ISO 9001:2015
CERTIFIED COMPANY

PRI Registrar
PERFORMANCE REVIEW INSTITUTE

Rovanco®
Piping Systems

Above/Below Ground Cryogenic Piping

www.Rovanco.com

Designed for Transferring

- **LNG (-258˚F, -161˚C)**
- **Propane (-47˚F, -44˚C)**
- **Butane (-5˚F, -20˚C)**
- **Liquid O_2 (-297˚F, -183˚C)**

"Green Energy" is the direction in which the world is heading. Moving away from fossil fuels and toward lower cost & lower emission sources makes Liquefied Natural Gas (LNG) a significant factor whose role will only continue to increase in the future.

LNG use can be found in a variety of industries. Some of these include; residential energy for cooking, heating homes and generating electricity, food, dairy & beverage processing, aggregates & asphalts manufacturing and of course marine fuel bunkering.

Transferring LNG to these end-use points demands specialized piping systems. LNG must maintain a temperature of approximately -260°F (-161˚C) to remain in liquid form. This makes a properly constructed & insulated system integral in conveying this precious resource.

Rovanco's Above & Below Ground Cryogenic Piping Systems have been optimally designed from the carrier pipe to the insulation and outer jacket. The materials used are of the highest quality and sourcing is carefully monitored and scrutinized.

During manufacturing, precision is paramount and each detail of the process is stringently followed each and every time to ISO 9001:2015 standards. This assures a Rovanco LNG and other similar liquefied gas transferring lines perform to specifications for years to come.

Features – Quality, Efficient & Effective

- **Stainless Steel or Carbon Steel Carrier Pipe**
  - Stainless Steel; Schedule 10 or Schedule 20
  - ASTM A333 Grade 6 SMLS, ASTM A53 Grade B ERW
  - ASTM A106 Grade B SMLS

- **Polyisocyanurate (PIR) Foam Insulation**
  - Temperature range from -297˚F (-183˚C) to 300˚F (149˚C)
  - Initial K Factor of .14, Density of 2.0 & Compressive Strength >90%
  - Also conforms with ASTM D1621, 1622, 2126, 2842, 2856, C518 & E96

- **Cryogel® Insulation**

- **Jackets Available for Above Ground Applications**
  - Spiral Lock Seam Galvanized, Aluminum or Stainless Steel Metal

- **Jackets Available for Below Ground Applications**
  - HDPE: Water-tight; thickest available in the industry; conforming to ASTM D3350; Type III, Category 5, Class C; & Grade P23/P34
  - Double Wall Pipe can be Carbon Steel with Rhinocoat® Fusion Bonded Epoxy Coating or Stainless Steel

Heat Transfer Calculations – Polyisocyanurate Foam for LNG Service

Input *(for Above Ground System)*	
Design Temperature	-260˚ F
Ambient Air Temperature	85˚ F
Air Velocity	2.0 mph
Jacket Surface Emissivity	0.95
Service Pipe Material	**Stainless Steel**
Insulation Material	**Polyisocyanurate Foam**
Mean Thermal Conductivity	0.14 Btu-in./hr.-ft^2 -F
Outer Jacket Material	**High Density Polyethylene (HDPE) / Metal Jacket**

Cross Sections						
Nominal Carrier Pipe Size (inches)	36	32	24	20	18	16
Insulation Thickness (inches)	5.5	5.5	5.5	5.0	5.0	5.0
Jacket Wall Thickness (mils)	175	175	175	175	175	175
Heat Transfer Calculations* *(Results)*						
Heat Loss (in Btu/hr.-ft)	-93	-84	-66	-61	-56	-51
Heat Fluctuation (in Btu/hr.-ft^2)	-7.6	-7.5	-7.2	-7.8	-7.6	-7.5

Above & Below Ground Cryogenic Piping Specifications:

Carrier Pipe:
Shall be 2" to 24" in diameter and be in 20' or 40' lengths. The material shall be Schedule 10 or 20 Stainless Steel, ASTM A333 Grade 6 SMLS, ASTM A53 Grade B ERW or ASTM A106 Grade B SMLS.

Insulation Types:
Polyisocyanurate Foam:
Shall be 300˚F cryogenic foam insulation has an initial K factor of .14, density of 2.0, closed cell content of >90%, compressive strength of 30 psi, and continuous service temperature of -297º F (-182˚C) to 300˚ F (148˚C). Conformance with ASTM Standards D1621, 1622, 2126, 2842, 2856, C518 and E96. It shall completely fill the annular space between the carrier pipe and jacketing. Provide written independent performance certification with submittals.

Cryogel Z®:
Shall be Cryogel Z flexible hydrophobic insulation, as manufactured by Aspen Aerogel, which has a K factor of .10-.13 (dependent on temp), from 5mm-10mm thick depending on specifications, compressive resistance of ≥5 psi, linear shrinkage <2%, water vapor absorp-tion ≤5% by weight, and maximum continuous service temperature of 257ºF. Conformance with ASTM Standard C795, C1191, C1338, C1617, C1763, E84 and E96. Carrie pipe will be completely wrapped with insulation, installed & secured according to manufacturer's instructions. Provide written performance certification with submittals.

Jacket Material:
Above Ground:
Spiral lock seam galvanized, aluminum or stainless steel metal in accordance with ASTM A366 and ASTM A256 G90 or as specified. See Table 1 for metal jacket thickness.

Table 1:

Jacket Size (in inches)	Aluminum Jacket Spiral Lock Seam with impact & chemical resistance equivalent to H-14 Temper T-3003 in accordance with ASTM-B 313.	Galvanized or Stainless Steel Jacket Spiral Lock Seam in accordance with ASTM A-366 ASTM A-26 G90.
4	22 gauge	26 gauge
6	22 gauge	26 gauge
8	22 gauge	26 gauge
10	22 gauge	26 gauge
12	22 gauge	26 gauge
14	18 gauge	22 gauge
16	18 gauge	22 gauge
18	18 gauge	22 gauge
20 & larger	18 gauge	22 gauge

Below Ground:
HDPE:
The exterior protective jacket shall be heavyweight, seamless, high impact, polyethylene conforming to ASTM D3350. Spray and wrapped polyethylene jackets are not considered to be seamless. Field joints shall be insulated with specified insulation type on carrier and half shells of high temp polyisocyanurate foam for outer insulation. No FRP jacket allowed.

Stainless Steel or Rhinocoat:
Outer casing shall be stainless or carbon steel. Casing up through 24" shall be 10 gauge. Casing 26" and larger shall be 6 gauge. Other thickness are also available.

If carbon steel, the exterior surface will be coated with a dual layer Fusion Bonded Epoxy system. The first coat will be 15 mils green finish coat. No glasswrap or filler materials shall be used in the epoxy. All exterior conduit surfaces shall be shot-blasted prior to the coating being applied. The Fusion Bonded Epoxy shall conform to thee ASTM Standards: ASTM D1763, ASTM G17, ASTM D1044, ASTM D2370, ASTM G14, ASTM G8, ASTM D968, ASTM D1002, ASTM D659, ASTM D257, ASTM D1000, ASTM G53 & ASTM B117.

The second layer will be 5 mils of black or brown compatible Fusion Bonded Epoxy coating that will provide mechanical protection to the first layer. The second layer of Fusion Bonded Epoxy will be applied no later than 5 seconds after the first layer has been applied so that is securely bonds to the first layer as both layers cure. The second layer must have an impact resistance of at least 160 lbs. per square inch as per ASTM G14-72. The Fusion Bonded Epoxy coating will be applied in a total thickness of no less than 20 mils. The coating system will be equal to Rovanco Piping Systems –Rhinocoat™. No asphalt, coal tar coating, FRP casing or any other type will be allowed.

Approved Vendors:
Carbon Steel Containment System by Rovanco, Joliet, Illinois or approved, ISO 9001 Certified, equal. Any alternate supplier must submit their technical data to the engineer ten days prior to bid date to be approved in writing as an equal.

Rovanco® Piping Systems, Inc.
20535 S.E. Frontage Road, Joliet, Illinois 60431
Tel: (815) 741-6700 • Fax: (815) 741-4229
www.rovanco.com • marketing@rovanco.com

ISO 9001:2015 CERTIFIED COMPANY
PRI Registrar
PERFORMANCE REVIEW INSTITUTE

 #06172025