API 521 8th Edition Ballot

Fire Critical Insulation Part 1
(Action Item 2023-01)

Instructions to Voters/Commenters

- Please limit your comments to the red-lined portions, which indicate new text, of the ballot only.
- If you are voting negative with multiple comments, please indicate which comment(s) is the reason for your negative vote, otherwise API's balloting system will categorize all of your comments as negative.

Thanks to Tim Weber and the work group for their efforts.

Melissa Marashi (Chevron)
David Fenton (ExxonMobil)

API 521 Task Force Chairs

4.4.13.2.7.2 Installation Considerations for External Insulation Systems

The designer should be certain that any system of insulating materials permits the basic insulating material to function effectively at temperatures up to approximately 904 °C (1660 °F) during a fire. This period of exposure can be for up to 2 h, depending on the adequacy of firefighting provisions, the accessibility of equipment, and the degree of skill and training of the firefighting group. This consideration is especially pertinent to newer installations using foamed or cellular plastic materials that have excellent properties at operating conditions but that (unless they were specially treated and pretested) have melted, vaporized, or otherwise been destroyed at temperatures as low as 260 °C (500 °F). Corrosion under insulation (CUI) should be considered when installing insulation.

The finished installation should ensure that fire protection insulation is not dislodged when it is subjected to the high-pressure water streams used for firefighting, such as streams from hand lines or monitor nozzles, if installed. One possible example of this type of procedure can be found in NFPA 58, Annex H. Some criteria that should be considered include the ability of the protected system to withstand direct-flame impingement. Fire insulation, or insulation that is part of a composite system, should be capable of withstanding an exposure temperature of approximately 904 °C (1660 °F) for up to 2 h. Insulation system materials selection should consider equipment metallurgy while providing required jacket integrity at fire water pressures and fire temperatures. Stainless steel jacketing and banding have demonstrated satisfactory performance in fire situations. On the other hand, jacketing systems that use aluminum exclusively have not demonstrated satisfactory performance. Insulation materials that may decompose during fires should be avoided or suitably protected with layered composite systems. If the jacket and/or banding integrity is compromised, insulation credit can still be taken in accordance with Equation (17) or Equation (18) if it can be demonstrated that the insulation material integrity and temperature resistance are maintained per requirements above [i.e. not dislodged by high-pressure water stream and withstand an exposure temperature of approximately 904 °C (1660 °F) for 2 h].

4.4.13.2.7.3 Physical Properties of Insulation Systems

The value of thermal conductivity used in calculating the environmental factor credit for insulation should be the thermal conductivity of the insulation at the mean temperature between approximately 904 °C (1660 °F) and the process temperature expected at relieving conditions (see 4.4.13.2.7.4). If reasonably possible, the variation in conductivity due to service and maintenance practices from known laboratory values should be taken into account. Therefore, the user should consult with the insulation material supplier as to the actual temperature limits for the insulation material. Where multiple-layer insulating systems consist of different materials, the physical characteristics of each material under the expected temperature conditions should be examined. Typical values of thermal conductivity for various insulating materials appear in Table 6. It is important to note that there may be several grades of each type of insulation shown in Table 6. The thermal conductivity and maximum temperature values shown in Table 6 can vary depending upon grade and should be verified for the specific grade of insulation being used.

Table 6—Thermal Conductivity Values for Typical Thermal Insulations [e]

Average Temperature of Insulation °C (°F)	Thermal Conductivity for Selected Material W/m·K (Btu·in./h·ft²·°F)						
	Calcium Silicate Type I [21]	Calcium Silicate Type II [21]	Mineral Fiber Mesh Blanket/Block [a] [23, 24, 26]	Cellular Glass Type I Gr 2 [22]	Molded Expanded Perlite Block [25]	Lightweight Cementitious [b] [77]	Dense Cementitious [b] [77]
–18 (0)	—	—	—	0.045 (0.31)	—	0.519 (3.6)	1.760 (12.2)
38 (100)	—	—	0.039 (0.27)	0.053 (0.37)	—	0.519 (3.6)	1.731 (12.0)
93 (200)	0.065 (0.45)	0.078 (0.54)	0.049 (0.34)	0.063 (0.44)	0.079 (0.55)	0.519 (3.6)	1.702 (11.8)
149 (300)	0.072 (0.50)	0.084 (0.58)	0.063 (0.44)	0.075 (0.52)	0.087 (0.60)	0.519 (3.6)	1.673 (11.6)
204 (400)	0.079 (0.55)	0.088 (0.61)	0.079 (0.55)	0.091 (0.63)	0.095 (0.66)	0.519 (3.6)	1.659 (11.5)
260 (500)	0.087 (0.60)	0.092 (0.64)	0.101 (0.70)	—	0.107 (0.74)	0.519 (3.6)	1.630 (11.3)
315 (600)	0.095 (0.66)	0.097 (0.67)	0.128 (0.89)	—	0.115 (0.80)	0.519 (3.6)	1.615 (11.2)
371 (700)	0.102 (0.71)	0.101 (0.70)	0.163 (1.13)	—	0.127 (0.88)	0.519 (3.6)	1.587 (11.0)
427 (800)	—	0.105 (0.73)	—	—	—	0.519 (3.6)	1.572 (10.9)
482 (900)	—	0.108 (0.75)	—	—	—	0.519 (3.6)	1.543 (10.7)
538 (1000)	—	0.111 (0.77)	—	—	—	0.519 (3.6)	1.514 (10.5)
593 (1100)	—	—	—	—	—	0.519 (3.6)	1.486 (10.3)
649 (1200)	—	—	—	—	—	0.519 (3.6)	1.471 (10.2)
	Maximum temperature for example of insulation listed [d] °C (°F)						
	649 (1200)	927 (1700)	649 (1200)	[c]	[c]	Approx. 870 (1600)	Approx. 1090 (2000)

[a] "Mineral fiber blanket/block" comprises rock, slag, or glass processed from the molten state into fibrous form. The thermal conductivities shown in the table are the highest values for the various forms of the insulation suitable for the maximum use temperature indicated.

[b] Thermal conductivities for lightweight and dense cementitious materials are approximate.

[c] Maximum use temperature not given in ASTM C552 [22] and ASTM C610 [25].

[d] There may be other grades of insulation that have higher maximum temperatures.

[e] Please consult manufacturer to confirm particular insulating material will meet all the requirements of fire critical insulation as listed in section 4.4.13.2.7.