

## GENERAL SPECIFICATION

### CORROSION

#### GS EP COR 227

**Multi-layer Glass Syntactic PP coating for wet thermal insulation of subsea pipes**

|      |         |                                    |
|------|---------|------------------------------------|
|      |         |                                    |
|      |         |                                    |
|      |         |                                    |
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## 1. Scope

This specification covers the manufacturing of multi-layer glass syntactic polypropylene coating for wet thermal insulation of subsea pipes.

This coating is to be applied over a three layers polypropylene coating (3LPP), this 3LPP being applied as per **GS EP COR 221**.

The coating shall be suitable for use from -20°C up to 95°C and for a maximum water depth of 2000 m.

Applications requiring resistance to temperatures or pressures outside these ranges have to be specifically treated via a dedicated qualification process.

## 2. Reference documents

The reference documents listed below form an integral part of this General Specification.

### External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

| Reference                            | Title                                                                                                                                                                                        |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <a href="#">EN 12496</a>             | Galvanic anodes for cathodic protection in seawater and saline mud                                                                                                                           |
| <a href="#">ISO 1133-1</a>           | Plastics - Determination of the melt-mass flow rate (MFR) and melt-volume flow rate (MVR) of thermoplastics - Part 1: Standard method                                                        |
| <a href="#">ISO 11357-4</a>          | Plastics - Differential scanning calorimetry (DSC) - Part 4: Determination of specific heat capacity                                                                                         |
| <a href="#">ISO 1183 (All parts)</a> | Plastics Methods for determining the density of non-cellular plastics - All parts                                                                                                            |
| <a href="#">ISO 12736</a>            | Petroleum and natural gas industries - Wet thermal insulation for pipeline, flowlines, equipment and subsea structures                                                                       |
| <a href="#">ISO 21809-1</a>          | Petroleum and natural gas industries - External coatings for buried or submerged pipelines used in pipeline transportation systems - Part 1: Polyolefin coatings (3-layer PE and 3-layer PP) |
| <a href="#">ISO 527-2</a>            | Plastics - Determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics                                                                                 |
| <a href="#">ISO 8301</a>             | Thermal insulation - Determination of steady-state thermal resistance and related properties - Heat flow meter apparatus                                                                     |

## Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

| Reference     | Title                                                    |
|---------------|----------------------------------------------------------|
| GS EP COR 201 | Galvanic anodes                                          |
| GS EP COR 221 | Three layer polypropylene external coating for pipelines |

## 3. Terms and abbreviations

|             |                               |
|-------------|-------------------------------|
| <b>3LPP</b> | 3 Layers PolyPropylene        |
| <b>GSPP</b> | Glass Syntactic Polypropylene |
| <b>MFI</b>  | Melt Flow Index               |
| <b>MLPP</b> | Multi Layer PolyPropylene     |
| <b>MSDS</b> | Material Safety Data Sheet    |
| <b>PP</b>   | PolyPropylene                 |
| <b>PPT</b>  | Pre Production Test           |
| <b>PQT</b>  | Procedure Qualification Trial |

## 4. Qualification of coating products and Applicator coating line

### 4.1 Coating product

All coating products to be qualified shall fulfill the requirements of Clause 5 of this general specification.

All data required in Clause 5 shall be provided by raw material manufacturer via Applicator upon Company request for review and approval.

### 4.2 Coating line

Only Company qualified coating line for 3LPP (GS EP COR 221) shall be used to coat pipes as per this general specification.

The qualification of a new coating line shall consist in a full PQT as per Appendix 1 of this general specification using qualified product as per clause 5.1 and shall be performed under Company supervision.

Once qualified, the Applicator is notified in writing. The need for new PQT is then waived.

The coating line remains qualified as long as no major modification have been implemented (the Applicator shall notify Company of such major modifications) to the line.

Company reserves the right to revoke the qualification at any time due to reported quality issues or more than 5 years without coating for Company. The Applicator is notified in written.

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The use of alternative or new coating products (complying with Clause 5.1) on an already qualified line without performing a new qualification is subject to Company approval.

The overall thickness of the coating is to be considered as it might lead to specific qualifications on a case by case basis.

A qualified line means that it can potentially meet the requirements of this General Specification using qualified raw materials. This shall be confirmed via the PPT.

## 5. Characteristics of the raw materials

### 5.1 Coating system

The Multi-layer PP coating consists of

- A 3LPP anti corrosion coating applied as per **GS EP COR 221**
- A intermediate layer of GSPP material, the thickness of which is dependent upon the thermal design requirements
- A solid PP top coat which shall comply with the relevant requirements of **GS EP COR 221**.

### 5.2 Marking and identification

All raw materials used for GSPP formulation and GSPP formulation itself shall be clearly identified with the following markings:

- Name of manufacturer
- Production plant
- Batch number
- Date of manufacture (if applicable)
- Shelf life (if applicable).

All products shall be stored as per relevant MSDS.

Special attention shall be given to storage and handling of glass microspheres.

### 5.3 Characteristic of the GSPP formulation

The GSPP material can be formulated by the Applicator. In that case, it shall be considered as the raw material manufacturer of the GSPP material. As such, he will be in charge of the following:

- Definition of a batch size of GSPP material
- QA/QC procedures for GSPP manufacture (traceability, quality control of each batch of material etc.)
- Issuance of the certificate of analysis as per clause 5.5.

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## 5.4 Technical requirements

- The glass microspheres shall be the 3M S38XHS.
- The thermal conductivity of the GSPP material at  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$  shall be lower than 0.160 W/m.K.
- The specific heat capacity of the GSPP material at  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$  shall be higher than 1300 J/Kg.K.
- A qualification report including the following items shall be sent to Company for review and approval
  - Relationship between the density of the GSPP material and the thermal conductivity (and specific heat capacity)
  - Effect of the hydrostatic pressure and temperature on the density, thermal conductivity and creep of the GSPP material up to  $95^{\circ}\text{C}$  and 2000 meter depth (for higher pressure and/or temperature, a specific qualification process will be required that is outside the scope of this specification).
- The system designer shall propose to Company for review and approval the end of life values to be used for thermal design calculations based on the results of the above qualification report.

## 5.5 Content of certificate of analysis

The certificate of analysis is issued by raw material Manufacturer with every batch of product. It reports all characteristics controlled on the corresponding batch.

The certificate of analysis shall report also the acceptable range for each of these measured value, as defined by the raw material manufacturer.

The certificate of analysis shall contain the information as reported below: