Building a New International Standard for LNG Bunkering Hose Transfer Assemblies

ASTM International's Committee on Ships & Marine Technology plays a pivotal role in developing new standards the entire industry can support.

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INTRODUCTION

When does the need for a new industry standard become evident? It might be at the time new technologies emerge in areas where there is incomplete knowledge and understanding. It could be when persistent problems reveal deficiencies in current system designs and field operating practices. Or, it might arise when a lack of comprehensive and universal standards is causing work inefficiencies – so much so that companies are needing to "reinvent the wheel" with each new customer application.

In the case of liquified natural gas (LNG) bunkering hose transfer assemblies, a combination of all three factors appeared to be at work. To be sure, LNG fuels are making great strides as an environmentally cleaner way to propel ships around the world when compared to traditional options such as diesel fuel. But LNG as a marine fuel remains in the relatively early stages of market adoption, so better standards are needed to help facilitate safe and efficient operations.

The necessity was even more pressing considering the special challenges associated with handling LNG safely – the most significant being the extremely low temperatures (-260°F) and high volatility of LNG.

WHERE ARE THE BEST PRACTICES?

Due to insufficient standards, there has been a lack of consistency in the construction of LNG bunkering hose systems. There were existing standards on the nautical side (IGF and IGC codes for natural gas and LNG safety), the land transport side (U.S. DOT codes) and the Pipeline & Hazardous Materials Safety Administration (PHMSA) and National Fire Protection Association (NFPA) codes for land-based facilities. None of these were comprised of consistent, agreed-upon standards for the equipment to deliver LNG fuel supplies to and from ships. As Thane Gilman, a senior mechanical engineer at the U.S. Coast Guard, notes, "The IGF Code was filling a void in defining general requirements for gas-fueled ships, but there was still a significant amount of work to be done in defining the requirements for specific equipment and systems".

The lack of standards, particularly in systems such as LNG bunkering hose transfer assemblies that experience repeated connections and disconnections in different locations, was resulting in project inefficiencies and delays. "Ideally, the systems for which designs are standardized should be ready for connection in any location compliant with the same standard, without the need for adapters or other modifications," Gilman emphasizes.

Ship's personnel make a connection of the bunker supply hose to the ship's bunker manifold.

Also important for any pressurized liquid system involving LNG is to ensure that the product is transferred without incurring damage to the piping and possible leakage. "Not only is LNG highly volatile and ignitable, the extreme cryogenic temperatures of LNG also require special materials for handling – such as in the case of ship hull steel which can become immediately brittle, crack and fail when exposed to LNG," Gilman notes.

Rick Foster, a veteran product specialist with metal hose manufacturer Hose Master LLC, explained how this has created an unsettled environment for equipment suppliers. "At our firm, we've had to research the role that hoses, fittings, gaskets, alarms and safety gear play in the loading process, and the environment in which the function is occurring. Before recommending a metal hose specification to a customer, we need to know how a hose assembly will work – and how it could possibly fail in the application. Also, we need to take into consideration how the hose assembly will be handled during fit-up and dismantling," Foster says.

To maximize efficiencies and reduce project lead times, industry players must be able to consult accepted piping and hose assembly standards for guidance. The leadership of unbiased organizations like the American Society of Mechanical Engineers (ASME) and the American Society for Testing and Measurement International (ASTM) are

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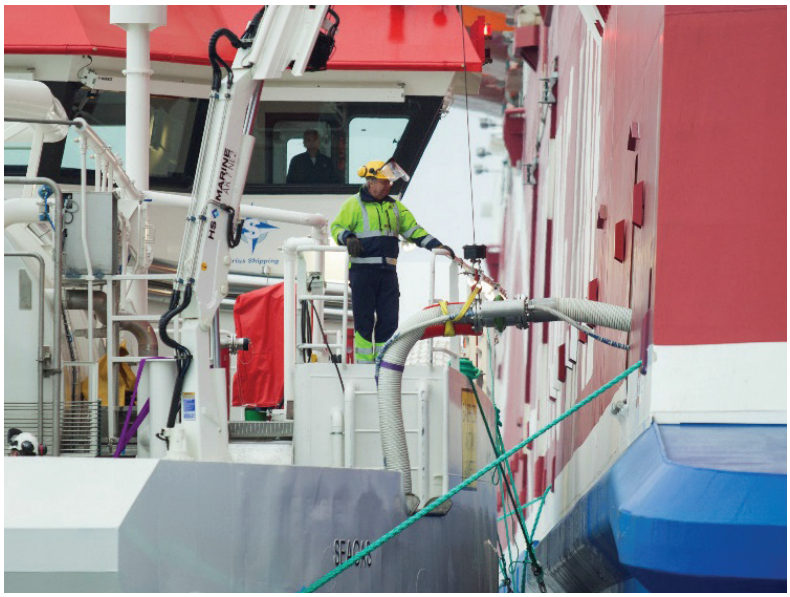
invaluable in guiding varied interests toward developing new standards that everyone can accept as “best practices” for the industry.

The ASTM is no stranger to this sort of challenge. Indeed, over its more than 100 years of existence, it has successfully developed more than 12,000 globally used standards. In short, the ASTM is a logical choice to lead the creation of an operational safety standard. Plus, it has an established track record of developing highly regarded standards tied specifically to the oil and gas industry.



Viking Grace takes on LNG from Seagas, the world’s first LNG bunker vessel.

F25 COMMITTEE AT THE CENTER

The centerpiece of the ASTM's involvement is its Committee on Ships and Marine Technology (F25). This committee's mission is to develop and maintain standard specifications, test methods, terminology, practices and guides that support the maritime industry in the design, construction, operation and repair of marine vessels, structures, systems, equipment and materials.

According to Todd Ripley, an R&D specialist with the U.S. Department of Transportation's Maritime Administration (MARAD) who also serves as the current chairperson of the ASTM's F25 Committee, the objective is to support the most secure, efficient, cost-effective and environmentally friendly practices possible in the marine segment. In view of this objective, the F25 Committee was the logical vehicle to identify needs and gaps in the standards that support the operation of LNG-fueled vessels being built and coming into service.

To collaborate effectively with the wider maritime industry, the F25 Committee established an LNG Working Group under the subcommittee for Piping and Machinery (F25.11) along with several task groups. Their mission was to start development on newly-identified work items as well as to ensure that the specific stakeholders in the LNG-as-fuel arena have an opportunity to contribute their expertise to the effort.

In the case of the new ASTM standards being developed for LNG bunkering hose transfer assemblies, a full spectrum of specialist were involved.

A PIVOTAL ROLE AS A FACILITATOR

Because of its status as a professional trade society, the ASTM is able to play a uniquely strong role in facilitating the exchange of ideas and information to come up with standards and practices that can be agreed upon by all parties. According to Todd Ripley, this consensus is borne out of several key philosophies of the F25 Committee:

- Development activities must benefit and meet the needs of the entire maritime industry.
- All segments of the maritime industry are encouraged to participate in committee, subcommittee and task group activities, enabling an equal balance of producers, users and general interest personnel as committee members.
- All new standards must be relevant and provide value to the maritime industry.
- Commit to work with a wide range of organizations throughout the maritime industry to advance the most comprehensive and effective industry standards possible.

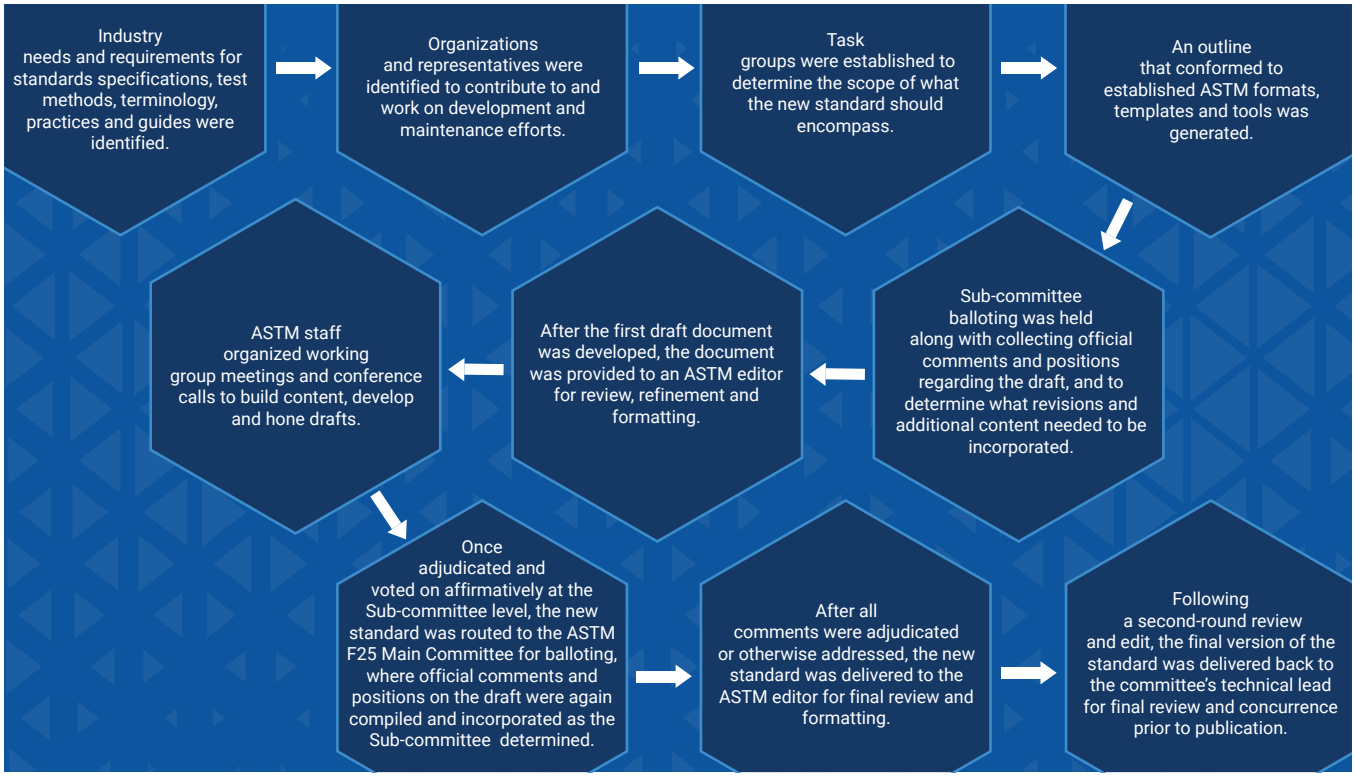
Ice builds up on the 6-inch LNG transfer lines during a ship bunker. The extreme temperature of LNG can cause damage to the ships structure if exposed to the LNG directly.

A PROVEN PROCESS PUT TO WORK

In existence since 1898, the ASTM is one of the oldest organizations of its type anywhere in the world. Over the ensuing decades it has fine-tuned a process for developing new industry standards. It's a process that involves "choreographing" an extensive, far-flung network of industry specialists. The ASTM staff is responsible for administrative support and communication logistics, so that as many specialists as possible can be involved and share their knowledge and insights.

But Todd Ripley notes that even with the availability of the latest communication tools, the steps required to develop a new ASTM standard are numerous. "The process can easily take from one year to three years – or even more – depending on factors such as technical complexity, the level of producer and user engagement with the development process, along with external drivers like changes in regulations," he notes.

For the F25 Committee's work on developing a standard for LNG bunkering hose transfer assemblies, the process was comprehensive. According to Ripley, over a period of 36 months the initiative unfolded as illustrated below.

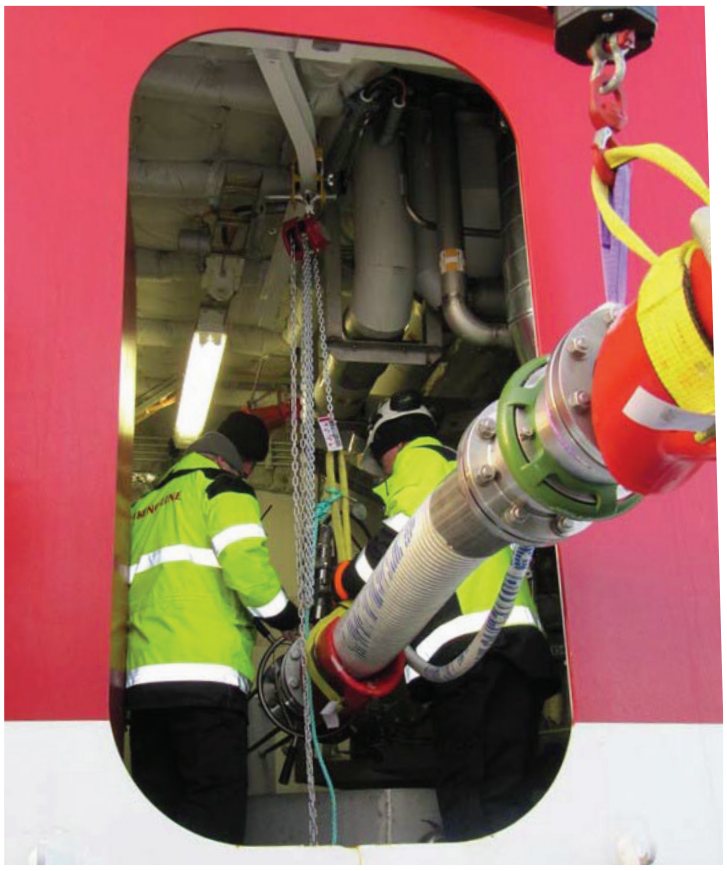


While the steps outlined on the previous page may seem onerous and maybe even overly bureaucratic, ASTM's experience has shown that a methodical approach while incorporating the input of all interested parties is the surest way for a new standard to meet the needs of all the participants in the industry including manufacturers,

"When you consider all who were involved in the process, every aspect and angle was truly covered. It made for comprehensive and consequential discussions, and it led us to a strong end-product: a standard that's useful as well as practical"

end-users, government agencies and regulators. In the case of the new ASTM standard being developed for LNG bunkering hose transfer assemblies, the full spectrum of specialists involved in the development process numbered approximately 15-20 people.

Rudi den Dulk, an engineer with composite hose manufacturer Guettling USA who was one of the members of the working group, saw success in how the ASTM's process brought the right level of involvement from people representing all constituencies. "When you consider all who were involved in the process, every aspect and angle was truly covered. It made for comprehensive and consequential discussions, and it led us to a strong end-product: a standard that's useful as well as practical," Dulk maintains.



The new standard provides minimum requirements for the design, manufacture, installation, and operation for LNG bunker hose assembiles.

HOW WILL THE NEW STANDARD IMPACT THE INDUSTRY

The new ASTM F3312 / F3312M – 18 standard provides guidance on the minimum requirements for the design, manufacture, installation and operation of hose transfer assemblies for cryogenic service as it pertains to the bunkering of LNG-fueled vessels.

A primary area of focus within the new standard is ensuring the containment of the pressurized fluid and safe operations. Since there are significant safety risks associated with the flammability and cryogenic temperatures of LNG, piping and hose assemblies built for LNG service must be designed to rigorous standards in order to mitigate any safety risks to operators in the field.

The new ASTM standard does not attempt to address all safety concerns. It remains the responsibility of all parties using the standard to establish proper safety, health and environmental practices, along with determining the applicability of any regulatory limitations.

Hose Master's Rick Foster notes that the new ASTM standard is recognized not only in American LNG loading terminals, but has international reach and influence as well. "The ASTM standard mirrors the international standard, with some added enhancements. I expect that it will quickly be officially recognized by most, if not all, of significant national and international companies involved in the LNG bunkering field," Foster predicts.

The new ASTM F3312 / F3312 – 18 Standard Practice for Liquified Natural Gas (LNG) Bunkering Hose Transfer Assembly can be downloaded via the following link: https://astm.org/Standards/F3312.htm.

Check out Dixon's Cryogenic LNG couplings and adapters

M/T Coralius:
Setting the Standard

As an example of how international engineering and performance standards can be applied to improving ship technology and functionality, the LNG bunkering vessel M/T Coralius is a fitting case. Owned by Sirius Shipping and the Anthony Veder Group and chartered by Skangas, the Coralius, which completed her first bunkering operation in September 2017, contributes to an LNG infrastructure in the Baltic Sea region while boasting a fuel transfer system technology that is truly state-of-the-art.

Coralius's size makes it well suited for small-scale carrier and bunkering duties.

With a capacity of 5,800 cubic meters of LNG, the Coralius is highly suited as a small-scale carrier, featuring a ship design that includes a flat working deck specially engineered for side-by-side transfer of LNG.

Coralius is fitted with Mann Tek 6-inch PERC and wire drift ESD system.

The ship's bunker delivery system was engineered to meet the latest SGMF guidelines ensuring safe and responsible use of LNG as a commercial marine fuel. It also meets the requirements of numerous regulatory bodies – among them SIGTTO, ISO, EN, Class approval with DNV, and BV. The transfer system, supplied by MannTek, can also be provided with a SIL 2 classification.

The Coralius represents the newest addition to a fleet of Sirius bunkering vessels that provide the M/S Viking Grace cruise ship with LNG. The first of these vessels was the LNGF Seagas, which was brought into service in 2013 and also features a MannTek transfer system. The MannTek system design is notable in that it lessens weight and minimizes the space required for LNG bunkering onboard.

For the Coralius installation, MannTek worked in close collaboration with Sirius Shipping, Anthony Veder Group and Skangas. Due to the volume of LNG that needs to be bunkered in a short interval, the system includes a 6" dry disconnect coupling (DDC) plus a 6" power emergency release coupling (PERC) for bunkering the LNG (as well as 4" dry disconnect couplings and a 4" PERC for smaller volume bunkering). Completing the system are LNG hoses plus an emergency shutdown vessel wire drift-off system that activates in case the ship would drift off position. As important as its proven credentials, the LNG transfer system on the Coralius delivers a lower cost of ownership in that both initial purchase price and ongoing maintenance costs have proven more attractive compared to alternative systems.

The success of the Coralius continues the notable success of LNG bunkering activities for Sirius Shipping, with nearly 1,400 such operations carried out to date thanks to MannTek's innovative system engineering. Indeed, MannTek is the most important supplier of LNG transfer equipment to the major LNG fueling facilities throughout the world. In addition to the M/S Viking Grace (the world's largest passenger ferry), other notable MannTek LNG transfer system installations include Tote Maritime's M/S Isla Bella (the first LNG-powered container ship) and Harvey Energy (the first LNG-powered OSV in America). Dixon supplied the couplings for the Harvey Energy project.

Coralius performs ship to ship LNG bunker operation.

With over 1,400 bunkers performed, Coralius is a notable success.

Sean Andersen is a product manager and LNG Specialist at Dixon. In addition to working closely with customers to evaluate, design and deliver custom LNG transport and bunkering systems, he is active in numerous industry organizations and societies. He is currently a member of the Chemical Transportation Advisory Committee (CTAC) Sub-Committee on LNG and the American Society of Testing and Measurement (ASTM) committee that is developing specifications and requirements for LNG fueling.

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