

DOW CORNING

Oil & Gas
Solutions

Proven technology for subsea wet insulation systems

Solid.
Silicone.
Science.

DOW CORNING®

XTI-1003

RTV Silicone Rubber Insulation

dowcorning.com/xti1003

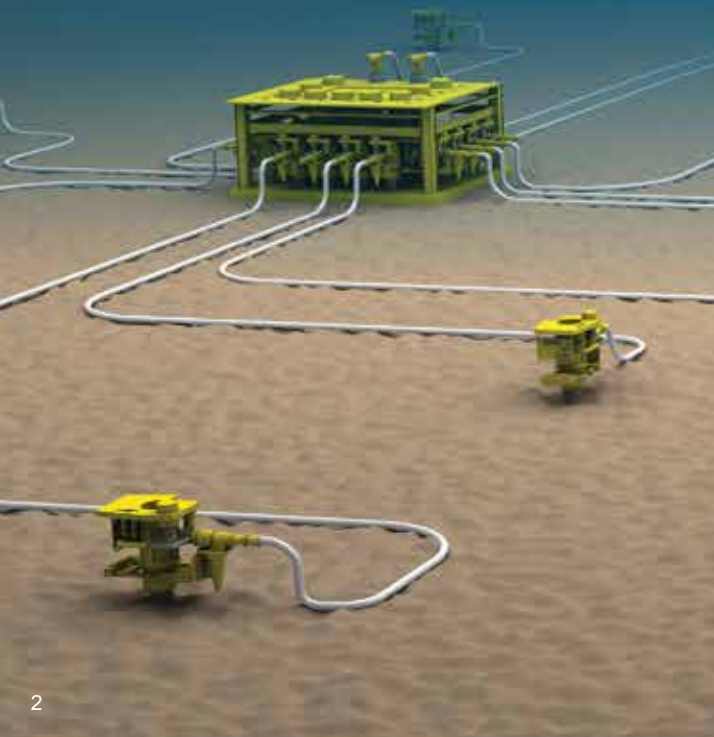
Deepwater oil and gas operations need more reliable, cost-efficient and lower-risk subsea wet insulation systems.

Robust materials and application quality are essential for structural and thermal integrity.

Reliable

Robust

Essential



Challenge Deepwater Flow Assurance

With subsea oil and gas operations moving into deeper waters, production equipment and tieback systems must handle much higher material temperatures and pressures. Subsea wet insulation systems, which are molded directly around components – and exposed to cold seawater on the outside and to high-temperature material flow on the inside – are favored in many deepwater flow-assurance strategies.

Various polymers and especially syntactic urethanes, epoxies and silicones, which contain glass microspheres to reduce density and improve insulation values, are used. Maintaining the production stream temperature above the hydrate formation and wax appearance temperatures can help to reduce flowline blockages and achieve a specified cool-down or “no-touch” time for shutdowns.

While industry standards for deepwater subsea insulation are unsettled, failures of some subsea wet insulation systems – caused by such problems as joint separation, cracking, degradation, hydrostatic crushing or improper application – demand more reliable, cost-efficient and lower-risk solutions that can maintain their structural and thermal integrity for the expected 20- to 25-year lifetime of the oil field.

Applicators need robust, proven, easier-to-apply insulation, along with optimized process-quality-control procedures, to help ensure the reliable performance that oil and gas operators specify.

Solution Solid Silicone Science

With in-depth silicone expertise, industry experience and operator-applicator collaboration, Dow Corning – a global leader in silicones and silicon-based technologies and innovation – has engineered an advanced “pure silicone” insulation option to help meet the flow-assurance needs of deepwater subsea oil and gas operations.

Dow Corning® XTI-1003 RTV Silicone Rubber Insulation is the first solid silicone thermal insulation proven for use in high-pressure, high-temperature oil and gas operations. The non-syntactic, two-part silicone rubber system adds simplicity to reduce risk of inconsistent processes creating quality control issues or harsh subsea environments causing performance shortfalls. Applicators may be able to reduce or prevent some of the common failure mechanisms seen with various subsea insulation systems.



Photo and application courtesy of Trelleborg Offshore Ltd © 2012

Performance and Application Benefits

Non-syntactic **Dow Corning XTI-1003 RTV Silicone Rubber Insulation** does not utilize glass microspheres, emphasizing increased joint strength, high heat capacity, long-term flexibility and resistance to extreme pressures. Easily mixed and applied using standard cast-in-place equipment and processes, it cures to a high-strength silicone rubber. Extensive testing is validating its effectiveness in withstanding harsh subsea environments.

Qualified coating specialists can support key producer requirements for specified field performance with:

- Thermal stability across a wide temperature range
- Good insulating properties for longer no-touch times
- Excellent flexibility and resistance to cracking
- Reduced degradation with property retention
- Easier processing for curved, straight-line and flexible sections without special procedures
- Joint integrity with strong silicone-to-silicone bonding
- Fast addition-reaction cure at ambient temperatures in unlimited thickness; can be accelerated with heat

SUBSEA EQUIPMENT POTENTIALLY REQUIRING INSULATION

- Wellheads
- Subsea trees
- Pipeline end manifolds (PLEMs)
- Pipeline end terminations (PLETs)
- Jumpers and spoolpieces
- Sleds
- Flowline ends and riser ends
- Flange connections

Typical Properties

PROPERTY	UNIT	RESULT
Appearance		Translucent or yellow
Shelf life, stored in sealed containers	Months	18
As Catalyzed – 10:1 Ratio, by Weight		
Working time at 25°C (77°F)	Minutes	90
Cure time at 25°C (77°F)	Hours	12
As Cured – Physical Properties		
Specific gravity		1.08
Durometer hardness, Shore A		40
Tensile strength	MPa	5.5
Elongation	%	325
Thermal conductivity (dry 0°C to 135°C)	W/mK	0.17
Thermal conductivity (aged wet at 135°C)	W/mK	0.17
Specific heat at 135°C	J/g°C	1.60
Tm	°C	-46

Specification Writers: These values are not intended for use in preparing specifications. Please contact your local Dow Corning Sales Application Engineer before writing specifications on this product.

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RTV Silicone Rubber Insulation

Performance Testing and Assessment

Industry experience and operator-appliator collaboration played major roles in the development of **Dow Corning XTI-1003 RTV Silicone Rubber Insulation**. U.S.-based Dow Corning proved that not all silicones are created equal in testing its new technology against a syntactic silicone for subsea thermal insulation. Compared to that proven, effective material, the advanced “pure silicone” technology exhibits superior flexibility, joint bonding, tensile strength, elongation and resistance to water ingress at high temperatures.

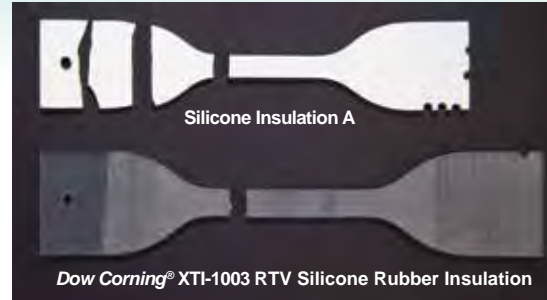
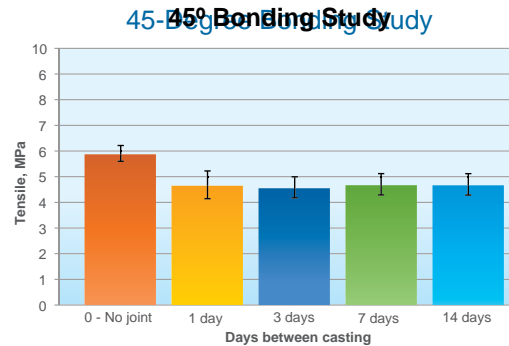


FIGURE 1. Photograph of submerged tensile samples that have been immersed in simulated seawater at 135°C for six months.

45-Degree Joint Bonding Study

In a 45-degree insulation-joint bonding study, excellent silicone-to-silicone bond strength was achieved, even with extended time between castings. Demonstrating high tensile strength and elongation, **Dow Corning XTI-1003 RTV Silicone Rubber Insulation** can provide good joint integrity in both rigid and flexible sections.

FIGURE 2. Representative photo (far right) of a cast tensile bar 45-degree bond joint of Dow Corning XTI-1003 RTV Silicone Rubber Insulation. Second cast was pigmented yellow for visual identification purposes of this photo.



Differentiating Characteristics Analysis

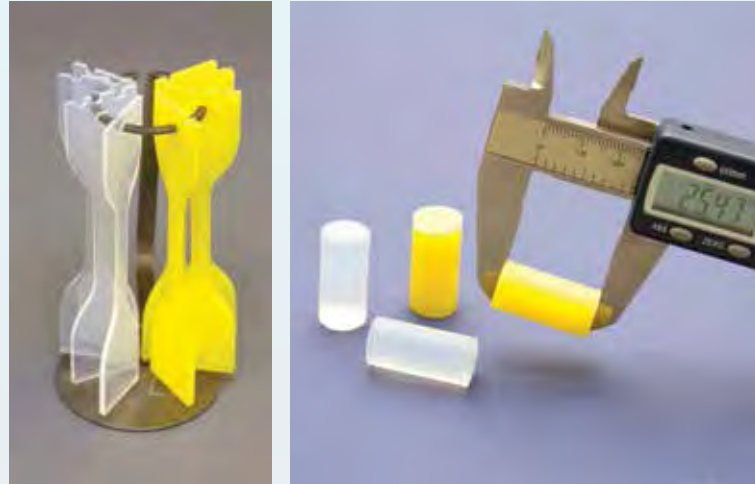
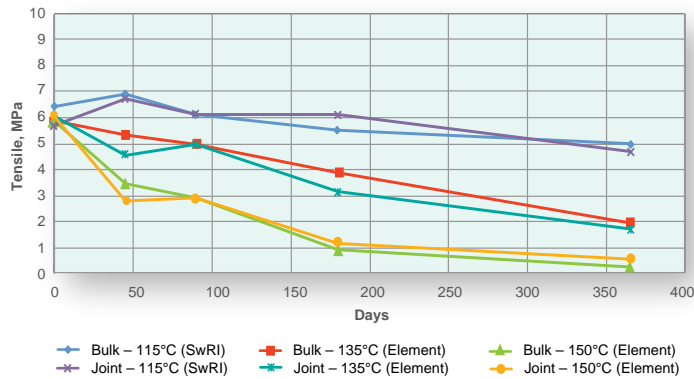
Differentiating Characteristics	Dow Corning® XTI-1003 RTV Silicone Rubber Insulation
High temperature	Very good
Flexibility	Excellent
Application ease	Very good
Joint strength	Excellent
Shelf life	Very good
EHS profile	Very good
Water absorption	Good
Cost in use	Good



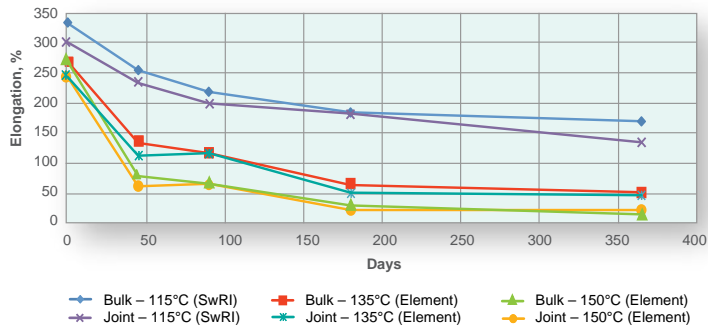
Extensive Heat-Aging Immersion Testing of *Dow Corning*[®] XTI-1003 RTV Silicone Rubber Insulation

Using proven industry test methods, **Dow Corning XTI-1003 RTV Silicone Rubber Insulation** was pushed to extreme limits to provide customers with the confidence that it will perform even under the harshest of environments.

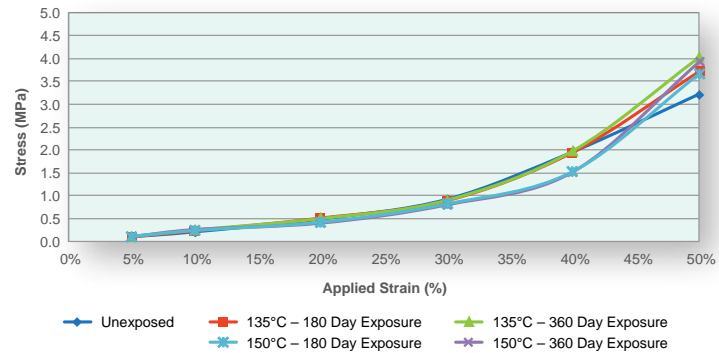
Extended Service Testing: Tensile Strength



Extended Service Testing: Elongation



Exposed Compression Testing



Exposure of 2 mm thick ASTM tensile specimens which are subjected to wet heat aging at specified temperatures under pressure in a 3% NaCl seawater mixture to observe accelerated aging characteristics at external third-party labs.

Exposure of compression cylinders 12.5 mm diameter x 25 mm length bulk specimens which are subjected to wet pressure heat aging.

Collaboration for Qualification

Applicator-operator collaboration is helping to qualify **Dow Corning XTI-1003 RTV Silicone Rubber Insulation**. This includes closely working with industry resources and independent testing facilities to assess ease of application and potential quality-control issues, as well as to validate performance characteristics in simulated service tests and extended heat-aging immersion tests.

Every application requires thorough engineering analysis to define insulation performance specifications to meet the particular flow-assurance needs of a subsea operation. Proper installation is essential for delivering the performance specified.

Simulated Service Test (SST) of Dow Corning® XTI-1003 RTV Silicone Rubber Insulation

	115°C		135°C	
	3	5	3	5
Thickness, inches				
Safe operating temperature (SOT)	45°C		45°C	
Hydrate formation temperature (HFT)	22°C		22°C	
Lowest ambient seawater temperature (SWT)	4°C		4°C	
Test maximum operating temperature (TMxOT)	115°C		115°C	
Hydrostatic external pressure	228 bar		250 bar	
Seawater service depth (SSD)	2,050 m		2,480 m	
SOT to HFT at SSD, hours	4.71	6.96	6.18	11.05
TMxOT to HFT at SSD, hours	13.35	15.24	16.43	29.6



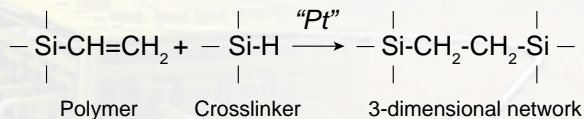
Photo and application courtesy of PERMA-PIPE Oil and Gas © 2015

Application Ease Aids Quality Control

Qualified insulation coating specialists, proper equipment and processes, and strict quality-control procedures are required to meet operator equipment specifications for insulation performance using **Dow Corning XTI-1003 RTV Silicone Rubber Insulation**.

The two-part, room-temperature-curing (RTV) insulation system is designed for easier processing of insulation for curved, straight-line and flexible sections. Yet, applicator expertise is critical for defect-free, cast-in-place insulation that will reliably achieve long-term performance metrics.

- Surfaces must be clean and free of contamination to avoid cure inhibition (partial curing or sticky surfaces).
- A primer is recommended to maximize adhesion to corrosion-control coatings on substrates.
- Sufficient air vents should be provided in molds to avoid excessive air entrapment in the insulation.
- The crosslinking-by-addition chemistry (hydrosilation cure) ensures complete curing, even in thick sections, without air exposure, shrinkage or harmful by-products.



- Curing requires up to 12 hours at room temperature (23°C) or up to 24 hours at colder temperatures, and it can be accelerated with heat.

Processing Information

FACTOR	RESULT
Base	
Packaging	200 kg drums
Shelf life, stored in sealed containers	18 months
Viscosity	55,000 mPa.s
Curing Agent (Catalyst)	
Packaging	20 kg pails
Shelf life, stored in sealed containers	18 months
Viscosity	300 mPa.s
Mixed 10:1 by Weight	
Viscosity	35,000 mPa.s
Working time at 23°C	90 minutes
Cure time at ambient temperature	12 to 24 hours; can accelerate with heat

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RTV Silicone Rubber Insulation

Advanced Advanced technology for subsea flow assurance demands expertise, experience and collaboration. At Dow Corning, solid silicone science guarantees that not all silicones are created equal.

Global. Local. Ready to Help.

With leading-edge materials innovation, recognized science-based expertise, broad technical support and worldwide commercial-supply capabilities, Dow Corning is a technology-driven solutions provider for the global oil and gas industry. Dow Corning customer service and engineering centers are strategically located in most world regions.

Learn More: Contact Us

Learn more about using **Dow Corning XTI-1003 RTV Silicone Rubber Insulation** for advanced flow assurance solutions in subsea oil and gas applications. Contact your Dow Corning Technical Representative, visit dowcorning.com/xti1003 or email industrial@dowcorning.com.



Images: Cover - AV20118, AV20059; Page 2 - AV20096; Page 4 - AV20208, AV20209, AV20315; Page 5 - AV23059, AV23058; Page 6 - AV22951.

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