



Exploration & Production

GENERAL SPECIFICATION

SUBSEA SYSTEMS

GS SPS 008

Thermal insulation of subsea stations

01	08/03	Change of Group name and logo
00	10/02	First issue
Rev.	Date	Notes



Contents

1. Scope	3
2. Reference documents.....	3
3. Introduction	5
3.1 Responsibility.....	5
4. General requirements	5
4.1 General.....	5
4.2 Coatings protection	6
4.3 Insulation coating	6
5. Thermal insulation coating.....	6
5.1 Introduction	6
5.2 System and materials.....	7
5.3 Qualifications required	7
5.4 Qualification tests.....	7



1. Scope

The purpose of this specification is to provide the requirements for design, qualification, application and quality control of coatings for thermal insulation of subsea stations including X-Mas trees.

It also covers the thermal insulation of loose components such as valves, sensors and other components or parts on the X-Mas tree to the extent necessary to maintain the overall heat insulation requirement for the subsea station.

The insulation coating shall be qualified and well documented for the service life specified for the Project.

Some of the requirements in this document are relevant to the specific coating systems described herein only. Alternative coating systems, test methods and acceptance criteria are subject to COMPANY's approval in accordance with section 2 of this document. The level of documentation and functional requirements described in this document shall be complied with.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

This technical specification is complementary to document **GS SPS 001** and shall therefore be read in conjunction with said document and the other COMPANY specifications and standards identified herein.

Standards

The subsea piping shall comply with all relevant statutory requirements and specifications as well as all relevant ISO and other standards, unless otherwise stated by COMPANY.

Reference	Title
ASTM D395-98	Standard Test Methods for Rubber Property-Compression Set
ASTM D870-87	Practice for Testing Water Resistance of Coatings using Water Immersion
ASTM D1525-87	Test Method for Vicat Softening Temperature of Plastics
ASTM D2117-82	Test Method for Melting Points of Semicrystalline Polymer
ASTM G17-83	Test Method for Penetration Resistance of Pipeline Coating (Blund Rod)
ASTM C177-85	Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by means of the Guarded-Hot-Plate Apparatus
ASTM D1141-52	Specification for substitute ocean water
ASTM D4940	Standard test method for conductimetric analysis of water soluble ionic contamination of blasting abrasives
BS 903	Physical Testing of Rubber



Reference	Title
pr EN 10286	Steel tubes and fittings for on- and offshore pipelines. External three layer extruded polypropylene based coating
ISO 34-1:1994	Rubber vulcanised of thermoplastic - Determination of tear strength
ISO 37:1994	Rubber vulcanised of thermoplastic - Determination of tensile stress-strain properties
ISO 188:1982	Rubber, vulcanised - Accelerated ageing or heat-resistance test
ISO 527:1993	Plastics - Determination of tensile properties (Part 1 and 2)
ISO 846:1978	Plastics - Determination of behaviour under the action of fungi and bacteria - Evaluation by visual examination or measurement of change in mass or physical properties
ISO 1817:1985	Rubber, vulcanised - Determination of the effect of liquids

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	



Total General Specifications

Reference	Title
GS COR 100	Design of cathodic protection of offshore structures
GS COR 220	Three-layer polypropylene external coating for pipelines
GS COR 350	External protection of offshore and related structures and equipment by painting
GS COR 560	Physical and chemical treatment of hydrostatic test water
GS SPS 001	Design Philosophy and Requirements for Subsea Stations
GS SPS 007	Tie-In Systems
GS SPS 009	Corrosion Protection of Subsea Station

3. Introduction

3.1 Responsibility

It is the responsibility of anyone who supplies equipment to this specification to ensure and document compliance with the requirements defined in this specification, and other relevant standards and statutory requirements.

Deviations from any of the requirements defined herein shall be treated as non-conformance in accordance with relevant COMPANY procedures.

4. General requirements

4.1 General

The corrosion protection and thermal insulation coating shall be documented to give the required service life within the defined service class, by accelerated qualification testing or long-term successful service record. Long term service is understood to be 50% of required service life.

CONTRACTOR shall present a proposal for coating systems and the necessary qualification tests in order to document their suitability for the Project service temperatures between, including relevant material tests and acceptance criteria. The testing shall as a minimum include the tests described in this document.

The requirements stated in this specification apply both for base coating on factory-applied coating as well as field joint coating.

Further, CONTRACTOR shall establish production procedures describing methods for surface preparation, coating application, inspection and testing.

CONTRACTOR shall also develop specific production procedures for coating of loose components including instructions for low heat processes for temperature sensitive components.

Previous performed qualification of coating procedures and materials fulfilling the requirements and service class stated herein may be accepted based on COMPANY evaluation and

approval. The validity of previously performed qualifications requires that no major changes have been made to the processing route of the materials, the material itself or the procedures for applying the coating system.

All work associated with coating manufacturing shall be described in procedures including material properties. The procedures and material properties shall be submitted to COMPANY for approval.

4.2 Coatings protection

In case of application of a coating protection under thermal insulation, coating qualification tests shall be provided in parallel with qualification tests for thermal insulation products, in order to verify the good adhesion between the two systems.

For field joint coatings, the joint product shall have the same performance as the main coating systems. Preferably, the same material shall be retained as the base coating.

4.2.1 Thin coating system

This system may be applied under insulation system on massive elements, as X-Mas tree, valves, etc., if the adhesion test shows no influence due to the application of this system between insulation system and steel substrate.

The system is applied according to **GS SPS 009**.

4.2.2 Thick coating system

This system is applied on manifold piping under insulation system according to **GS SPS 009**.

4.3 Insulation coating

The thermal insulation coating shall be defined by the CONTRACTOR from the Flow Assurance report document. This specification will define the normal working of the effluent and the thermal transients during a shut down cycle.

From this specification, CONTRACTOR shall define the thermal insulation system (U-value and thickness).

5. Thermal insulation coating

5.1 Introduction

Thermal behaviour of the production system is of primary importance in order to:

- Avoid hydrate formation both on shut-down and when flowing
- Improve productivity as lower temperature implies higher viscosity which is already significant
- Decrease heating requirements on topsides, as the process requires the fluid to be heated at high temperature to reach the sell specifications.

Thermal requirements are of several types and depend on the selected system, i.e. heated or not. Those requirements can be divided in two kinds:

- Flowing conditions, common to all systems as heating is not used while producing
- Shutdown conditions for which the requirements differ according to the system.



The thermal requirements for flowing as well as shutdowns conditions are specified for various cases which shall cover nominal and degraded identified states.

5.2 System and materials

Heat preservation systems usually consist of an insulation material applied to the equipment. These materials may be divided into two groups, epoxy based and elastomers. Both types may be supplied as solid material or as syntactic material.

In syntactic materials small reinforcing beads are added to the base material to strengthen the material and improve the thermal conductivity.

Less conventional methods of heat preservation may be investigated and proposed. These methods are based on variations of the "Pipe-in-Pipe" principle, i.e. various ways of encapsulating (boxing in) the equipment.

5.3 Qualifications required

CONTRACTOR shall present a proposal for insulation systems and the necessary qualification tests in order to document suitability for service temperature required in the Flow Assurance report document, including relevant material tests and acceptance criteria. The testing shall as a minimum, include the tests described in section 5.4. The qualification may be accepted based on COMPANY evaluation and approval.

The procedures and material properties shall be submitted to COMPANY for approval and COMPANY may select to witness qualification procedures and other tests, with a minimum of one week notice.

5.4 Qualification tests

The following tests will be used as a basis for qualifying the insulation at the required service conditions:

- Compressibility in order to verify the materials suitability for subsea service.
- Accelerated ageing in order to verify the acceptable variations for the thermal conductivity (water absorption), the hardness, the adhesion and the resistance to cathodic disbondment. This test is based on a modified ageing test ([ASTM C 177](#)) where the values for pressure, temperature, duration and sample thickness are chosen so that it is possible to predict the materials performance for the intended service.

No specific limitation will be set but maximum of 25% in reduction may be considered as an acceptance criteria and the final choice of the material will take into account the feasibility for application on equipment and the minimum reduction obtained.