests present a far more confusing picture. The Materials Laboratory test shown in Column 1 (page 4) gave low chloride values. This test involves an ambient temperature water extraction, and is fundamentally the test that we have applied in past years to evaluate the suitability of an insulation for use on stainless steel. The test used to give the results in Column 2 involves a nitric acid extraction. We do not believe the resulting chloride contents are relevant, except perhaps for stainless steel equipment used in acid areas. We, therefore, tend to disregard the Column 2 results in arriving at a general criterion for insulation selection.

The test results in Column 3 were obtained from a 200F water extraction. We regard these results as having a practical significance, and tend to interpret the results as supporting the recommendation that stainless steel piping be primed under insulation to prevent stress corrosion cracking. However, two factors cloud the issue here. First, test results are reported only down to a minimum of 100 ppm chlorides. This is not sufficient accuracy for a clear evaluation. If the true value were 10 or 20 ppm chloride, we would consider it acceptable for use on stainless steel without priming. However, at something approaching 100 ppm, we would agree that priming was necessary. A second confusing factor is that the 200F water extraction test has never been run on the old, asbestos-containing grades of calcium silicate which we have used for years on stainless steel equipment with minimal difficulty. We need this type of information to permit a solid comparison of chloride content between our old and new insulations,

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and to determine the real need for a substantial investment in painting stainless steels under insulation.

One additional test result deserves careful consideration. MF Pipe Insulation (mineral wool) melted away rapidly when exposed to a hot flame (about 2000F). This represents relatively poor fire resistance. It might be pointed out that we generally require reasonable fire resistance from insulation. For example, we take credit for the insulation limiting heat input to a system when we size relief valves. Epitherm 1200 is superior to MF Pipe Insulation in fire resistance, but both are inferior to calcium silicates. The real impact of this phenomenon should be carefully considered when choosing an insulation. In discussing this subject with Mr. E. R. Calanan, it was his opinion that a material with poor fire resistance like MF Pipe Insulation was generally not acceptable on-plot, but could be used for off-plot piping.

On the basis of the above information, we find ourselves in the following position:

- 1). We have the information which allows us to choose between different brands of calcium silicate insulation. However, the best choice may vary, depending on relative importance of the different criteria in a given service. (See attached chart.)
- 2). We do not now have any mineral wool block or blanket insulations which have been tested and approved. This leads us to recommending only the calcium silicate block insulations for vessels, until either laboratory tests or further input from our refineries or contractors leads us to acceptable brands of mineral wool for this usage.
- 3). Our tendency has been to use block rather than blanket insulation for columns and vessels, and our Standard Drawings reflect this. With the increased use of mineral wool, we may wish to update our position on block vs. blanket insulation. This could lead us to additional Standard Drawings to cover the alternative.

In summary, many insulation questions remain to be answered. We are not yet at the point where we can prepare an adequate insulation standard.

R. L. PIEHL

RLP:hc

cc: EHE
RDS
JGH/PEJ
PGS

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COMPARISON OF CALCIUM SILICATE INSULATIONS

	THERMO-12	KAYLO-10	CAL-TEMP N.A.	THERMASIL	CARYTEMPSK *
BREAKAGE	OK	FRAGILE 10%+ BREAKAGE IN SHIPMENT	OK	OK	OK
DUSTY?	MODERATELY	BAD	BAD	BAD	BEST
TEMP. LIMIT	1200F	1200F	1200F	1200F	1500F
FIRE RESISTANCE	BEST	BEST	BEST	INTERMEDIATE	WORST OF GROUP BUT ACCEPTABLE
CHLORIDE CONTENT	WORST	BEST	INTERMEDIATE	INTERMEDIATE	BEST
ORDER OF PREFERENCE²	2	5	3	4	1
LIMITATIONS	GENERALLY GOOD CHOICE EXCEPT ON STAINLESS STEELS	EXPECT HIGH BREAKAGE. WE JUDGE THAT THIS OUTWEIGHS ADVANTAGES	ROUGHLY SAME AS THERMO-12	ROUGHLY SAME AS THERMO-12	GENERALLY BEST CHOICE EXCEPT IN HIGH FIRE RISK AREAS

* THIS IS CLEARLY A MATTER OF JUDGEMENT AND WILL VARY WITH SERVICE.

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* Carytempo 1500 is Pearlite, not calcium silicate.