



CINI 2013 (26 May 2015 Results) - ISO-C1®/2.5 (40 kg/m³)

May 26 2015	Units	CINI 2013 Standard			ISO-C1®/2.5
4 Material Properties					
4.2 Nominal Density - ASTM D1622	kg/m ³		40.0		40.3
				Actual	
4.3 Apparent Thermal Conductivity (aged 6 months @ 23 ± 2°C)	W/m.°K			Temperatures Tested	
- ASTM C177		-170°C	0.016	-165°C	0.009
		-120°C	0.019	-129°C	0.015
		-80°C	0.022	-100°C	0.019
		-40°C	0.025	-73°C	0.022
Mean temperature of measurement:		-20°C	0.024	-45°C	0.024
		0°C	0.024	-17°C	0.024
		10°C	0.025	not	tested
		20°C	0.027	10°C	0.023
		40°C	0.029	24°C	0.023
				66°C	0.028
4.4 Closed Cell Content - ASTM D6226	% minimum		≥95		95
4.5 Water Absorption - ASTM D2842	% by volume		≤5.0		0.0
4.6 Water Vapor Transmission - ASTM E96 (Procedure A)	g/m ² .h		≤0.8		0.47

5 Mechanical Properties

5.1 Compressive Strength		kPa			
- ASTM D1621	at -165°C		All directions	280	
	Parallel				495
	Perpendicular				360
	at 23°C		All directions	200	
	Parallel				295
	Perpendicular				220
5.2 Linear Thermal Expansion Coefficient		m/(m.°K)			
- ASTM E228	-165 to 23°C		average	≤70 x 10⁻⁶	59 x 10⁻⁶
5.3 Tensile Strength		kPa			
- ASTM D1623	at -165°C		All directions	265	
	Parallel				484
	Perpendicular				279
	at 23°C			320	
	Parallel				410
	Perpendicular				335
5.4 E Modulus (all directions)		MPa			
- ASTM D1623	at -165°C			≤16	
	Parallel				4.09
	Perpendicular				3.07
5.5 Poisson's Ratio					
	-165°C			0.4	0.4

5.6 Cryogenic Thermal Stress Resistance (CTSR) factor¹	Calculated		≥ 1.5		5.8
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6 Chemical Properties

6.1 Leachable Chloride - ASTM C871	mg/kg		≤60		≤60
6.2 pH - ASTM C871			5.5 - 7.0		6.9

7 Combustibility

7.1 Flame Spread index - ASTM E84			≤25		≤25
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¹ In cryogenic and cold services increased contraction stresses occur in the insulation materials. Therefore an increased tensile strength and a reduced tensile modulus and linear thermal expansion are required. This is formulated in a safety factor. At service temperatures below -50°C, the cryogenic thermal stress resistance (CTSR) factor of the PIR insulation foam shall comply in the X, Y and Z direction with the following equation:

$$\frac{\sigma(1-\delta)}{E \cdot \alpha \cdot \Delta T} \geq 1.5$$

where:

- σt = insulation material measured at service temperature according ASTM D 1623.
- δ = the Poisson's ratio of the insulation material
- E = the average value of the tensile modulus, expressed in kPa, of 5 test pieces of the
- α = the average linear thermal expansion coefficient of the insulation material, expressed
- ΔT = the temperature difference between service temperature and ambient temperature,

Note: The formula above is a safety factor, expressing the ratio of the tensile strength of the material and the tensile stress induced in the material at a certain operating temperature. For cryogenic service, typically temperatures are taken of -165°C service temperature and +23°C ambient.