



ThermalStar® X-Grade® Sub Grade Modulus

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ThermalStar X-Grade insulation products are designed for use in below grade applications including below concrete slabs. The products have been used in cold storage facilities, warehouses, water treatment facilities, loading ramps, and other high traffic applications.

Products covered by ASTM C578 such as ThermalStar X-Grade are often classified according to gross compressive resistance, such as 15 psi, 25 psi, 60 psi, etc. These are material standard properties, not design properties. For massive uses of these products, such as lightweight fill under highways or along bridges, ASTM D6817 compressive values at 1% deformation are commonly the appropriate values for design.

For under concrete slabs, a key design consideration is the stresses that a material under a slab will be subject to. Commonly, calculations proposed by Timoshenko & Woinowsky, called the Theory of Plates and Elastic Foundations, are used to determine maximum pressure. Followers of this theory often ask for a material's "K value", "subgrade modulus", "Winklers constant", or other monikers for the "K" in the following equation:

Max pressure on a subgrade material = $P/8$ times the square root of K/D

Where:

K = Subgrade Modulus of material below the slab (X-Grade®)

P = load on the concrete slab in pound

$D = Eh^3 / 12 (1-u^2)$

Where: E = modulus of elasticity of concrete slab

h = concrete slab thickness

u = Poisson's Ratio of concrete

The overall "K" of X-Grade® is determined by taking the value for "k" of X-Grade at 1" thick and dividing by total thickness of the X-Grade® ($K = k / \text{total thickness inches}$).

ThermalStar X-Grade Type	k for 1" thick
X-Grade 15	720 lb/in ²
X-Grade 25	1000 lb/in ²
X-Grade 40	1500 lb/in ²
X-Grade 60	1800 lb/in ²

This bulletin is current as of the date above.

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