

Thermal Conservation Technologies



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R50 insulation, ~10" thick

- “Hot” = 100°F - 70°F, absorb 1.89 W/m²
- “Cold” = 20°F - 70°F, lose 3.15 W/m²
- Current Vacuum Insulation Panel (VIP) is 1” thick and R30

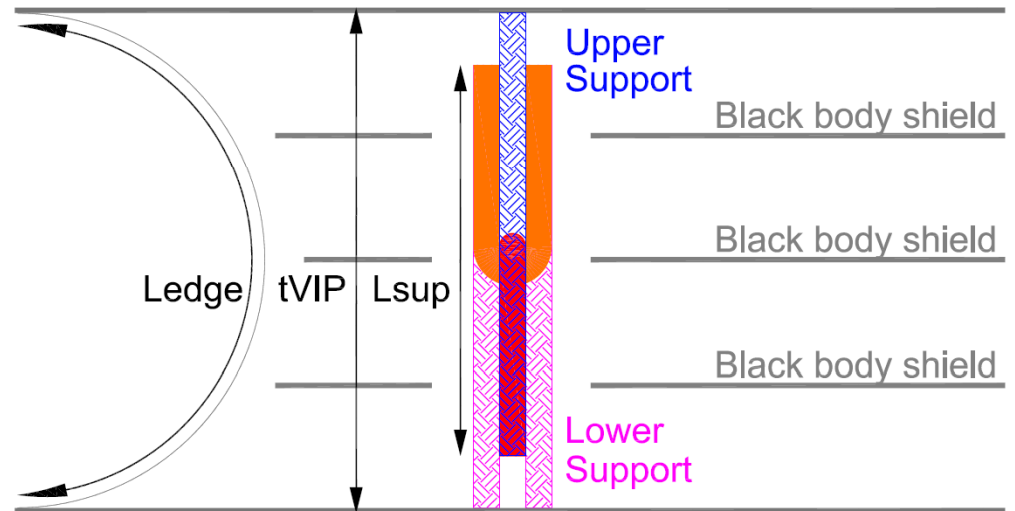
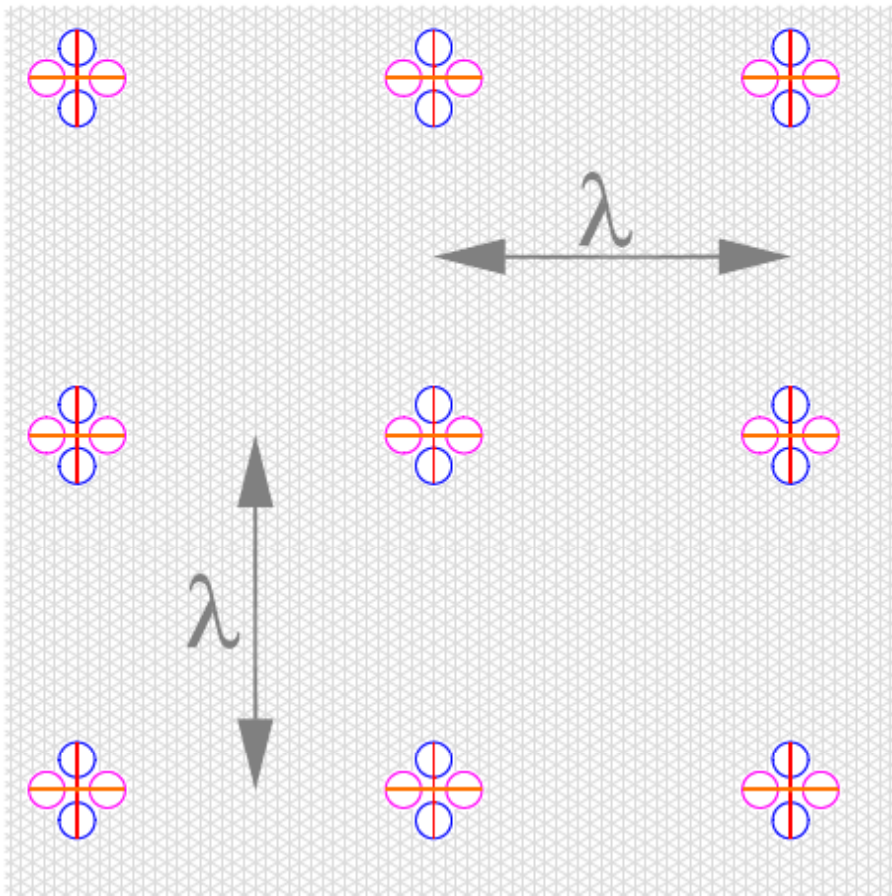


Problems

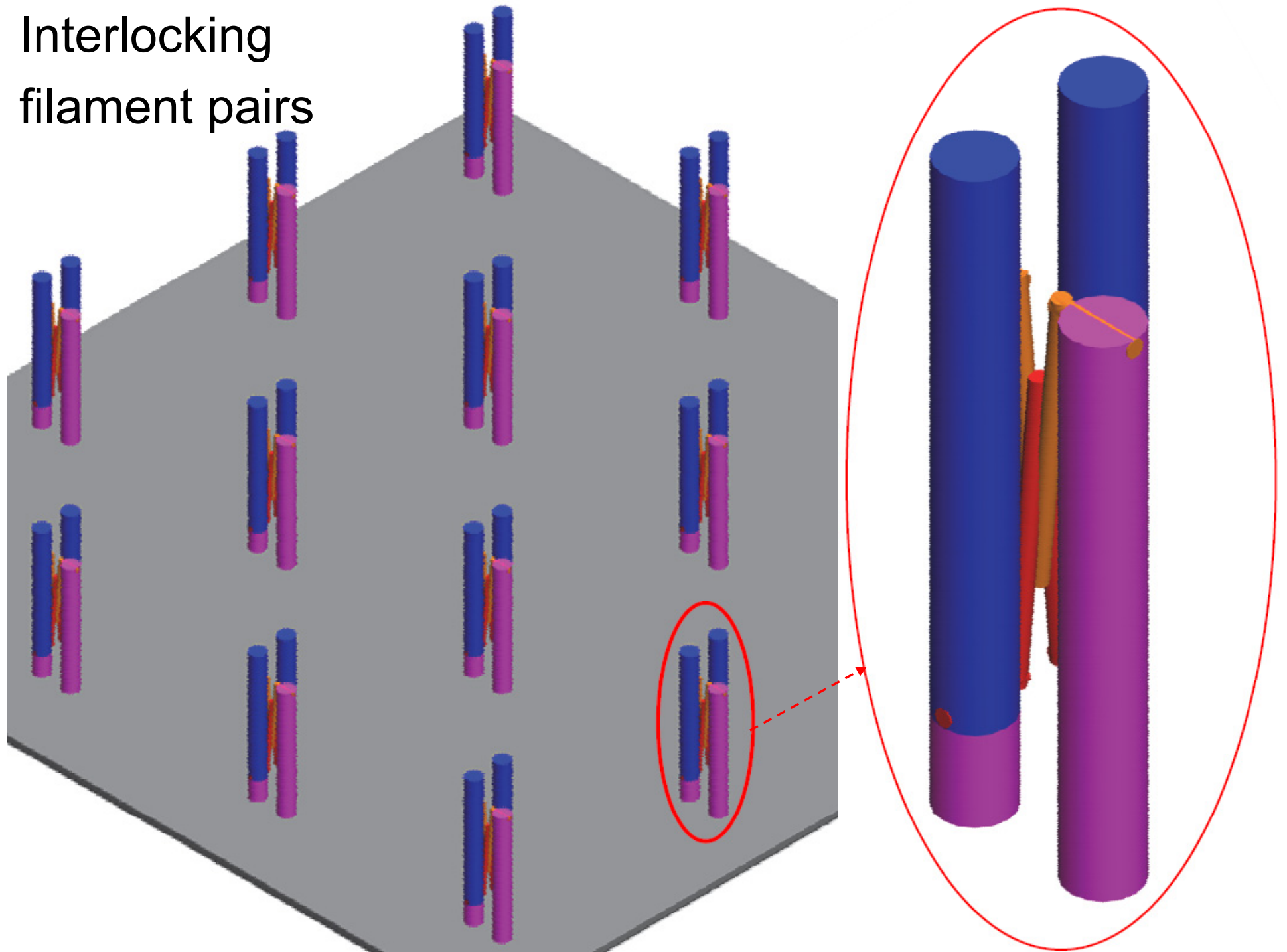
- Current VIP is a factor of 6 better than conventional trapped air insulation without any edge losses.
- Edge losses reduce factor to 2.4 on a 1 meter square panel.
- Current VIP is easily punctured reducing any advantage over conventional insulation.
- Cost is \$10 - \$20/ft²

0.5" thick VIP and R50 with edge losses.

High tensile thermal impedance, minimize black body radiation, molecular transport, & edge losses. Puncture resistant stainless steel.



Interlocking
filament pairs





Heat transport for tensile VIP

$$Q_{\text{Total}} = Q_{\text{Supports}} + Q_{\text{Edge}} + Q_{\text{BB}} + Q_{\text{Mol}}$$

- “Hot”, absorb 1.77 W < R50 = 1.89 W
- “Cold”, lose 2.70 W < R50 = 3.15 W

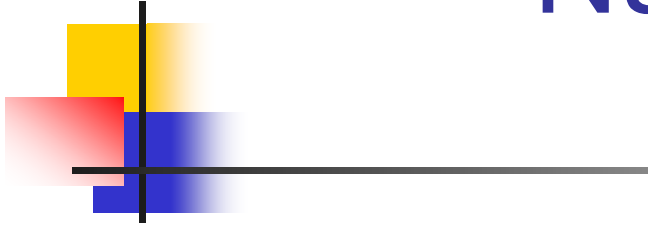
Refrigerated Transportation

Great Dane Trailers

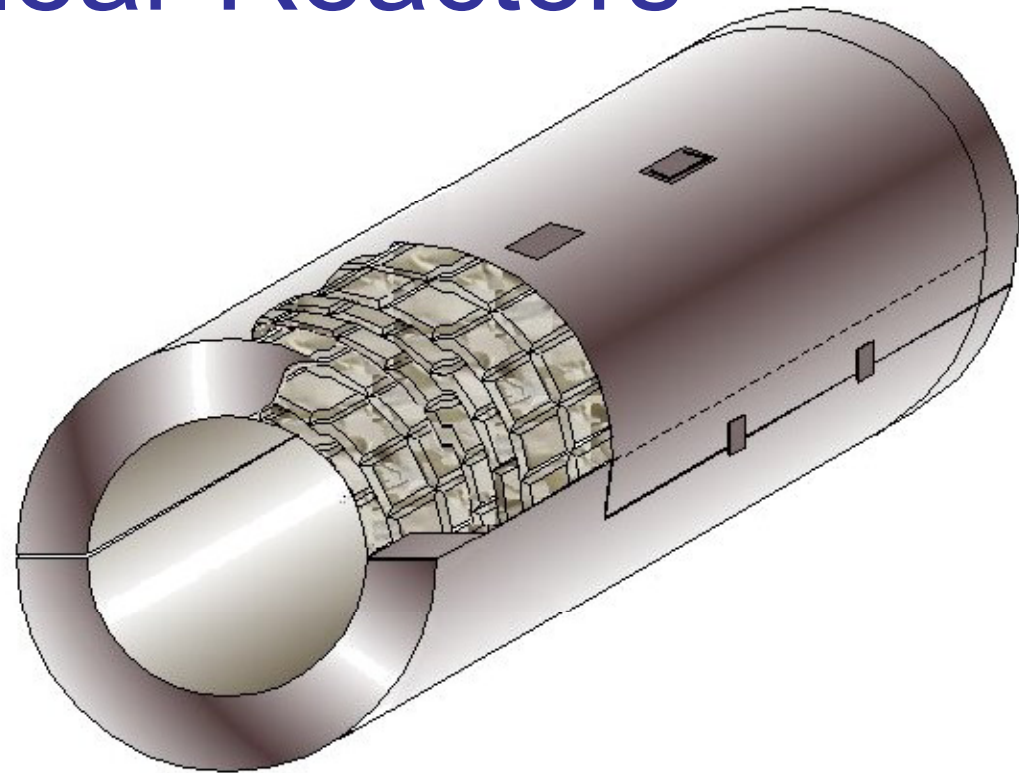


- 16.2m x 4.1m x 2.6m, 238m² insulated with R12
- TRU runs ~1500 hours/year & consume ~1500 gallons
- 330k in US, switch to R50 & conserve 1% total diesel 7

Nuclear Reactors

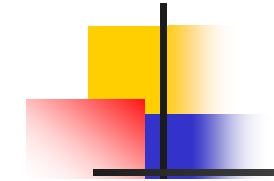


Transco

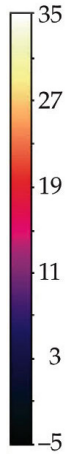


- Stack dimpled stainless steel sheets, ~R11
- Tolerate 60 psig burst steam pipe & not create debris
- Maximum temperature 370°C
- Tolerate radiation

Permanent & Temporary Buildings



Temperature differential (°F)



Saint-Gobain Fraunhofer Center





Conclusions

- 0.5” thick tensile VIP exceeds R50 with edge losses.
- Design uses two layers of 51 μ m thick stainless steel and three layers of 7.6 μ m thick aluminum which is 0.9 kg/m², 51mm thick polyurethane foam in refrigerated trailers is 1.6 kg/m²
- Expected cost \$2-4/ft².



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