



Flow Assurance Solutions

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# Insulating and Protecting Flowlines and Subsea Equipment

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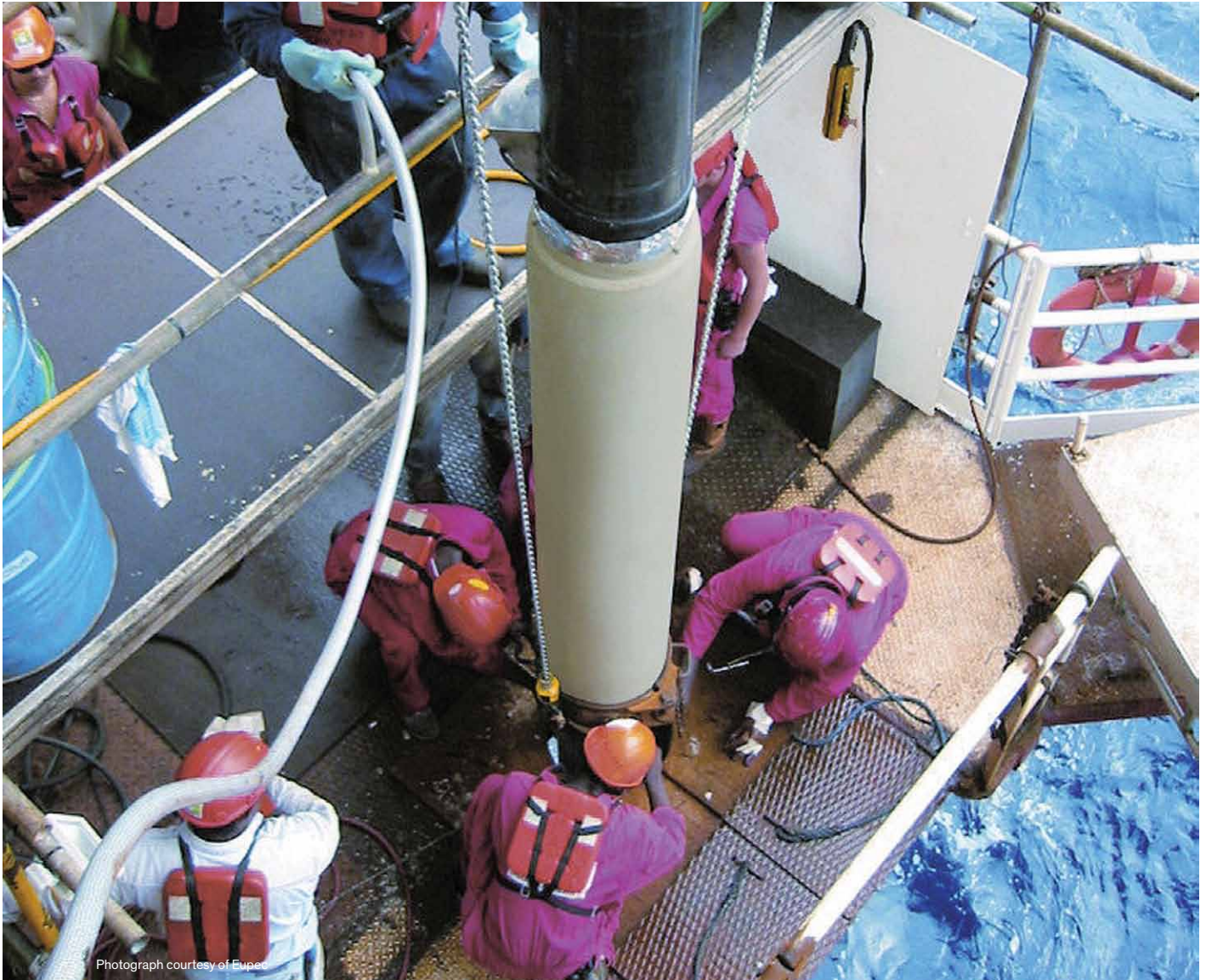
# Assuring Flow in the World's Most Extreme and Remote Environments

Photograph courtesy of Technip

## Innovative Solutions Backed by Deep Application Experience

Rising global energy demand is driving oil and gas producers to maximize existing assets and tap the potential of deeper, hotter and more remote reserves. Innovative, proven flow assurance technologies are more critical than ever to help access these valuable resources from more extreme environments – safely and responsibly.

With more than 530 successfully completed pipeline projects over the past three decades, Dow has established a reputation as a global flow assurance technology leader. Our dedicated flow assurance team members work closely with oil and gas operators, engineering firms, lay contractors, subsea equipment manufacturers and our global applicator network to design and help execute a wide range of projects on time, on budget and within specifications.



Photograph courtesy of Eupec

## 30 Years of Proven Systems and Technologies

Dow's systems and technologies for flowline insulation and subsea equipment are complemented by a comprehensive network providing customers with global expertise, local technical support and a dedicated project manager to oversee all project logistics. Additionally, none of Dow's flow assurance materials uses Mercury catalysts, but they still provide the high performance expected of HYPERLAST™ products.

Explore our portfolio of flow assurance solutions in the following pages.

### Flow Assurance Insulation System Portfolio

Technology/Application	HYPERLAST™ Glass Syntactic PU	HYPERLAST™ Solid PU Elastomers
Line Pipe (offshore)	✓	✓
Field Joint Coating (offshore)	✓	✓
Custom Coating	✓	✓



Photograph courtesy of Bredero Shaw



## Versatile, Cost-Effective and Globally Respected

### HYPERLAST™ Syntactic Flow Assurance Systems

HYPERLAST™ Glass Syntactic polyurethane materials have been field-tested and widely used in hundreds of successful pipeline projects around the world. They deliver excellent thermal insulation, adhesion, impact strength and durability across a broad spectrum of demanding installation and operating conditions.

HYPERLAST™ Syntactic DW 512/150E/200E/300E:

- Water depths to 3,000 meters (10,000 feet)
- Temperature performance up to 115°C (239°F)
- K factors of 0.145 – 0.165 W/m•K (0.084 – .095 Btu/ft/hr °F)

### Typical Properties of HYPERLAST™ Syntactic Materials

Product Name	Features	Max. Service Temp. (dry), °C	Typical Cured Density, kg/m <sup>3</sup>	Thermal Conductivity, W/m•K	Microsphere Type	Gel Time (100g at 25°C), mins
HYPERLAST™ Syntactic DW 512/150E	Flowline insulation [deepwater rated to 1,500 m (5,000 ft)]	115	790	0.145	Glass	5.00 – 9.00
HYPERLAST Syntactic DW 512/200E	Flowline insulation [deepwater rated to 2,000 m (6,600 ft)]	115	830	0.154	Glass	5.00 – 9.00
HYPERLAST Syntactic DW 512/300E	Flowline insulation [deepwater rated to 3,000 m (10,000 ft)]	115	850	0.165	Glass	5.00 – 9.00

# Protecting More Than 250,000 Field Joints On- and Offshore

## Field Jointing Systems

HYPERLAST™ FJ rigid polyurethane foam systems are designed especially for field jointing of large-diameter pipelines in conjunction with pipe-in-pipe and/or concrete weight-coated gas transmission lines. The fast curing action of HYPERLAST FJ materials helps achieve rapid cycle times of as little as 5 minutes.

The latest additions to our line of field-proven HYPERLAST FJ systems include:

- HYPERLAST FJ 125EB – high-modulus field joint coating for polypropylene line pipe
- HYPERLAST FJ 760E – fast property development (“set-up”) general purpose field joint coating
- HYPERLAST FJ 7004 – fast, robust field joint coating for concrete weight-coated pipelines

HYPERLAST FJ systems can also be used in coating subsea architecture with complex geometry. Excellent bond strength can be achieved with suitable pre-treatment of the parent coating (find additional information on primers on page 7).

## Typical Cured Densities of HYPERLAST™ Foam Systems

Product Name	Typical Cured Density, kg/m <sup>3</sup>
HYPERLAST™ FJ 4000	100
HYPERLAST FJ 4001	160
HYPERLAST FJ 4002	200
HYPERLAST FJ 7000 + GRAVEL	1,100



## Typical Properties of HYPERLAST™ FJ Systems (Solid Polyurethane Elastomers)

Product Name	Lay Technique	Features	Max. Service Temp. (dry), °C	Max. Water Depth, m	Typical Cured Density, kg/m <sup>3</sup>	Thermal Conductivity, W/m•K	Gel Time (100g at 25°C), mins
HYPERLAST™ FJ 125EB	Reel, J-lay, S-lay	High-modulus field joint	115	3,000	1,150	0.195	2.45 – 3.15
HYPERLAST FJ 543E	Reel, J-lay, S-lay	High-temp field joint – fast gel	125	3,000	1,150	0.195	2.45 – 4.15
HYPERLAST FJ 548E	Reel, J-lay, S-lay	High-temp field joint – slow gel	125	3,000	1,150	0.195	5.00 – 8.00
HYPERLAST FJ 689E	Reel, J-lay, S-lay	Reduced-settling field joint	115	3,000	1,150	0.195	2.30 – 3.30
HYPERLAST FJ 760E	Reel, J-lay, S-lay	Field joint – fast gel	115	3,000	1,150	0.195	2.30 – 3.30
HYPERLAST FJ 7004	J-lay, S-lay	Field joint – fast gel	115	3,000	1,000	0.195	2.50 – 3.30



## Protecting and Insulating Complex Subsea Architecture

### Custom Coating Solutions

The inherent flexibility and processing ability of Dow's two-component, liquid-processable polyurethane systems make them particularly useful for custom coating applications where other thermoplastic materials are difficult to apply and where adhesion to the metal surface is of paramount importance.

Available in a selection of materials to complement the parent coat and field jointing system, HYPERLAST™ custom coating materials provide reliable protection and thermal insulation for manifolds, risers, jumpers, spool pieces, Xmas trees, PLEMs, PLETs and related subsea architecture.

### Typical Properties of HYPERLAST™ Systems for Custom Coating

Product Name	Features	Max. Service Temp. (dry), °C	Max. Water Depth, m	Typical Cured Density, kg/m <sup>3</sup>	Thermal Conductivity, W/m•K	Microsphere Type	Gel Time (100g at 25°C), mins
HYPERLAST Syntactic DW 512/150E	Custom coating insulation [deepwater rated to 1,500 m (5,000 ft)]	115	1,500	790	0.145	Glass	6.5 – 8.5
HYPERLAST Syntactic DW 512/200E	Custom coating insulation [deepwater rated to 2,000 m (6,600 ft)]	115	2,000	830	0.154	Glass	6.5 – 8.5
HYPERLAST Syntactic DW 512/300E	Custom coating insulation [deepwater rated to 3,000 m (10,000 ft)]	115	3,000	850	0.165	Glass	6.0 – 8.0
HYPERLAST FJ 548E	High-temp custom coating – slow gel	125	3,000	1,150	0.195	None	5.0 – 8.0
HYPERLAST FJ 540E	High-temp custom coating – slow gel, yellow color	125	3,000	1,150	0.195	None	5.0 – 8.0

# Enhanced Interfacial Bonding

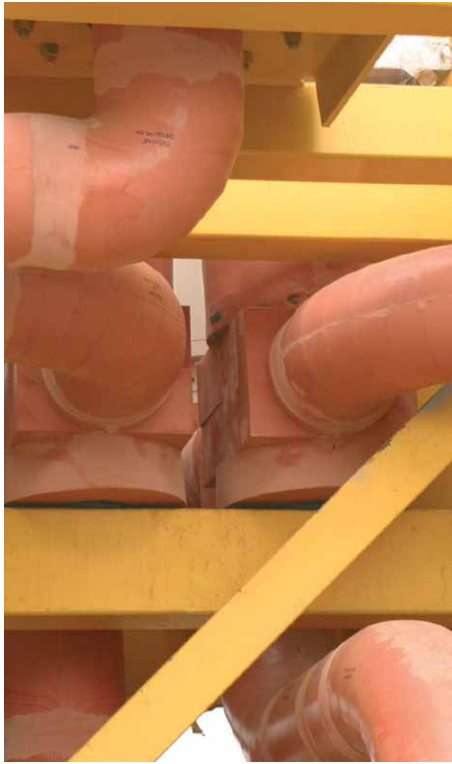
## Interface Primer Solutions

Dow offers a selection of primers for varying substrates and conditions. HYPERLAST™ Primer 4016 is used to bond PU to metal substrates. HYPERLAST Primers 9295 (standard) and 9297 (fast cure) are designed to promote the bond between GSPU and GSPU in difficult environmental conditions, such as high humidity and the inability to heat the insulation coating sufficiently to achieve an adequate bond.

Your Dow representative can provide detailed primer application guidelines to achieve the best possible bond.

## Interface Bonding Strength Test Results – Failure Mode

Relative Humidity, %	Substrate Temp., °C	No Primer	Overcoating Time, Hours	Primer 9295 Standard Cure	Primer 9297 Fast Cure
50	30	Adhesive	2	Adhesive	Cohesive
			24	Cohesive	Cohesive
50 <sup>(1)</sup>	50	Cohesive	2	Cohesive	Cohesive
			24	Cohesive	Cohesive
70	30	Adhesive	2	Adhesive	Cohesive
			24	Cohesive	Cohesive
70	50	Adhesive	2	Cohesive	Cohesive
			24	Cohesive	Cohesive
98	30	Adhesive	2	Adhesive	Cohesive
			24	Cohesive	Cohesive
98	50	Adhesive	2	Cohesive	Cohesive
			24	Cohesive	Cohesive



(1)Optimal conditions for bonding without primer.  
 Standard-cure primer: Overcoating window – 12 hours minimum to 14 days maximum.  
 Fast-cure primer: Overcoating window – 4 hours minimum to 48 hours maximum.  
 Primers used based on recommendations from Dow.

## Characteristics of HYPERLAST™ Interface Primers

Product Name	Features	Gel Time, mins	Application
HYPERLAST™ Primer 4016	Brush-applied to shotblasted pipe during field jointing and used to bond PU to metal substrates	60 – 120	Brush applied
HYPERLAST Primer 9295	Slow cure; designed to promote the bond between PU and PU in difficult environmental conditions	15 – 20	Brush applied
HYPERLAST Primer 9297	Fast cure; designed to promote the bond between PU and PU in difficult environmental conditions	<10	Brush applied



## Enabling On-Site Mixing Anywhere

### **ETNAFLOW™ Portable Mixing Plant**

Dow has developed an efficient, convenient and proven process for the occasions when conventional glass syntactic polyurethane (GSPU) on-site mixing methods are not possible or practical due to project deadlines, project size or location: the ETNAFLOW™ Portable Mixing Plant. The ETNAFLOW process offers applicators:

- Local, fresh production of HYPERLAST™ Glass Syntactic PU Flow Assurance Systems
- Safe, closed-loop technology
- Minimal energy requirements
- Optimal transportation, storage and waste reduction

The ETNAFLOW™ Portable Mixing Plant meets critical needs for coating pipes in large-scale, offshore pipeline projects:

### **Streamlined Transport of Pipe Insulation Components**

- Material is produced ready for project demands, avoiding labor-intensive reconstitution of many drums
- Customers receive the polyol in intermediate bulk containers (IBCs) and the glass microspheres in large bags
- Polyol and glass are mixed in situ, using local labor
- Critical spare parts are also shipped, ensuring reliability



Photograph courtesy of Bredero Shaw

**Allows for the Fastest Line Pipe Insulation Coating in the World**

- Set-up and installation take as little as two weeks
- Once pipes are coated, the ETNAFLOW™ plant can be disassembled, containerized and removed, usually within two weeks – leaving the environment as it was before the unit arrived

**Increases Local Content**

- The on-site formulation process of the ETNAFLOW™ Portable Mixing Plant increases local content

**Assures Safety and Quality**

- Raw materials and the final mixture are handled in a closed-loop system, helping to minimize chemical exposure and improve worker safety while providing consistent quality control
- The glass microspheres are treated gently to prevent damage to the glass

- During mixing, key quality variables are managed by an advanced process control system and recorded electronically
- The system enhances formulation accuracy, and the quality and consistency of the finished product
- Long-distance troubleshooting and process monitoring are possible through remote telemetry

**Sustainable Process**

- Optimizes project logistics such as transportation, storage and disposal by allowing raw materials and pipe coating to be moved closer to the deployment location
- Minimal electricity required
- Does not typically require additional infrastructure to be built on site
- No trace left on the site after removal of ETNAFLOW™ plant

## More Than 530 Successfully Completed Projects Worldwide – and Counting





## Your Global Flow Assurance Partner

### **Continually Innovating to Meet Evolving Industry Needs**

Over the past three decades, Dow has been serving the global oil and gas transmission market with a range of flow assurance systems and technologies, specialized chemistries and customized services.

Dow is committed to maximizing value for our customers by offering innovative, customized solutions tailored to the ever-evolving needs of the oil and gas industry. Backed by the extensive resources of The Dow Chemical Company, we offer advanced chemical innovation, intimate industry knowledge and exceptional service.

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**The Dow Chemical Company****U.S., Canada and Mexico****dowoilandgas.com**

Toll Free 800 447 4369

**Latin America** +55 11 5188 9222**Europe**

Toll Free +800 3 694 6367\*

+32 3 450 2240

**Asia Pacific**

Toll Free +800 7776-7776\*

+60 3 7958 3392

**Middle East (Dubai)** +971 4 453 7000**North Africa (Cairo)** +202 2 480 1466

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