



Pyrotek Wollite Backup Insulation Compared to Common Competitor

PROCESS

Aluminium and glass production

PYROTEK PRODUCT

Wollite is a pourable, lightweight mineral foam insulation material suitable for insulating refractory liners or complex refractory shapes. It is composed primarily of the calcium silicate-based mineral wollastonite. It has very low thermal conductivity, which results in even temperature distributions and low thermal loss.

Benefits

- Uniformly fills narrow and complex cavities
- Low viscosity during pouring
- Highly insulating
- Easy and safe to remove and reinstall
- Contains no refractory ceramic fibres (non-RCF)
- Low thermal conductivity
- Thermal shock resistant
- Non-wetting to molten aluminium or glass

Pyrotek recently tested its Wollite 30 ST-1 backup insulation against a competitor's product commonly used as backup insulation in aluminium billet casting tables. While both products are 2-part pourable insulations with observably similar attributes, there are some key performance differences between them.

MATERIAL COMPARISONS

General Observations and Product Packaging

Both of the pourable insulations in question can be ordered in "kits" that include a premeasured quantity of refractory component, usually referred to as "Part A," and a premeasured amount of an acidic activator solution, usually referred to as "Part B."

The package sizes, shapes, and material quantities for Part A and Part B components vary; however, in terms of volume-filling, one standard kit of either product will fill nearly 1 cubic foot of insulation space each.

Material Setting Time

Pourable insulation "setting time" refers to the time it takes for the mixed part A and part B solutions to thicken to the point where the mixture can no longer be poured or can no longer adequately fill small voids without clogging them.



Pyrotek Wollite backup insulation being poured.

Setting time for Wollite 30 ST-1 and the competitor's product were measured using both observational and quantitative methods. For the quantitative method, a Brookfield viscometer identified the point at which the foam around the viscometer spindle solidified. Observationally, setting time was noted when the liquid was too viscous to be poured.

Although very similar to the competitor material, feedback suggests that Pyrotek Wollite 30 ST-1 has a setting time that is too short for proper installation. Therefore, in early 2018, Pyrotek will begin supplying a newly reformulated Wollite recipe with increased setting time that nearly doubles the original setting time without negatively affecting other properties.

The following table compares setting times for Wollite's new and original recipes with the competitor's product.

Wollite Setting Time vs Competitor		
	Quantitative	Observational
Wollite (original recipe)	4 minutes	4.25 minutes
Wollite (new recipe)	7 minutes	7.5 minutes
Competitor	4.5 minutes	4 minutes

Material Strength After Firing

To support refractory, prevent crack propagation and contain any molten metal spillage, material strength becomes a beneficial attribute to castables like Wollite, especially when backup insulation is to support large metal head or heavy hot-facing refractories.

Material strength for Wollite 30 ST-1 and the competitor's product were measured using mould-cast and prefired

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Pyrotek Wollite Backup Insulation Comparison Test Results (continued)

pucks. The pucks were crushed using a load cell, while the maximum strength in mega Pascals (MPa) and pounds per square inch (psi) was recorded.

Wollite 30 ST-1 measured nearly 20 percent stronger than the competitor. Note that this experimental test of relative strength was not the ASTM standard used to determine technical data sheet values.

Cold Crushing Strength	
Wollite	Competitor Product
115.2 psi	96.7 psi
0.79 MPa	0.67 MPa

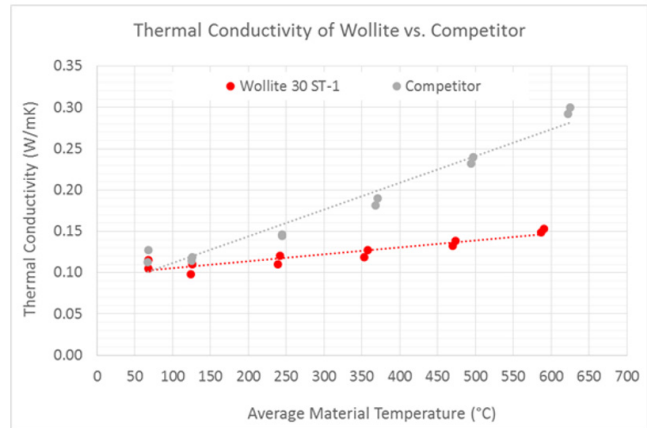
Furthermore, the competitor's product became quite frail after only one exposure to the high temperatures needed for the thermal conductivity test, described below. The flat plate specimen of the competitor's product used in the test was nearly unusable for a second round of testing because of degradation. Wollite, on the other hand, remained intact. This observation could have implications about the durability of the competitor's product when exposed to multiple high-temperature thermal cycles.

Thermal Insulation

Thermal insulation is critical for any lightweight castable, particularly when used for backup insulation. Lower thermal conductivity implies benefits such as lower shell temperatures, more uniform temperature distributions and higher molten liquid temperatures. This can become especially important for long trough runs or temperature-sensitive alloys.

In general, both products have similar thermal conductivities at temperatures below around 150°C; however, as average temperature increases, the thermal conductivity of the competitor's product increases faster than Wollite, eventually to the point where there is significant difference, especially at temperatures in the 500–600°C range.

The following chart summarizes thermal conductivity of Wollite vs the competitor's product.



The thermal behaviour of the competitor's product might be explained by the formation of air pockets, which are relatively much larger than those that form in Wollite. These pockets may also provide some insight into the differences in material strength.

A linear interpolation of all recorded thermal data for each product was used to create the following table, which compares thermal conductivity at specified intervals. For both materials, the R² linear fit of the data was at least 0.90, indicating a good linear fit.

Thermal Conductivity		
	Watts Per Meter-Kelvin (W/mK)	
Temperature	Wollite	Competitor Product
25°C	0.10	0.09
125°C	0.11	0.12
250°C	0.12	0.16
350°C	0.13	0.19
500°C	0.14	0.24
600°C	0.15	0.27

Conclusion

In conclusion, Pyrotek Wollite has shown to be stronger and better insulating than the competitor's product. Starting in 2018, a new version of Wollite will be available with longer working time for operators during install, so that less material is wasted or improperly installed.

