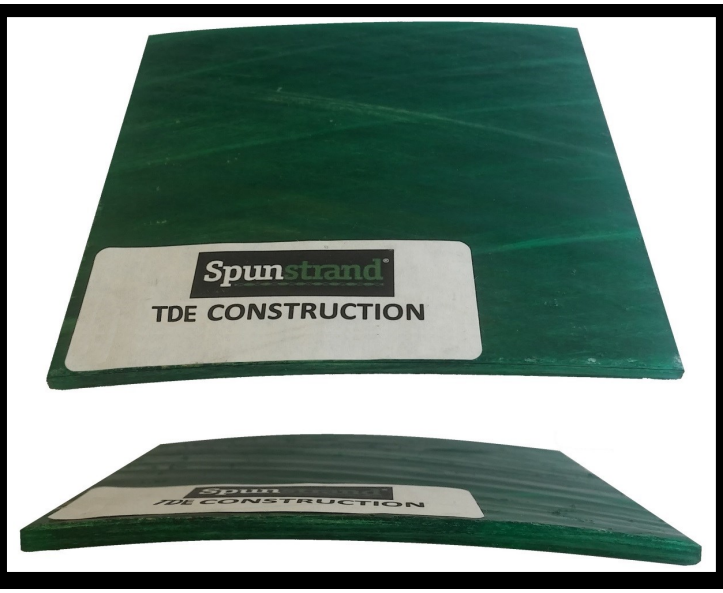
The Choice is Yours

ASTM C518 "R-Value"

NSF P374 "TDE"



Underslab Duct Approval Options

Engineers, Architects and building owners have a choice to make on specifying and designing for underslab HVAC ducts. This choice is between fiberglass duct (FRP) and plastic ducts (PVC or HDPE). When it comes to the insulation performance of these products, there are currently two types of recognized approvals with code agencies like ICC. There are several manufactures of FRP underslab duct with ASTM C518 tested and listed R-value ratings from R-4 to R-12. ASTM C518 testing is the industry standard and the only R-value testing recognized by the International Engineer Conservation Code (IECC). Then there are also several manufactures that are referred in the product listings as TDE rated to an R-10 equivalent per the NSF TDE test protocol. These products are single wall un-insulated, often mistakenly called self-insulated products, which test between .80 and 1.3 in an actual ASTM C518 R-value test. The TDE test is not an R-value test, nor is it recognized as one by ICC or the IECC. The TDE test is a very "loosely" defined protocol with the air going through roughly 40 lineal feet of duct and a couple fitting in a simulated trench with no actual external mechanical/thermal load. The protocol attempts to stipulate that if the tested duct has similar entering and exiting air temps as the base line R-10 insulated duct, the test sample should be called an R-10 equivalent.

Aside from insulation performance, it should be noted that all the FRP manufactures have a class 1 flame and smoke rating to meet the code standard for class 1 on the inside of ducts and plenums. The HDPE or PVC products have a flame spread of 200 and an unpublished smoke rating estimated at 700. Because the code has listed HDPE and PVC products as acceptable for underground use, the choice is again left to the specifier or buyer.

Lastly, the TDE products being single wall are roughly 60% of the price of the actual insulated products. The questions becomes, what is the difference in energy costs between an actual R-1 or say R-6 insulated over the 25 year life of a building? Also, what is the potential liability of using a non fire retardant material for duct and plenums, which all mechanical codes still call for?

The statements above can all be verified by checking the listings at WWW.ICC-ES.org/listing/. Then go to reports and legacy reports. In div 23 31 00 HVAC ducts and casings, you will find the listings of AQC (Blue Duct) which uses the TDE test and DOES NOT have a listed R-Value per ASTM C518. In Div 23 31 16.16 you will find the Spunstrand listing, which has both the ASTM test certified insulation and the TDE listing as well. Another resource on this topic is a white paper produced on this topic located at http://spunstrand.com/thermal-distribution-efficiency-tde/ .

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BRIEF COMPARISION BETWEEN
ASTM C518 and NSF PROTOCOL P374

DEFINITIONS:

R-VALUE:

A measure of resistance to the flow of heat through a given thickness of a material (as insulation) with higher numbers indicating better insulation properties. [Merriam-Webster]

THERMAL DISTRIBUTION EFFICIENCY:

The resistance to changes in air heat as air is conveyed through a distance of air duct. [NSF P374]

TEST OVERVIEWS:

ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties By Means of Heat Flow Meter Apparatus

- Produces results that show a material's exact thermal conductivity (k value).
- R-value is directly linked to a material's thermal conductivity (k).
- Is the ONLY industry recognized testing method to determine R-value.
- Referenced in UMC as the only acceptable method of verifying a material's R-value.

NSF PROTOCOL P374: Air Duct Thermal Efficiency Performance

- Produces results that show thermal distribution efficiency (TDE).
- TDE is a percent difference between the inlet and outlet temperature in the duct, NOT the direct measure of the thermal performance of a material, or the loss of energy through the duct wall.
- One must correlate or make assumptions about the material's thermal properties based on TDE performance. The only way to generate values such as R-values is through comparisons of NON-thermal transmission properties.
- With the large number of variables in play, such as test air temp, ambient vs. test air temp differences, velocity differences, etc. can you safely make any assumptions?
- Why take a material with a known R-value (tested to ASTM C518) and compare it to an unknown material? Why not just test the new material to ASTM C518?

CONCLUSIONS:

NSF P374 compares air temperature into a duct system to the air temperature leaving a duct system, which is not a measure of thermal performance and does not translate directly to energy savings. ASTM C518 produces results of energy transmission through a particular duct wall, which shows true thermal performance and is directly linked to energy savings.

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