FILE NAME: Oil Industry and American Petroleum Institute (API)

DATE: 1947 Apr

DOC#: API077

DOCUMENT DESCRIPTION: Trade Journal Article - Insulation Technique for OIl-Refinery Structures

the OIL AND GAS JOURNAL

published weekly by the

PETROLEUM PUBLISHING COMPANY

211 S. CHEYENNE AVE., TULSA 1, OKLAHOMA

FOUNDED IN 1910 BY PATRICK C. BOYLE

Subscription rate to the petroleum industry, United States and foreign, 1 year, $3.00. Single copies, 20 cents. Back copies, when over a year old, 50 cents. Note: Payments from outside the U.S.A. may be in the form of an international money order or check on a U.S.A. bank. Entered as second-class mail matter at Tulsa, Okla., under Act of March 3, 1879.

Vol. 45, No. 51 April 28, 1947

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Insulation Technique

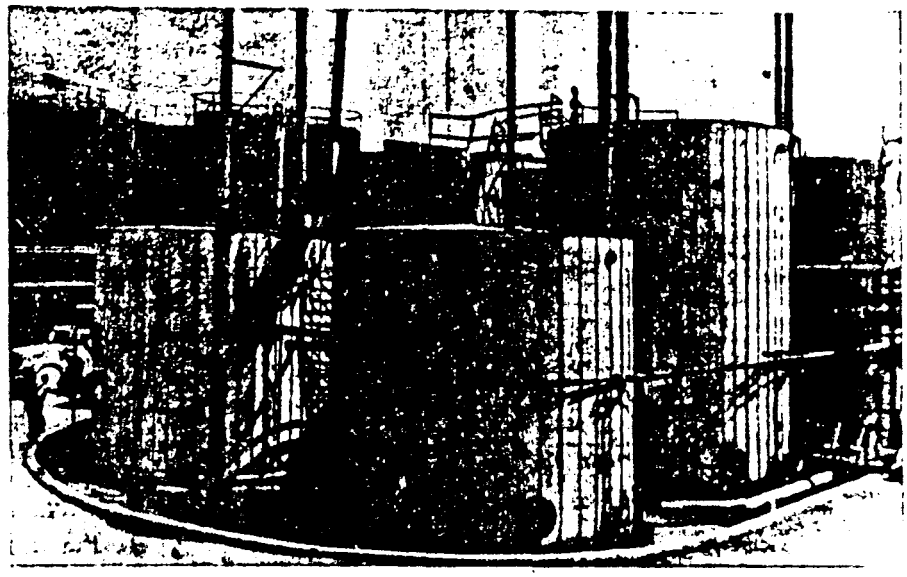
For Oil-Refinery Structures

*by S. S. Parker**

TO be of optimum value, insulation for refinery equipment must possess a combination of characteristics. Obviously, to be effective, an insulating material must have a low "k" factor, to minimize heat transmission. Of nearly as great significance, in applying insulation to such large irregular surfaces, is the ease with which it may be applied to conform closely to the surfaces. Initial efficiency of any insulation is of small significance unless the installed material retains its initial properties over long periods of time in unfavorable environments. The ease with which insulation may be protected from moisture, vibration, corrosive fumes, and other harmful influences, and the facility with which the insulation lends itself to ready maintenance, are fundamental to successful application and long-range operating value.

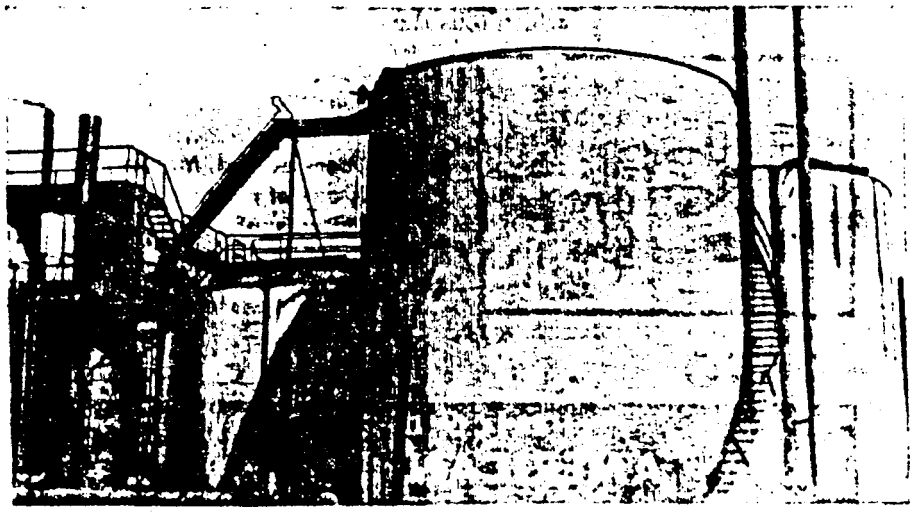
Application methods vary from refinery to refinery, each having greater or lesser success with various insulating materials. According to Ashland Oil & Refining Co., Ashland, Ky., great success, over a 10-year period, has been obtained from the artificial silicate fibers which in their various forms are grouped generally as mineral wool. The specific advantages and experiences which Ashland has found through the use of the mineral-wool materials, should be interesting to all petroleum and chemical industrial consumers of insulation.

*Design engineer, Ashland Refining Co.



This recently built group of road-oil-mixing tanks is insulated with 2 in. of blanket mineral wool between the tank wall and an outer moisture-sealing sheet-metal shell

Compared with some forms of insulation, the blanket form materially decreases the time and expense of application. In addition it has lower unit area costs for equivalent insulating value. Maintenance operations may be readily performed by removing unit panels of backed-blanket mineral wool, without disturbing adjacent insulation, and may be immediately replaced, with the same insulating value as originally possessed, without extensive construction operations. Frequently, quite extensive maintenance operations are undertaken and completed in less than a day, where, with ordinary brick-type insulation, several days or weeks would be required to scaffold, cut, fit, and lay. This rapidity of repair operation permits the maintenance of minor matters without shutting down operating units and without materially disturbing the efficiency of operation.



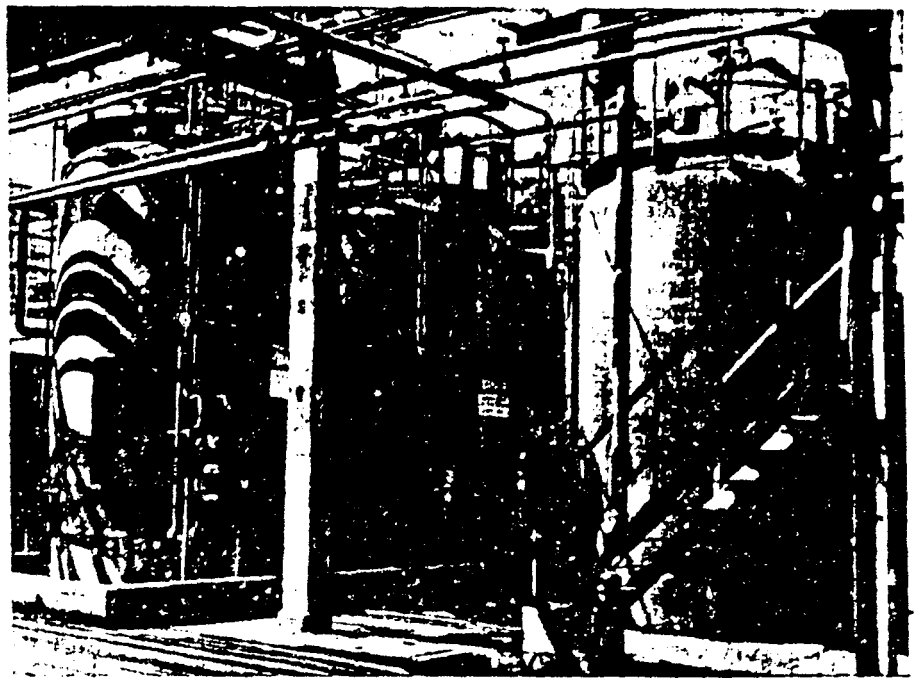
Asphalt oxidizing tanks at Ashland Oil & Refining Co. Noxious vapors from the operation are passed through the fume absorbing towers visible in the left side of photograph

Advantages of Mineral Wool

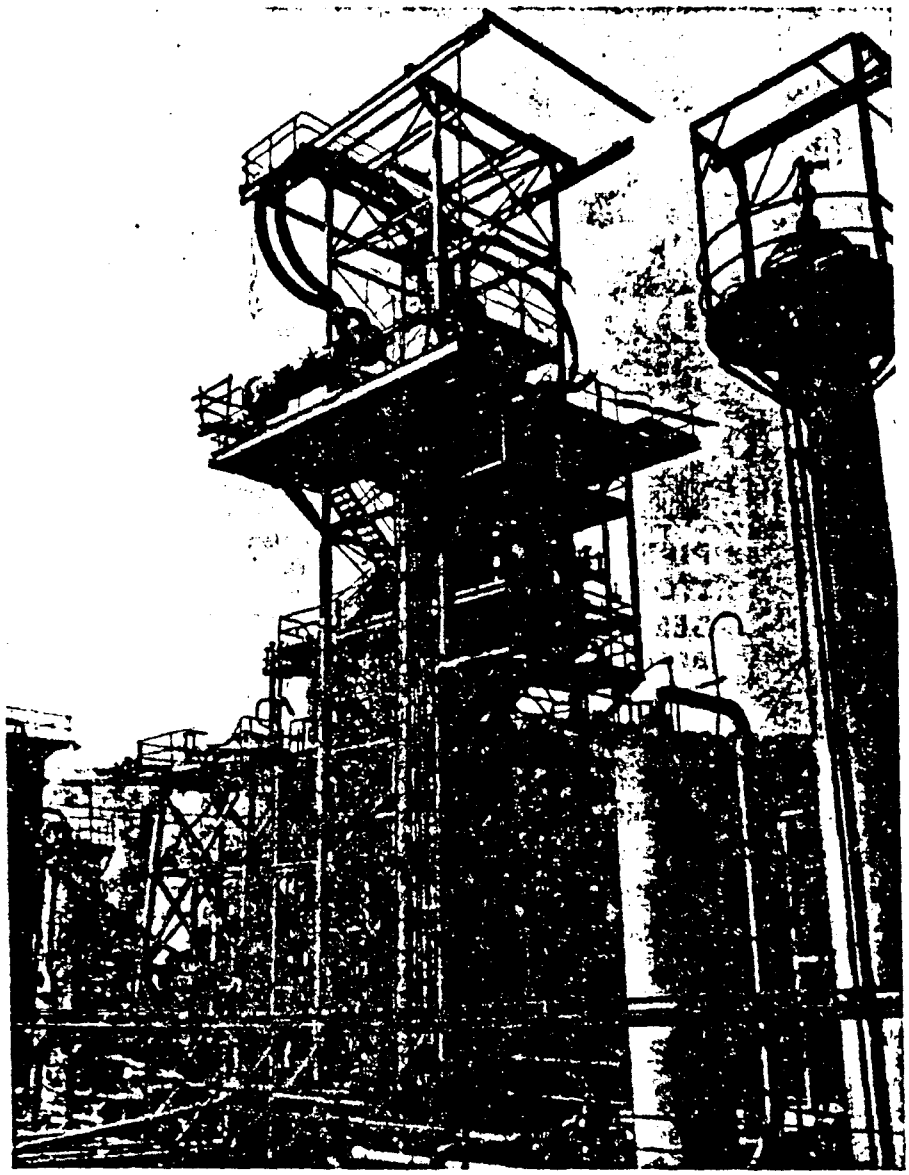
Ease of first application, as well as ease of maintenance, would be of no real value if insulation had to be subjected to constant attention to keep it in good condition. Experience has shown Ashland that mineral-wool blankets, properly applied, have the ability to retain both structure and thermal coefficients in service. Freedom from packing, sifting, powdering, cracking, and other defects so frequently encountered with some insulating mediums commonly used in refinery practice, eliminates expensive insulation maintenance and repair, and insures continuous opera-

tion under controlled conditions for long periods of time. The ability to operate and maintain equipment without interruption of function is obviously most important in the economics of refinery management.

Asphalt oxidizing at Ashland's refinery is performed in four tanks, two with 1,500 and two with 5,000 bbl. capacity. These oxidizers are insulated with 2 in. of blanket mineral wool which is supported between a chicken-wire mesh (in contact with the ¼-in. steel plate inner tank) and expanded metal lath outside. The blankets are held in place by heavy wires which were butt welded to the steel plate prior to application of the insulation. The wires pierce the blanket and their ends are securely clinched to the lath backing. All joints of adjacent blankets are securely wired together at the lath edges. Weather protection and moisture sealing are simultaneously obtained by the application of a corrugated galvanized sheet metal outer shell. Riveted seams of the 20-gage galvanized iron prevent penetration of water or other harmful atmosphere constituents and make a strong outer structure.



This battery of electric field precipitators is insulated with 2 in. of blanket mineral wool. A plastic sealing coat and two outer coats of brushed asphalt protect the insulation



Four inches of blanket mineral wool in two staggered layers effectively control stage temperature variations of approximately 325° F. along the height of this six-fraction unit

Exhaust gases and smothering steam from the asphalt tanks are withdrawn and passed through two fume-absorbing towers. Coke is used in these towers to absorb the noxious, corrosive waste gases for health protection and the remaining non-condensed steam is allowed to vent to the atmosphere. The use of insulation on these units yields additional advantages, beyond reduced fuel consumption and protection against temperature variations. The optimum oxidizing temperature can be held constant, giving the oxidation cycle more opportunity to convert the bases, and thus materially reduce cycle time.

Mixing and Blending Tanks

Road-oil mixing and blending tanks are another volume heating operation in which Ashland has found blanket insulation particularly effective and easy to apply. At present five units are in operation, two 1,000 and three 1,500-bbl. vessels. The construction of these tanks is quite similar to that employed in the asphalt processors. Two inches of mineral wool blanket is used, applied identically as in the insulation of the above units, except that, in the absence of corrugated galvanized iron, 20-gage flat roofing sheet was used with edges raised and rib-crimped between adjacent sheets. Such assembly provides both weather sealing and stiffening. In all of these process tanks the heat control is so effective that the external tank surface is only moderately warm to the touch. Around 90° to 100° F. (when the ambient temperature is 70° F.) is the usual range.

The primary purposes of heat con-

servation and uniformity of temperature throughout the tank are effectively accomplished. Furthermore, when enlargement of units, or removal and re-erection is called for, the mineral-wool blankets are easily removed, in such a manner that they are completely reusable without loss of effectiveness.

A new vacuum fractionating column built in 1942 is run under 28-in. Hg. vacuum at temperatures which range, approximately, from 725° F. at the base to 400° F. at the top of the unit. The tower was covered with two layers of mineral wool blanket, each two inches thick, faced with wire mesh, backed with metal lath. Each layer was securely wired and clamped in place, and the seams of the two layers were staggered to prevent through joints which might have low insulating value. In this case the exterior metal lath was smoothly filled and coated with plastic sealing compound troweled into the lath. The entire surface was then hot mopped with two coats of asphalt mastic, to complete the weather seal.

In constructing large units, with multiple layers of insulation, it is most important that the insulation be applied while dry, and be protected from water until the weather seal is complete. Water-soaked insulation is a good conductor of heat. When effectively vapor proofed, any water which may be trapped in the insulation before vapor proofing can remain for extended periods, and when converted to steam, it can seriously rupture the weather-sealing coats in its escape.

Though silicate wools are not subject to rot or other disintegration due to the action of water, their efficiency is greatly reduced if the air voids within the insulation fill with water, and the damage to equipment can be severe over extended times. The singular absence of cracking, sagging, and other mechanical weaknesses which is inherent in mineral-wool blankets affords a wide margin of safety against failure. When applied dry and properly, mineral-wool-blanket insulation has an indefinite life. Units at Ashland which have been in operation for more than 10 years are still effectively insulated and protected.

Nine large 200-bbl. desalting units, plus auxiliary surge and control tanks, are used at Ashland. The nine electrical units, and all of the feed lines and surge tanks are insulated with 2 in. of blanket. Though the control is critical, the low temperature, 200° F., does not require the application of greater thicknesses. The metal-lath-backed blankets are filled and smoothed with a plastic sealing coat over which two coats of hot asphalt are brushed to seal the units from moisture. Both engineering and laboratory divisions have closely followed temperature uniformities and product qualities in connection with the desalters and attribute much of their success to the insulation technique.

One insulation trend at Ashland which is worth mentioning is the use of mineral-wool insulating materials on piping. Several large-diameter steam lines are being built, to carry high-pressure steam from the original plant to a new addition, a distance of more than ½ mile. These lines will be protected with formed blanket mineral wool. Experience at this refinery has indicated that losses will be between 10° and 15° F. in steam being transported at 225 psi. at 550° F.

The technical characteristics Ashland has found important in insulating materials over the past 10 years include: (1) ease of application and of maintenance; (2) freedom from rot and chemical disintegration; (3) freedom from mechanical failures due to powdering, dusting and cracking; (4) the ability to encase, vapor seal, and moisture-proof after application; (5) freedom from danger of combustion; (6) low initial cost, and (7) complete salvageability—all in addition to low thermal conductivity factors.