The Truth about Polyiso – See the Big Picture!

INSULATION

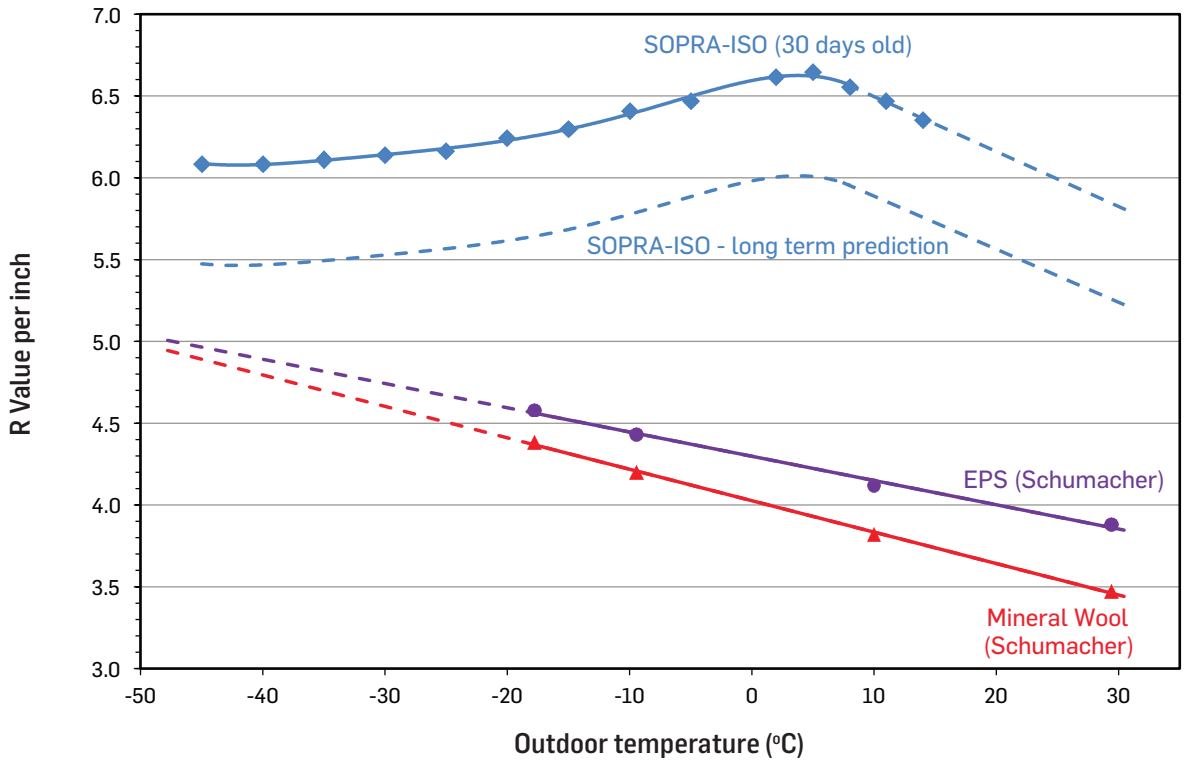
There are several products for standard and commercial roof insulation on the market. Polyisocyanurate, mineral wool, expanded polystyrene... construction professionals have access to a wide selection when it comes to choosing a roof insulation product. Obviously, these technologies do not all have the same features and performances, and one can quickly get lost among all the misleading or ambiguous information.

To choose the right insulation, it is important to consider a global perspective and not focus on only one feature. If you take the 'big picture' into account, you will understand why polyiso remains the optimal solution for conventional roof insulation. See for yourself!

The Actual R-Values at Low Temperature

R-value (RSI in the metric system) indicates the thermal capacity of the insulation. Higher R-value of the insulation means better heat transfer resistance. This also means superior energy savings.

The R-value of most insulation products, such as mineral wool and EPS, increases slightly and gradually as the temperature decreases. Polyiso behaves differently, therefore some insulation manufacturers will quickly point out its R-value at low temperatures and declare that it falls below that of other insulation products. It is important to contextualize these statements. In the graph below, you can see the R-value of three popular insulation technologies for conventional roofs depending on outdoor temperature.



As previously mentioned, EPS and mineral wool perform similarly as their R-value increases linearly when temperature drops. Although the study where this data was published (Schumacher, *The Effect of Temperature on Insulation Performance*, Construction Canada, June 2015) does not include results at temperatures below -20°C, it is generally accepted that the linear variation of R-value with temperature will carry on at even lower temperatures due to the fact that air is responsible of the thermal performance of these insulation types.

Under the same conditions, as temperature drops, the R-value of SOPRA-ISO increases to a maximum, then decreases and stabilizes. That being said, **the R-value per inch of SOPRA-ISO remains higher than that of EPS and mineral wool** over the whole range of temperatures the building will be exposed to.

The above graph shows the evolution of SOPRA-ISO's R-value down to an exterior temperature of -45°C as measured by an independent third party on a 30-days-old board. As with any insulation material using a blowing agent other than air, SOPRA-ISO will see its R-value reach a number that is lower than the one measured 30 days after manufacturing. However, the evolution over time of SOPRA-ISO will not change the shape of the R-value curve as a function of temperature. Based on LTTR evaluation as per CAN/ULC-S770, we can predict that the blue dashed line represents SOPRA-ISO's long term R-value profile. This curve also remains above predictions of R-value for other insulation types over the whole range of temperatures the building will be exposed to.

In other words, SOPRA-ISO performs better than other insulation products all year, both short and long term.

R-Values: Actual vs. Technical Data Sheet

Some will say that the actual R-value of polyiso at low temperature is lower than that stated on the technical data sheet (TDS). In fact, the real R-value of polyiso is **higher** than the one stated on the technical data sheet when the outdoor temperature is approximately between -12 °C and 18 °C, while it is lower in temperatures colder than -12 °C and warmer than 18 °C, as it is the case for all insulation products.* Again, it is important to contextualize these statements.

The table below shows the number of hours in 2017 when the outdoor temperature reached four ranges for several Canadian cities.

	R-value of SOPRA-ISO lower than the TDS	R-value of SOPRA-ISO higher than the TDS	R-value of all insulation types lower than the TDS
NUMBER OF HOURS AND TOTAL HOUR PERCENTAGE FOR THE YEAR 2017			
City	**T° < -12 °C**	**T° between -12 °C and 18 °C**	**T° > 18 °C**
Vancouver, BC	0	7 472 (85.3 %)	1 288 (14.7 %)
Edmonton, AB	1178 (13.4 %)	6 493 (74.1 %)	1 089 (12.4 %)
Winnipeg, MB	1 284 (14.7 %)	5 985 (68.3 %)	1 491 (17.0 %)
Toronto, ON	93 (1.1 %)	6 619 (75.6 %)	2 048 (23.4 %)
Montréal, QC	539 (6.2 %)	6 008 (68.6 %)	2 213 (25.3 %)
Fredericton, NB	631 (7.2 %)	6 522 (74.5 %)	1 607 (18.3 %)

**R-value of all insulation materials decreases when temperature is higher than 18 °C.*

R-value of SOPRA-ISO lower than the TDS (T° < -12 °C)

When the temperature drops **below -12 °C**, the R-value of SOPRA-ISO gradually decreases below that indicated in the technical data sheet. In 2017, these temperatures were rarely or never reached in Vancouver and Toronto, and represented only 6% to 15% of the year for the other cities. The thermal "penalty" of this period is greatly offset by the thermal "gain" achieved during most of the year when the temperature is between -12 °C and 18 °C.

R-value of SOPRA-ISO higher than the TDS (T° between -12 °C and 18 °C)

In all cities analyzed, the outdoor temperature was **between -12 °C and 18 °C** for 68% to 85% of the total hours of the year 2017. In this temperature range, the R-value of SOPRA-ISO is higher than that recorded in the technical data sheet. The insulation reaches its full potential when a building needs to be heated; that is when the outdoor temperature drops under 12 °C. It is precisely in these conditions (which were experienced during most of the year 2017) that SOPRA-ISO performs best, and even better than what is indicated in the technical data sheet.

R-value of all insulation types lower than the TDS (T° > 18 °C)

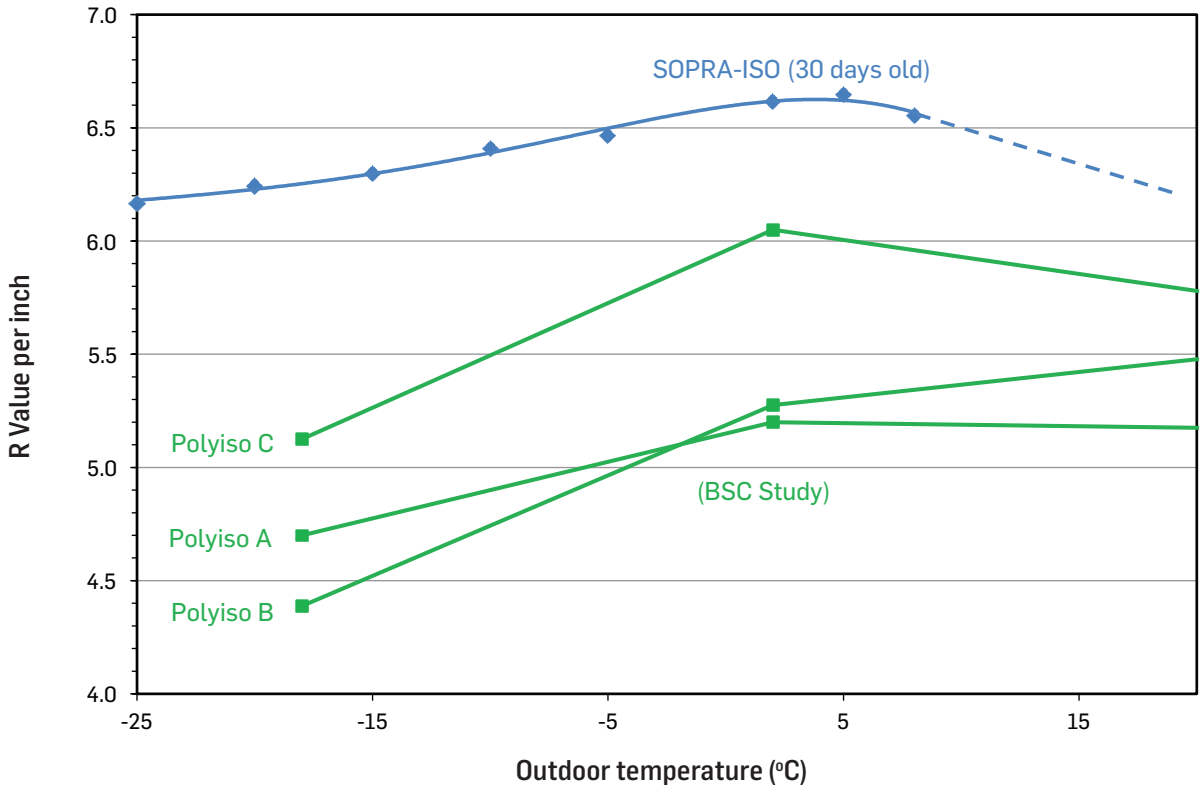
The period when the temperature reached or **exceeded 18 °C** represents from 12% to 25% depending on the city, but it is a period when the thermal performance of the insulation is much less important, because the difference between the indoor and outdoor temperatures is minor. Also, The R-value of all types of insulation, including EPS and mineral wool, drops below that indicated in their technical data sheet.

Taking into account the big picture of the situation over an entire year, SOPRA-ISO provides a thermal performance equal to or greater than that stated in its technical data sheet.

SOPRA-ISO: World-Class Insulation

SOPREMA does not do things in a traditional way. Innovation is at the heart of the company's priorities, and this vision is reflected in the solutions offered to industry professionals.

Indeed, SOPREMA's SOPRA-ISO insulation does not compare to most other polyiso panels found on the market. SOPRA-ISO's world-class performance comes from its unique enriched formula. In fact, take a look at the following graph to understand why SOPRA-ISO is the perfect solution for the Canadian climate.



In the above graph, SOPRA-ISO is compared with three sources of polyiso panels mentioned in Building Science's *Understanding the Temperature Dependence of R-values for Polyisocyanurate Roof Insulation from Building Science Corporation (BSC)*. These panels were chosen by BSC because they were representative of the products available on the Canadian market in 2013, before SOPREMA manufactured SOPRA-ISO. We can see that the performance of SOPRA-ISO is significantly superior to Sources A and B polyiso panels, as their R-values decrease much more in outdoor temperatures lower than -10°C. In other words, the chemistry behind SOPRA-ISO was specifically designed to offer optimal performance in Canadian weather.

When you see the big picture, SOPRA-ISO performs better than not only the majority of polyiso panels on the market, but also other insulation products used for conventional roofs (EPS and mineral wool).

Therefore, SOPRA-ISO is an innovative solution that cannot be considered as a traditional polyiso panel found on the market.

Have You Thought About Weight?

The weight of the roof is an essential aspect to consider when designing a building structure. The insulation product you choose will play a major role in the weight of the roof.

In the table below, you will find the respective thicknesses and weights of polyiso and mineral wool, for three examples of roofs (R-20, R-30 and R-40) and a case where a layer of mineral wool replaces a layer of polyiso on top (R-5).

		R-5	R-20	R-30	R-40
Polyiso	Thickness required (R-5.7/in)	0.88 in	3.5 in	5.25 in	7 in
	Weight (if density of 28 kg/m^3)	0.6 kg/m^2 0.12 lb/ft^2	2.5 kg/m^2 0.51 lb/ft^2	3.7 kg/m^2 0.76 lb/ft^2	5.0 kg/m^2 1.02 lb/ft^2
Mineral wool	Thickness required (R-3.8/in)	1.3 in	5.3 in	7.9 in	10.5 in
	Weight (if density of 150 kg/m^3)	5.0 kg/m^2 1.02 lb/ft^2	20.1 kg/m^2 4.11 lb/ft2	30.1 kg/m^2 6.16 lb/ft^2	40.1 kg/m^2 8.20 lb/ft^2
Weight added by mineral wool compared with polyiso		4.4 kg/m^2	17.6 kg/m^2	26.3 kg/m^2	35.1 kg/m^2
		0.90 lb/ft^2	3.59 lb/ft^2	5.38 lb/ft^2	7.18 lb/ft^2

With an R-30 insulation roof, mineral wool, having a much lower R-value than polyiso (R-3.8 per inch compared with R-5.7 per inch) adds more than 5.4 lb per ft^2 (26.3 kg per m^2).

For example, here is the weight each insulation will add to the structure for a 2,787 m^2 (30,000 ft^2) roof:

	R-5	R-20	R-30	R-40
Polyiso (total weight)	1 739 kg (3 833 lb)	6 955 kg (15 333 lb)	10 432 kg (23 000 lb)	13 910 kg (30 666 lb)
Mineral wool (total weight)	13 972 kg (30 803 lb)	55 887 kg (123 210 lb)	83 830 kg (184 810 lb)	111 773 kg (246 417 lb)
Weight added by mineral wool compared with polyiso	12 233 kg (26 970 lb)	48 932 kg (107 877 lb)	73 398 kg (161 810 lb)	97 864 kg (215 751 lb)
Difference (%)	**+703%**			

The differences in weight between the two insulation materials are considerable, and these will undeniably affect the necessary structural adjustments needed to support all this additional weight. These adjustments will also mean additional costs in materials, such as steel.

Therefore, polyiso is an easy and hassle-free solution with respect to the weight that the structure will withstand.

Compressive Strength: Why?

Compressive strength is another element that can play an important part in the selection of roof insulation. It refers to the weight that insulation can withstand before warping.

Here are the compressive strengths typically found on the market:

	Polyiso	Mineral wool
Compressive strength	20 to 25 psi (138 to 172 kPa)	11 to 15 psi* (76 to 103 kPa)

**Some mineral wool manufacturers will offer a panel with a 20 psi top layer. However, the compressive strength of the entire panel is between 11 and 15 psi.*

Better compressive strength means better resistance to the loads (live or dead) the insulation will withstand. These loads can take the form of pedestrian traffic, stagnant water, pedestrian slabs, etc.

Polyiso, with a resistance of more than 20 psi, can withstand these loads without compromising its integrity and thermal performance.

SOPREMA, Your Comprehensive Roof Solution

In addition to insulation solutions, SOPREMA offers a wide range of complete roof systems – from support panels to waterproofing products, and adhesives to mechanical fasteners. SOPREMA has earned a place among industry leaders thanks to the expertise and availability of its technical staff who support building professionals in their projects, from design to completion.

Ask your SOPREMA representative about the right system for your needs.