



Open Letter to the Mechanical Insulation Industry July 2018

Dear Industry Participants,

Recently Dyplast was made aware of several marketing documents from Pittsburgh Corning comparing FOAMGLAS^{®1} to PIR/PUR systems. These include “Truth in Performance,” “Polyisocyanurate Foam versus FOAMGLAS Insulation,” and “FOAMGLAS Response to Dyplast Customer Bulletin dated 6/2010.” These marketing pieces are misleading and contain numerous false statements. While I will not waste your time going through every misrepresentation, this letter will address key areas in order to let you decide if there is any reason to give credit to the Pittsburgh Corning claims. Additionally, I will outline key facts about Dyplast ISO-C1[®] products because real data and actual infield performance are a better basis to evaluate products.

First it should be noted that Dyplast Technical Bulletin 06/2010 “Polyisocyanurate versus Cellular Glass” was revised in 2012 and removed entirely from the website in January of 2014 and replaced with a new technical bulletin focusing on low temperature applications.

Dyplast stands by its ISO-C1 family of polyisocyanurate foam products (PIR). Over the years Dyplast has adhered to a strict policy regarding product performance and quality control. Here are a few highlights:

1. All ISO-C1 products meet or exceed the ASTM C591-17 standard specification. These include the requirement that test specimens shall be taken from specified locations within the bun. All testing has been performed at independent certified laboratories.
2. All ISO-C1 products meet ASTM E84 requirements for a Class 1 foam at $\leq 25/\leq 450$, a flame spread/smoke development rating, and were tested at independent certified laboratories. Class 1 is acceptable in the majority of low temperature industrial applications.
3. ISO-C1[®]/2.0 is recognized by Factory Mutual as a Specified Tested Identified Component under FM Approval Standard 4880 for use in Insulated Building Panels. This listing requires ASTM E84 test of $\leq 25/\leq 450$ in addition to a flammability characterization test. FM audits ISO-C1 production and performance two times a year. ISO-C1/2.0 also has a Notice of Acceptance from Miami Dade which certifies that ISO-C1/2.0 meets Florida's strong building code requirements.

¹ FOAMGLAS is the registered trademark of Pittsburgh Corning Corporation

4. Dyplast ISO-C1/2.5 which is commonly used in cryogenic applications such as LNG, meets CINI 2013 requirements for PIR used for thermal insulation of piping and equipment (CINI 2.7.01). This involves testing the insulating and physical properties of ISO-C1/2.5 at temperatures ranging from 93°C to -165°C including aged k-factor (more on this later). CINI standards include dealing with contraction stresses that occur at cryogenic and cold temperatures and in this regard, CINI has developed a Cryogenic Thermal Stress Resistance factor (CTSR). The CTSR of ISO-C1/2.5 is 5.8 which substantially exceeds the minimum of ≥ 1.5 defined by the specification.
5. Dyplast has a full-time staff devoted to quality control and tests randomly selected samples from every production run for ASTM C591 compliance. In addition, an independent certified lab audits ISO-C1/2.0 for physical performance required by ASTM C591.

After review of Pittsburgh's Corning's (PC's) misleading and in some cases totally false claims, I wanted to highlight some of the egregious claims:

- Life cycle - PC claims that "PIR/PUR systems typically have as low as a 6-7 year life cycle." Dyplast sells PIR and has millions of board feet and thousands of linear feet of LNG pipe insulated with ISO-C1 products and has not had a reported failure. In fact, ISO-C1/2.5 has been installed on LNG facilities since 2005 without any failures and when two of those facilities converted from import to export they again chose ISO-C1/2.5 for the new insulation. Properly installed and maintained systems using ISO-C1 products will have life cycles in excess of 20 years not 6-7. Due to ISO-C1's lower initial cost, superior insulating value and long-life cycle, ISO-C1 will constantly provide lower life cycle costs.
- Fabrication - PC claims to have a higher fabrication efficiency which is greater than PIR due to reduced breakage. Having visited numerous fabrication shops I am unaware of the "innovative techniques" that they claim. What are they?
- Global standard - Yes there are several domestic and international manufacturers of PIR but there are also several international manufacturers of cellular glass. ASTM & CINI represent internationally recognized standards. Dyplast has previously stated that its products meet these international standards.
- Thermal Conductivity - Dyplast always reports aged k-factors per ASTM C591 not initial k-factors as PC has stated. Based on published data, here are the actual k-factors (in W/m.^{°K}) for ISO-C1/2.5 and the derived values for FOAMGLAS® ONE™.

ISO-C1®/2.5 per ASTM C177 ¹		FOAMGLAS® ONE™ per ASTM C177	
Actual Temperature Tested	Actual Thermal Conductivity, W/m.°K	Selected Mean Temperature	Derived ² Thermal Conductivity, W/m.°K
-167°C	0.0121	-165°C	0.020
-130°C	0.0167	-129°C	0.023
-102°C	0.0198	-101°C	0.026
-74°C	0.0228	-73°C	0.029
-46°C	0.0257	-46°C	0.032
-18°C	0.0271	-18°C	0.036
10°C	0.0264	10°C	0.040
23°C	0.0275	24°C	0.042
65°C	0.0331	38°C	0.044
93°C	0.0371	93°C	0.054
¹ Aged 6 months @ 23 ± 2°C		² Values determined using a polynomial at the insulation mean temperature	

As the published data show, while both products improve as temperatures become lower, ISO-C1/2.5 is clearly better at every temperature range tested. ISO-C1/2.5's results are from actual tests at the temperatures shown. Lower K-values equal less required insulation and can represent differences in thickness and weight.

Based on a NAIMA 3E Plus® v 4.1 model for a general set of conditions, normally seen in LNG facilities for a 20" pipe using ISO-C1/2.5 and FOAMGLAS ONE k factors the thickness required for ISO-C1/2.5 is 6" and for FOAMGLAS ONE is 7.5." For a 36" pipe ISO-C1/2.5 remains at 6" and for FOAMGLAS ONE requires 8.0." Clearly less ISO-C1/2.5 is needed.²

Additionally, PC makes you think all PIR is put on with 3 layers. Generally, PIR goes from a single layer to a double layer at 3" or over of insulation and to a triple layer at 6" of insulation. Of course, actual design of a system should be left to the design engineers.

² Thicknesses were verified using the 3E parameters for the thicknesses calculations listed below:

- Heat Flow Limitation Calculation with 8 BTU/hr./ft² heat flow limit
- Base Metal: Stainless Steel
- Jacket Material: 0.3 Stainless Steel, dull, in service
- System Application: Pipe – Horizontal
- Process Temp: -270 F
- Ambient Temp: 90 F
- Wind Speed: 5 MPH



This will at the very minimum create a substantial difference in the weight of insulation used. ISO-C1/2.5 weighs 40 kg/m³ and FOAMGLAS weighs 98 kg/m³ (for C552, Type I, Grade 6). According to our math using ISO-C1 2.5 would result in less weight and less insulation resulting in less cost.

- Water Absorption – Dyplast has not claimed that ISO-C1 water absorption is less than any cellular glass product. ISO-C1/2.5 has a water absorption of 0.27% per ASTM C272 (Procedure A) not the higher values stated by PC. Dyplast also recommends that a zero-perm vapor barrier and joint sealant be used as does PC. The example of 28 days of submerged insulation challenges logic. If a facility is flooded for 28 days any piping system would have to be replaced or completely refurbished regardless of the insulation. The fact that there are numerous LNG and industrial facilities that have used ISO-C1 successfully is a clear demonstration that in a properly installed system water penetration is not an issue for either ISO-C1 or FOAMGLAS.

These are but a few of the misleading and false statements PC makes. I question why an owner, EPC or fabricator would trust a company that uses such information to help sell their product. Dyplast has clearly stated in the past that ISO-C1 and PIR as well as FOAMGLAS can be used in cold or cryogenic applications. I have tried to keep this response brief and will let you be the judge of which one is best suited to provide the most cost-effective solution.

Dyplast does not speak for any of our competitors but has complete confidence in the ISO-C1 product line and the in-place use and record of our product. If you have any additional questions, please feel free to call me.

Very truly yours,

A handwritten signature in black ink, appearing to read "Ted Berglund", written in a cursive style.

Ted Berglund,
President & CEO