



# Premium Anti-Corrosion Coating Gel For Insulated & Cold Service Application

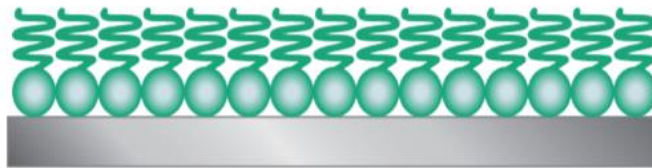
## PROBLEM STATEMENT & SOLUTION

Loss of Containment due to leaks caused by Corrosion under Insulation (CUI), Corrosion under Fireproofing (CUF) and general Environmental corrosion on steel has significant cost implications for process plants. As a result, piping fixtures, vessels, tanks, valves and other equipment often require expensive inspection, repairs, replacements and overdesign. Besides the detrimental environmental impacts of a leak, lost time due to production losses adversely impact operational profits.

The external corrosion of steel piping and process equipment results from moisture trapped on the surface of steel. This has been a perennial problem in process facilities for many decades. Traditional solutions such as surface painting have proven ineffective with associated cost running into billions of dollars globally. Surface paint/resin often disbands and disintegrates over time making the system susceptible to non-arrested corrosion and loss of wall thickness. Field inspections often show that the conventional coatings are unable to effectively keeping moisture out and are thus ineffective CUI and CUF prevention or mitigation solutions.

### -Next-Generation Corrosion Protection. How it works!

ArmorGel™ premium anti-corrosion gels provide advanced and superior external corrosion, Corrosion under Insulation CUI and Corrosion Under Fireproofing CUF prevention and mitigation by creating a protective shield around the metal substrate. This prevents moisture (electrolyte) and gases from initiating a corrosion reaction on the applied surfaces. No surface moisture – No external Corrosion.



*Fig1 Protective shield prevents moisture and gases from reacting with metal surface*

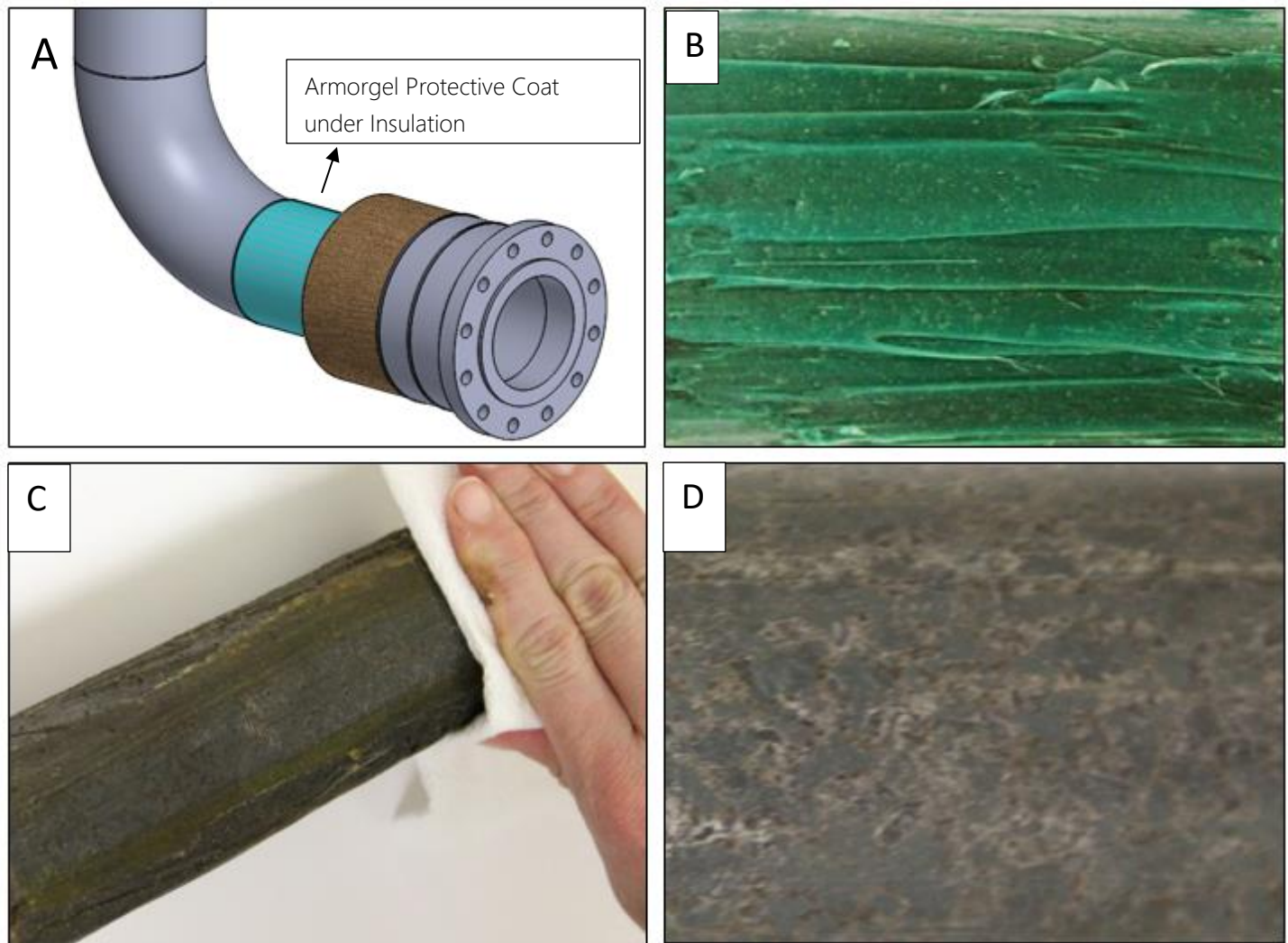
ArmorGel™ non-drying surface coating technology prevents the initiation of galvanic, alkaline and chloride corrosion in process equipment by the process of metal surface mineralization thereby inhibiting rust/corrosion reactions. It may also prevent related damage mechanism types on the pipe external surfaces such as crevice corrosion, general atmospheric corrosion, oxidation, and chloride stress corrosion cracking. The technology promotes asset integrity and plant safety while reducing losses associated with unsafe operations, lost production and downtime. One of the many advantages is the easy application process with immediately installation of insulation and Minimal effort required to remove coating from metal surface.

## PRODUCT CLASSES

- ≡ **ARMORGEL 4000-CS:** Suitable for CUI and CUF prevention and mitigation in cryogenic and cold service applications. Product temperature range is -60°F (-51°C) to 250°F (121°C).
- ≡ **ARMORGEL 4100-RS:** Suitable for CUI and CUF prevention in carbon steel and low alloy steel systems operating between -10°F (-23°C) to 250°F (121°C).
- ≡ **ARMORGEL 4200-HT:** Suitable for CUI and CUF prevention in high temperature applications, especially in 300 series austenitic stainless steel and duplex stainless steels systems. Product temperature range is -10°F (-23°C) to 400°F (204°C).
- ≡ **ARMORGEL CLEANER 5000:** Designed and endorsed cleaning agent for removal of applied gels making cleanup easy.

Armorgel™ premium anti-corrosion gels are engineered to withstand critical CUI & CUF causative conditions such as all externally insulated and fireproofed Systems and those that are in intermittent service or operate between:

- ≡ 10°F (-23°C) and 350°F (176°C) for carbon and low alloy steels.
- ≡ 140°F (60°C) and 400°F (205°C) for austenitic stainless steels and duplex stainless steels.
- ≡ Environments that provide airborne contaminants such as chlorides (marine environments, cooling tower drift) or SO<sub>2</sub> (stack emissions) can accelerate corrosion and Plants located in areas with high annual rainfall or warmer, marine.
- ≡ Cyclic thermal operations, intermittent service and cryogenic service equipment that operate below the water dew point which create condense water on the metal surface resulting into wet insulation.
- ≡ Insulating materials that hold moisture and contaminants that may be leached out of the insulation, such as chlorides.



**Fig 2. A:** Armorgel/Insulation pipe assembly, **B:** Brushed-on Armorgel on pipe,

**C:** Armorgel simple wipe off after 13 months' field trial, **D:** Visual examination of pipe after trial. No rust or Under-Insulation corrosion build up.



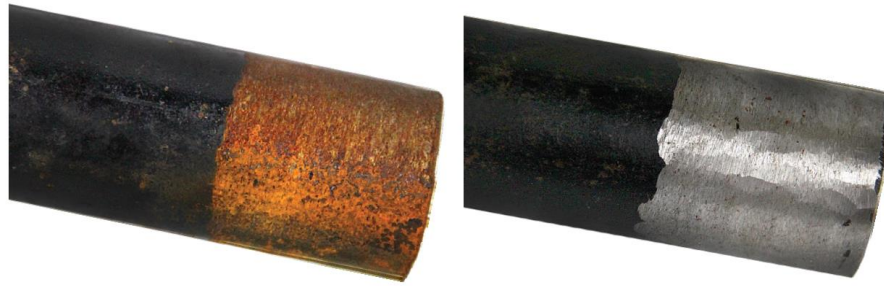


Fig 3. Visual inspection of unprotected pipe (left) VS gel protected pipe after 1 year in service

Data from field trial tests confirmed ArmorGel™ reached all design criteria with respect to protecting a section of pipe when exposed to external corrosion agents to mimic application instance for general external corrosion, CUI, CUF and Cold service moisture buildups for over one year.

### ARMORGEL™ IS FOOD GRADE TOO!

Special consideration was put into the design and manufacturing of this product keeping in mind possible applications for food processing plant and ways it may interact with environmental as well as wildlife. ArmorGel™ meets H1 food grade requirements set by the National Sanitation Foundation (NSF).



### CURRENT SUCCESSFUL APPLICATION AREAS – INDUSTRIES / SYSTEMS

ArmorGel™ premium anti-corrosion gels are applicable for CUI, CUF and external corrosion prevention and mitigation in:

- |                                         |                                          |
|-----------------------------------------|------------------------------------------|
| ≡ Oil & Gas Facilities                  | ≡ Meat & Seafood Processing/Cold Storage |
| ≡ Refineries & Petrochemical Facilities | ≡ HVAC Installations                     |
| ≡ Chemical Manufacturing Plants         | ≡ Chilled Water Piping                   |
| ≡ Power Plants                          | ≡ Steam Lines                            |
| ≡ Food & Beverage Plants                | ≡ Ammonia Refrigeration equipment.       |
| ≡ Storage Tank Farms & Terminals        | ≡ Liquefied Natural Gas (LNG) Facilities |

Trouble Spots - Areas Susceptible to CUI and CUF Damage in Industrial Application Sites. Most areas of potential CUI damage in a process plant are identified from Tables 1 to 5 below of API583RP.

**General areas:** Areas downwind of cooling towers exposed to cooling tower mist, Areas of protrusions (i.e. transitions) through the jacketing at manways, nozzles, & other components, Areas of protrusions through insulation for systems operating at or below ambient, or in cold service, Areas where insulation jacketing is damaged or missing, Areas where caulking is missing or hardened on insulation jacketing, Areas where the jacketing system is bulged or stained, Areas where banding on jacketing is missing, Areas where thickness monitoring plugs are missing, Areas where vibration has caused damage to the insulation jacketing, Areas exposed to steam vents, Areas exposed to process spills, the ingress of moisture, or acid vapors, Areas exposed to deluge systems, Areas insulated solely for personnel protection, Areas under the insulation with deteriorated coatings or wraps, Areas with leaking steam tracing, Pipe and flanges on pressure safety valves, Systems that operate intermittently above 250 °F (120 °C), Systems operating below the atmospheric dew point, Systems that cycle through the atmospheric dew point, Ice-to-air interfaces on insulated systems that continually freeze and thaw.

**Piping:** Dead-legs, vents, and drains, Pipe hangers and supports, Valves and fittings, Bolted on pipe shoes, Steam-tracing/electric-tracing tubing penetrations, Termination of insulation at flanges and other piping components, Carbon/low alloy steel flanges, bolting, and other components in high alloy piping, Jacketing seams on the top of horizontal piping, Termination of insulation on vertical piping, Areas where smaller branch connections intersect larger diameter lines, Low points in piping with breaches in the insulation, Close proximity to water (e.g. wharf) and/or ground (e.g. increased absorption), Wet due to flooding or submerging into water, Damage due to foot traffic



**Pressure Vessels:** Support rings below damaged or inadequately caulked insulation on vertical heads/bottom zones, Stiffening rings on insulated vessels/columns in vacuum service, Insulated zone at skirt weld, Insulated leg supports on small vessels, Ladder and platform attachments, Termination of insulation at nozzles and saddles, Fireproofed skirts (CUF), Anchor bolts (CUF), Bottom of horizontal vessels (i.e. lower third to half of vessel), Irregular shapes that result in complex insulation installations (e.g. davit arm supports, lifting lugs, body flanges, etc.)

**Tanks & Spheres:** Area above chime, Stairway tread attachments, Insulation support rings, Fireproofed legs on spheres (CUF), Insulation penetrations such as nozzles, brackets, etc. on shell and roof.



*Pic p4—Jacketed piping with missing insulation plug (top photo) allowing water ingress. Ref-API 583*

## COMPATIBILITY – ARMORGEL VS INSULATION TYPES

ArmorGel™ premium anti-corrosion gels are compatible with most commercially available Insulation types in the market.

- ≡ Granular Types (Calcium silicate C533, Expanded perlite C610, Silica aerogel C1728)
- ≡ Fibrous Types (Mineral wool C547, Fiberglass C547)
- ≡ Cellular Types (Cellular glass, Polyurethane, Polyisocyanurate foam C591, Elastomeric foam C534, Polystyrene foam C578, Phenolic foam C1126).



## PHYSICAL & CHEMICAL PROPERTIES

### APPEARANCE

Color	Green
Physical State	High visibility Gel
Odor	None
Relative Density	0.95-1.05
Solubility	Insoluble in water.
Flash Point	> 143.3 C (>290F) Cleveland Open Cup.
Auto- ignition temperature	> 442 C (>827.6F)
Chemical stability	This product is stable. Non-radioactive.
Compatibility	Compatible with most types of insulation.
Hazardous Decomposition products	None produced under normal conditions of storage and use.

### PACKAGING, TRANSPORTATION AND STORAGE

Shelf Life	2 years
Information about protection against explosions and fires	No special measures required
Precautions for safe handling	No special measures required
Requirements to be met by storerooms and receptacles	No special requirements
Information about storage in one common storage facility	Not required
Further information about storage conditions	Not required
Specific end use(s)	No further relevant information available
Personal precautions, PPE and emergency procedures	Not required
Environmental precautions	No special measures required
Methods and material for containment and cleaning up	Absorb with liquid-binding material (i.e. sand, diatomite, acid binders, universal binders, sawdust). Dispose of the collected material according to regulations

### HAZARD IDENTIFICATION

GHS Label	Non-regulated material
Hazard Pictograms	Non-regulated material
Signal Word	Non-regulated material
Hazard Statement	Non-regulated material

### FIRST AID MEASURES

After inhalation	Supply fresh air; consult doctor in case of complaints
After skin contact	Generally the product does not irritate the skin
After eye contact	Rinse opened eye for several minutes under running water
After swallowing	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. Treat symptomatically.

## FIELD APPLICATION AND USE

### ≡ Surface Preparation Guidelines

**Rusted Metal Surfaces:** Water jet or wire brush rusted surface before cleaning the surface to remove all loose scale, grease and dirt. Clean damp rusted surfaces with water soluble solvent like alcohol or ethylene glycol before gel. Ensure that metal surface is dry before gel application.

**New Metal Surfaces:** Remove all mill varnishes, film and coating from the new metal surface. Wire brush any pitting or scale. There is no need to remove red rust from unvarnished metals. If there is pitting or scale, wire-brush them off.

**Hot Metal Surfaces:** Installation on hot metal surface above OSHA and WHIMIS personnel protection standards is not recommended due to health and safety concerns. Consult your safe department before proceeding with installing on any hot surface.

**Wet Metal Surfaces:** A dry surface is best is for the application of ArmorGel™ premium anti-corrosion coating gels. All surfaces should be wiped dry with omnidirectional fabric as much as possible. The gel should not be applied under the rain and any dampness that results from other surface preparation activities, unexpected atmospheric precipitation or condensation should be dried before gel application.



Cold and Wet Surfaces: Ensure that wet metal surfaces are above freezing point (32°F/0°C). Use an omnidirectional fabric to clean condensation off cold metal surfaces.

Cold and Dry Metal Surfaces: Follow product temperature specification with respect to minimum use temperature. For optimum performance, the metal surface must be clean and free of oils or slag.

### ≡ Gel Application

ArmorGel™ premium anti-corrosion gels can be easily applied by spray, glove and brush/trowel action. Apply to surface, assuring coverage on all desired pipes surface, crevice areas, threaded parts, or other components.

Apply ArmorGel™ evenly across the pipe's surface. Ensure there are no voids or spaces where moisture could be trapped or interact with the pipe's surface. The conventional coating coverage thicknesses are 25MIL; 30MIL and 35MIL depending on the size and susceptibility to the system to CUI are recommended. Please refer to the coverage charts for specific pipe ODs.

Glove or brush ArmorGel™ premium anti-corrosion gels onto the pipe or surface in sufficient quantity enough to cover the metal substrate. To ensure the accuracy of the thickness and reduce product wastage, you may use a properly sized trowel. The trowel should be held at a 90° angle and slid down the pipe to trim off excess gel which can be reused in another section or returned to the container. The tracks of the trowel may be smoothed by hand. Application without a trowel has no detrimental effect on corrosion mitigation as long as ArmorGel™ premium anti-corrosion coating gel is applied liberally to the affected area.

### ≡ Gel Removal & Disposal

ArmorGel™ premium anti-corrosion gels can be easily removed using Armorgel™ Cleaner 5000. Spray cleaner and scrub off with a damp fabric or non-abrasive brush. Cleaning residues must be disposed in accordance with local, state and federal laws, statutes and regulations.

## RELATED DOCUMENTS- MSDS TDS PRODUCT LABELS

Precautions: All offered products are sold and distributed for the intent and purpose described in this literature and the related documents. The manufacturer and distributors will not be liable or responsible for misuse. Defective product batch not meeting published specification will be replaced within a year from the sale date. All labels, application guides, handling, storage and precautions must be read in totality and understood by a user, personnel and all employees who interact with the products. Purchases are responsible for ensuring use, transportation, disposal, storage and application within user sites comply with all applicable federal, provincial, state and local regulations with respect to all health, safety and environmental laws/ guidelines.

**FOR INDUSTRIAL USE ONLY. KEEP OUT OF REACH OF CHILDREN. KEEP CONTAINER TIGHTLY CLOSED. NOT FOR INTERNAL CONSUMPTION. CONSULT SAFETY DATA SHEET FOR MORE INFORMATION. THE INFORMATION ON HERE AND COMPETITIVE PRODUCTS PROVIDED SHOULD ONLY BE USED AS A GUIDE. PRODUCT PROPERTIES ARE TYPICAL RESULTS AND SHOULD NOT SERVE AS A SOLE RESOURCE FOR DETERMINING THE CORRECT PRODUCT FOR A PARTICULAR APPLICATION. PLEASE CONSULT A BFX INDUSTRIAL REPRESENTATIVE TO ENSURE THAT THE PRODUCT IS THE CORRECT CHOICE FOR THE APPLICATION.**

