

Dyplast products



IMC

Insulation Materials Corporation

Teamwork: Polyiso Pipe Insulation at Elba Island LNG



Southern Natural Gas Company's LNG facility expansion project at Elba Island, GA.

The Project and Our Ultimate Clients

Elba Island Expansion Project

Southern Natural Gas Company (SNG), a subsidiary of El Paso Corporation, recently completed Phase II of an expansion at their Elba Island Liquid Natural Gas (LNG) receiving terminal, south of Savannah, GA. The centerpiece of the expansion was an 80 percent increase in storage capacity at Elba and an increase in the daily design rate of the facility by more than 350 million cubic feet per day. Upon completion, Elba's storage capacity totaled 7.3 billion cubic feet with sendout capacity of 1.2 billion cubic feet per day.

The expansion also included new docking facilities that can hold two ships at once, diverting LNG tankers off the Savannah River, providing a more flexible transit passage for freight shipments into the Savannah Port, and maximizing safety and security while an LNG tanker's cargo is unloaded.

The expansion project included insulation of 31,895 linear feet of piping that connects the ship offload facilities with storage, regasification, and transportation facilities. LNG tank and equipment insulation was also required.

The above photograph depicted the site during the mid-period of the expansion.

EPC Contractor Scope

Chicago Bridge & Iron (CB&I) was selected as the turnkey engineering, procurement, and construction (EPC) contractor for the Elba Island Phase II Expansion Project. The lump sum turnkey approach eliminated the handoffs and redundancies that often occur when multiple contractors are engaged on the same project. The result was an integrated project with consistent, safe, and reliable execution of the work.

In addition to the new storage tank and the sendout system, the CB&I scope included additional boil-off compression and recondensing capacity, two LNG ship unloading stations and related civil, mechanical, electrical, control, instrumentation, and insulation works. The expansion project included tie-ins to the existing facility.

The demanding project schedule could be met only if parallel work was carried out whenever possible, always carefully coordinated so that schedule savings could be realized at every opportunity.

Teamwork among contractors was also a necessity to achieve cost and schedule expectations.

The Insulation Specification

CB&I, the expansion project prime contractor, specified a two-layer polyisocyanurate insulation system for LNG pipe insulation, covered with a combination of vapor retarder mastic and sheeting, and enveloped in aluminum color-coded jacketing. CB&I specifications provided minimum physical properties for system components, as well as specific standards for shop fabrication of shaped insulation segments, such as hemi-cylindrical sections, pipe ells for small elbows, mitered sections for large elbows, and tees. The project subcontracting structure required that highly-qualified insulation contractors submit lump-sum bids for the supply and installation of the insulation system.

The Insulation Team

Dyplast Products, with its new ISO-C1 polyiso product line, was convinced its product and company responsiveness could create a winning scenario if teamed with the *right* fabricator and *right* insulation contractor. Dyplast accordingly contacted LandCoast, an insulation contractor with extensive experience in industrial insulation, requesting that Dyplast and its ISO-C1 product be considered for the project. After its evaluation, LandCoast concluded that Dyplast's ISO-C1 would be a compliant and competitive product for Elba Island. Dyplast next entered into discussions with the leading fabricator of rigid foam insulation on the East Coast, Insulation Materials Corporation (IMC). IMC was similarly committed to pursuing the Elba Island project, concluding that its innovations in fabrication could significantly improve quality and schedule while reducing cost. IMC therefore agreed to submit a lump sum bid to LandCoast using ISO-C1, fabricated in their New Jersey facility.

Thus the team was formed, and LandCoast was awarded the insulation contract by CB&I. The pipe insulation system scope included 31,895 linear feet of piping connecting the ship unloading facility with the storage, recondensing, and sendout system, plus the insulation of valves, fittings, and components. The insulation system consisted of double-layer insulation for piping with outside diameters varying in size from 3.5 to 41.25 inches.

IMC, Dyplast, LandCoast, and CB&I took teamwork to a new level by closely coordinating quality, just-in-time deliveries, and communication feedback to ensure that installation of the insulation system proceeded expeditiously and in sync with other contractors.



ISO-C1 Polyisocyanurate Bunstock Exiting the Production Tunnel.

Why Dyplast ISO-C1?

ISO-C1 (manufactured by Dyplast Products) was selected over competing polyiso products for the Elba Island project only after balanced multi-value assessments by several parties. Key factors in the decision included:

- ISO-C1 physical properties were validated by independent laboratory
- physical properties met or exceeded requirements set by ASTM C591, the governing standard for polyiso rigid foam
- ISO-C1 exhibited lowest aged K-factor of competing polyisocyanurate products
- customized bunstock sizing provided efficient shipping logistics and scrap minimization during fabrication
- availability of high density polyiso provided options for pipe hanger applications
- ability to fabricate blocks to close tolerances allowed for tight seams and joints
- flexibility and responsiveness in deliveries and technical advice enabled reduced costs, improved schedules, and enhanced relationships
- easy to handle and work in the field, with minimal breakage
- quick product turn-around and delivery (e.g. 2-3 days)

LNG Insulation Challenges

Effective, long-term insulation of liquid natural gas (LNG) piping and components (at -260°F) demands product attributes and installation expertise that 'push the envelope' of insulating systems. "The extraordinary insulating characteristics of polyisocyanurate, its long term demonstrated performance, and its competitive installed cost make it the decisive choice for LNG applications", says *Robert March, Sr., IMC President*. "Polyiso's insulating properties improve as temperature drops; at -260F this equates to dramatic cost savings for the facility owner over the life of the insulating system - - with matchless energy savings, minimum LNG boil-off, and condensation prevention. No alternative insulation has attributes that can offset the advantages of polyiso," he adds. The water vapor permeability, strength, dimensional stability, and physical integrity of polyiso allow for a synergistic insulation system capable of exceeding the performance expectations of the most demanding application.



The LNG Solution

After contract award, Dyplast Products, IMC, and LandCoast began the project by closely examining manufacturing cost savings, transport economies, fabrication and installation efficiencies, and possible innovations given the specific sizes, quantities, and shapes of insulation to be fabricated. Dyplast's ability to customize polyiso bunstock dimensions was clearly an advantage, since bun sizes could be matched to minimize waste as Dyplast cut the bunstock into blocks ("pipe chunks") which were, in turn, sized for minimizing waste during shape fabrication by IMC. Optimally sized pipe chunks also allowed for efficient packing in transportation containers. Dyplast shipped over 1.25 million board feet of ISO-C1, in 43 semi-trailers within a period of 5 months - - while maintaining committed shipments to other clients.

Factory fabrication of polyiso segments for special pipe components, including mitered sections for large elbows (with pre-installed vapor retarder) and "ell" segments for smaller elbows, facilitated installation of the insulation system. In addition to reduced labor costs, factory fabrication of special cuts yielded a closer fit to irregular piping components - - reducing air spaces and the need for fiberglass "fill". Precision tolerances in horizontal and vertical seams also allowed for tighter joints. Several IMC innovations were tested during this period, including IMC's proprietary interlocking segments that may reduce installation labor and improve system permeability on future projects.

In summary, LandCoast project manager, Sergio Franco, noted that "Teamwork and supplier responsiveness allowed us to maintain our demanding schedule. High product quality facilitated a highly efficient installation. ISO-C1's excellent friability and strength characteristics made it easy to handle and cut, with minimal breakage. Even with tight banding, the ISO-C1 segments held their shape and did not crack. IMC's precision tolerances and consistency also promoted the delivery of a top-quality end product for our client."



ISO-C1 Fabricated into a Hemi-cylindrical Segment, ready for installation



Staggered, double-layer ISO-C1 polyiso, terminating at flange. Joint sealant on outer longitudinal seam; vapor retarder sheet.

Polyiso vs. Alternatives

Polyiso's service temperature range is generally -297F to +300F, although it has been used at even lower temperatures. (Qualified insulation engineers must be consulted when insulating cryogenic systems.) Although conventional wisdom has been that new generations of pentane-blown foams have poorer thermal conductivity, Dyplast broke the paradigm by achieving an industry-best aged K-factor of 0.18 at 75F (*independent laboratory*), reaching compliance with the traditional ASTM C591 standard that many had lobbied to make less restrictive. And ISO-C1's K-factor improves significantly as temperatures drop.

With the lowest K-factor of any commercially viable insulation, polyiso is the insulation-of-choice for the vast majority of low-temperature and cryogenic applications. And ISO-C1 maintains its performance and integrity at cryogenic temperatures. Insulation alternatives are often selected only because of lack of familiarity with the improved characteristics of polyiso.

Why IMC Fabrication?

Since 1971 Insulation Materials Corporation (IMC) has been supplying commercial and industrial clients with comprehensive lines of insulation systems to meet virtually any application, from cryogenic temperatures to 2,300°F. IMC distributes products for leading manufacturers, and also fabricates a variety of products in shops at two of its five facilities.

Chill water, low-temperature, and cryogenic (i.e. <100°F) applications are particularly demanding since in addition to providing a foundation of solid thermal resistance, the insulation system must control condensation while often resisting severe environmental conditions such as high humidity, inclement weather, and mechanical abuse. IMC is highly experienced in tailoring complete and optimal insulation systems based on their informed interpretation of job specifications provided by the design engineer. IMC is skilled at matching the interdependent web of properties of components within the insulation system (including service temperatures, permeance, emissivity, strength, dimensional stability, and so on), so as to create an insulating system that can meet the expectations of the client over the long term. Material cost, installation labor, on-site storage conditions, long term maintenance, and even aesthetic considerations must be factored. IMC often offers its expertise in an advisory role to the EPC or installation contractor.

IMC's modern fabrication facilities also support innovative approaches such as larger/longer insulation sections, interlocking segments, closer tolerances, complex routed shapes, factory-applied laminations, and so forth that can reduce installation labor, minimize material volume and waste, reduce system vapor permeance, and optimize thermal performance.

- Cellular glass, for instance, is often used in low temperature applications in spite of its poor insulating and handling characteristics due to the perceived advantages of its low water vapor permeability and high compressive strength. Yet a double, staggered layer of polyiso with a vapor retarder covering achieves the same objectives while delivering significant cost and energy savings over the life of the system. And higher density polyiso has the compressive strength to respond to most needs, such as saddles in pipe hangers.
- Extruded polystyrene also has poorer insulating value with an aged K-factor of 0.259 vs. 0.18 for ISO-C1, and is generally not used at cryogenic temperatures. It also can melt on excursions above 165F, and may require an anti-corrosion coating.
- Elastomeric insulation, with a K-factor of 0.27 at 75F, is usually rated for use between -70 to +220F. At cryogenic temperatures the foam becomes rigid; dimensional stability and long term integrity are concerns. Installation labor for multi-layer systems can also add to costs.
- Fiberglass, glass wool, or mineral fiber insulations are rarely used below 0F due to low insulating values as well as poor water vapor transmission and absorption characteristics.
- Phenolic insulation configured for pipe has been avoided in recent years due to corrosion concerns. Yet its major disadvantage in cryogenic applications may be its shrinkage and dimensional instability. The brittle nature of phenolic foam at low temperature can result in gaps at joints and fittings.
- Polyurethane (PUR) insulation has been generally replaced by polyisocyanurate (PIR) insulation, which is a form of polyurethane but with better K-factor and dimensional stability. Polyurethane foam-in-place insulation is utilized in limited cryogenic applications, but susceptibility to blistering, outgassing of foaming agent residues, and shrinkage must be considered.



Vapor retarder mastic coating over ISO-C1 at termination. Aluminum jacket adds mechanical protection to the insulation system.

Dyplast
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Because project conditions and local codes vary, the customer is responsible for determining product applicability and installation procedures. No warranties are given or implied. All implied warranties of merchantability or fitness for a particular purpose are expressly excluded.

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