



Exploration & Production

GENERAL SPECIFICATION

CORROSION

GS COR 231

**External elastomer based coating
for risers of sea line**

02	10/04	General review, reference to GS SAF 337, transition zone
01	09/03	Change of Group name and logo
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1. Scope

This document defines the minimum requirements for an elastomer based coating. This coating is intended as external protection applied in plant for steel line pipes and fittings to be used for steel risers of submerged pipelines supported along a fixed platform.

Elastomer shall be adapted to the maximum operating temperature. Polychloroprene, EPDM or other rubbers may be proposed.

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.

Standards

Reference	Title
ISO 11124-2 to 4	Preparation of steel substrates before application of paints and related products. Specifications for metallic blast-cleaning abrasives
ISO 11126-7	Preparation of steel substrates before application of paints and related products. Specifications for non-metallic blast-cleaning abrasives: fused aluminium oxide
ISO 11127-1 to 7	Preparation of steel substrates before application of paints and related products. Methods for testing non-metallic blast-cleaning abrasives
ISO 8501-1	Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings
ISO 8501-2	Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Part 2: Visual assessment of surface cleanliness
ISO 8503-4	Preparation of steel substrates before application of paints and related products -- Surface roughness characteristics of blast-cleaned steel substrates -- Part 4: Method for the calibration of ISO surface profile comparators and for the determination of surface profile -- Stylus instrument procedure
ISO 4287	Geometrical Product Specifications (GPS) -- Surface texture: Profile method -- Terms, definitions and surface texture parameters
ISO 8502-1 to 4	Preparation of steel substrates before application of paints and related products. Tests for the assessment of surface cleanliness

Reference	Title
ISO 8502-6	Preparation of steel substrates before application of paints and related products. Tests for the assessment of surface cleanliness: extraction of soluble contaminants for analysis - the Bresle method
ISO 868	Plastics and ebonite -- Determination of indentation hardness by means of a Durometer (Shore hardness)
ISO 8503-1 to 4	Preparation of steel substrates before application of paints and related products. Surface profile of abrasive blast-cleaned steel
BS 903 A1	Physical Testing of Rubber. Part A1: Determination of Density
BS 903 A2	Physical Testing of Rubber. Part A2: Method for Determination of Tensile Stress Strain Properties
BS 903 A3	Physical Testing of Rubber. Part A3: Determination of Tear Strength
BS 903 A6	Physical Testing of Rubber. Part A6: Method for Determination of Compression Set at Ambient, Elevated or Low Temperature
BS 903 A9	Methods of Testing of Vulcanized Rubber. Part A9: Determination of Abrasion Resistance
BS 903 A16	Methods of Testing of Vulcanized Rubber. Part A16: Determination of the Effect of Liquids
BS 903 A19	Methods of Testing of Vulcanized Rubber. Part A19: Accelerated Ageing and Heat Resistance Tests
BS 903 A26	Physical Testing of Rubber. Part A26: Method for Determination of Hardness
ASTM D 1149	Test Methods for Rubber Deterioration from Surface Ozone Cracking in a Chamber (flat specimen)
ASTM G 8	Standard Tests Methods for Cathodic Disbonding of Pipeline Coatings

Professional Documents

Reference	Title
NACE RP 0274	High voltage electrical inspection of pipeline coatings prior to installation

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS SAF 337	Passive Fire Protection

3. Characteristics of the coating and the raw materials

3.1 Essential coating properties

They shall be as follows:

- Be stable at service temperature, continuous and waterproof to prevent impregnation by the surrounding electrolytic environment (pipeline in immersed zone, splash zone and emerged zone)
- Be compatible with the cathodic protection and have high resistivity so as to have appropriate electrical resistance at the application thickness
- Have good adherence to the metal to avoid the spread of accidental defects of continuity
- Have excellent behaviour to ultraviolet rays
- Have good inertia:
 - To chemical and biological agents in the water or resulting from corrosion or cathodic protection reactions
 - To the products transported, that is, to hydrocarbons in the event of accidental leakage.
- Have good resistance to mechanical and thermal stress generated by movements relative to the environment and the pipe line, during handling, transportation, installation and hydrostatic tests.
- Have fire and jet fire resistance as per GS SAF 337, paragraph 7.9
- Special care shall be taken as to prevent possible corrosion at transition zone between coating and upper limit of splash zone. This transition should be located at level where inspection is convenient.

3.2 Characteristics of the raw materials

All raw materials shall be stored before use as per MSDS of manufacturers.

All materials shall be provided with conformity certificate (this is a document issued by raw material manufacturer. It is a list of physical or chemical characteristics controlled for every production batches. For each of these characteristics, a conformity range is reported by the manufacturer).

All material batches shall be provided with their certificate of analysis (this is a document issued by raw material manufacturer with every batch of product. It reports all characteristics controlled on the corresponding batch. The content of certificate of analysis shall be equivalent to the conformity certificate, except that measured values shall be reported instead of conformity ranges).

When submitted during qualification, the company reserves the right to ask for changes with regards to manufacturer's specification ranges in certificate of conformity for each characteristic.

4. Coating application

4.1 Coating system qualification

Qualification tests shall be carried out by the CONTRACTOR who shall provide technical qualification documents for the coating including:

- Certified copies of the reports on the tests to check the physical and chemical properties and the behaviour of all products used (including certificate of conformity and certificate of analysis)
- Detailed specifications of the products to be used and instructions for handling and application (for each layer)
- Expected final properties and manufacturer recommendation as per Table 1

All products, application procedure and final properties of Table 1 shall be approved by the company before coating application begins.

The coating shall have, as a minimum, the following layers:

- A primer applied to the steel to provide corrosion protection and adhesion to the subsequent coating. Care should be taken for proper atmospheric conditions, open time and thickness (to provide full coverage), which shall be 60 microns minimum. A cathodic disbondment test shall be provided to ensure its proper application and characteristics.
- A bonding agent or intermediate layer to ensure adhesion between primer and top coat. Care should be taken for proper atmospheric conditions, open time and thickness (to provide full primer coverage). Adhesion tests shall be provided as to ensure proper application and characteristics of the bonding layer.
- A rubber coat, to ensure proper mechanical and weathering resistance in addition to fire and jet fire protection.

4.2 Surface preparation

- Before abrasive blasting, the line pipes and accessories surface shall be inspected and cleaned to remove all traces of oil, grease and loose deposits. Any visible trace of oil or grease shall be removed using an appropriate non-oily and non-toxic product.
- If line pipes and accessories have been in contact with marine or industrial atmosphere, they shall be cleaned before abrasive-blasting to remove any contamination. Cleaning

shall be carried out using an adapted process. Salt contamination shall be lower than 2 micro grams per square cm as per [ISO 8502-6](#)

- All line pipes and accessories shall be preheated (40 to 70°C) before abrasive blasting. Temperature shall be checked continuously with infra red camera.
- The surface shall be blast cleaned to A or B Sa 3 as per [ISO 8501-1](#)
- The grit shall be selected so that the average roughness Ry5 (as per [ISO 4287](#)) obtained ranges from 60 to 90 microns (as per [ISO 8503-4](#))
- Immediately after abrasive blasting, all dust and traces of abrasives shall be removed from the pipe surface by brushing and vacuum cleaning. Maximum acceptable level shall be 2 according to [ISO 8502-3](#).
- Each cleaned line pipes and accessories shall be inspected for surface defects. Any defect shall be removed.
- Cleaned line pipes and accessories shall then be coated before degradation of surface preparation. They shall not be left in a moist and/or salt contaminated atmosphere. The metal temperature shall be 3°C above the ambient dew point temperature. Any line pipes and accessories which have not been coated before degradation of their surface preparation shall be completely re-blasted before coating.

4.3 Coating application

Application procedure shall be provided by CONTRACTOR to COMPANY for approval during qualification stage (see 4.1). Once approved by COMPANY, the procedure and product used shall not be changed without formal approval by COMPANY.

Special care shall be taken as to make sure atmospheric conditions are acceptable (10°C minimum and 75% humidity maximum, steel temperature 3°C above dew point) and no stop in the continuation of coating application has happened. In case the overcoat time between layers exceed the manufacturer recommendation, test results shall be provided as to ensure the proposed procedure to re activate the surface ensure equivalent adhesion and characteristics as in a continuous process. Failure to do so will lead to the rejection of the coating. Vulcanization condition and parameters shall be continuously recorded.

Repairs: The method of repair used to correct faults found during factory inspections shall be submitted to the Company's approval.

4.4 Transition zone

Transition zone corresponds to the junction between the riser coating and the paint system of pipeline at upper level of the splash zone. Special care should be taken as to prevent any corrosion or damage in that zone:

- The location of this zone shall be at a level accessible for later inspection, out of any supporting clamp
- A smooth bevel of the riser coating shall prevent disbanding and penetration of water
- A compatible heat shrinkable sleeve or equivalent shall be applied at the transition zone to prevent water ingress between the two coating types. Adhesion values at maximum service temperature on the two coatings shall be documented.

4.5 Required thickness

The thickness shall ensure proper mechanical protection together with fire and jet fire resistance as per **GS SAF 337**.

4.6 Coating characteristics

The properties required for the coating obtained are given in the table 1.

Table 1: Characteristics of final coating

Properties	Standard	Values
Visual inspection		No defects or damages
Shore A	ISO 868	65 +/-5
Thickness		12 mm mini
Holiday test (4kV/mm, 30 kV max)	NACE RP 0274	No Holiday
Hammer test	Manufacturer	No voids
Adhesion test	Manufacturer	10 N/mm mini, cohesive failure. No disbanding to the steel
CD test 28 days at 23°C	ASTM G8	< 5 mm
CD test 48 hrs at 65°C	ASTM G8	< 2 mm
Ozone resistance	ISO R1431	>80
Heat ageing (7 days at 100°C)	ISO R188	Hardness change <10%
Fire and jet fire resistance	GS SAF 337	Conform

4.7 Inspection of the coating process and tests

The inspections shall be performed in accordance with the "frequency of inspections" given in appendix 1.

5. Repairs

Repair procedures shall be approved by the COMPANY.

5.1 Minor repairs for 20 cm² maximum surface defects

Minor surface flaws up to 3 mm in depth shall be repaired using a self curing mix that is compatible with the elastomer coating.

Before application, the damaged coating surface shall be lightly abraded and cleaned with solvent.

5.2 Other repairs

The faulty coating shall be cut back to the metal. The steel surface shall be roughened by a sanding disc and the coating lightly abraded.

Primer and adhesive coats shall be applied according the procedure.

After these preliminary operations, the coating shall be restored with a minimum overlap of 20 mm on each side of the repaired area.

These repaired areas shall be covered with a nylon film. Vulcanization shall be performed as for plant vulcanization.

Inspections and tests shall be performed in accordance with the requirements in the appendix.

6. Field joint coating procedure

This shall be approved by the COMPANY and shall include:

- Surface preparation of steel surfaces and plant coating
- Application of the different coats: primer, adhesive, elastomer in thickness no greater than the thickness of plant coating
- Elastomer vulcanization: temperature, duration
- Inspections to verify coating conformity, and in particular Shore hardness, holiday detection and hammer tests.

7. Quality assurance procedures

7.1 Design

Before the start of the fabrication, a Quality Plan must be drawn up by the CONTRACTOR, detailing all the procurement, fabrication, inspection and acceptance testing procedures.

These shall be described in "detailed procedures".

7.2 Qualifications

Coating procedure and materials shall be approved by the COMPANY.

7.3 Quality control

The CONTRACTOR shall establish a Quality Plan according to the check list in the Appendix.

During coating application, the CONTRACTOR's Quality Control department shall carry out measurements, tests and inspections as described in this document. The results of these shall be recorded.

Coating application and the tests listed in the Appendix 1 shall be carried out in the presence of the COMPANY or his representative.

7.4 Nature and frequency of measurements, tests and inspections

As given in the Appendix 1.

7.5 Marking

The marking shall be applied to each line pipe by suitable means with a durability compatible with the planned works. The marking details to be used are described in the contractual Job specification.

7.6 Technical file

The technical file submitted by the CONTRACTOR at the end of the coating work shall include:

- Line pipe characteristics, a complete list of all line pipes coated
- Line pipe coating type and thickness in plant
- Quality plan
- Data sheets of products used, with their test certificates
- Test, inspection and final acceptance reports
- Repair procedure.

8. Handling, transportation and storage

The coated line pipes must be handled using leather, webbing or rubber slings and must be carefully stored to avoid any damage to the line pipe coatings and the chamfers.

The use of slings made of steel or hemp or any material that can shape the line pipe coating is strictly forbidden.

The coated line pipes must be stored so as to avoid any damage to the coating (on sandy, stone-free ground or on wooden staging). The line pipes must be separated by wooden wedges.

Appendix 1 Nature and frequency of tests and inspections

Description	Qualification	Production
Raw materials (certificate of conformity as per 3.2)	All raw materials	All raw materials
Raw materials (Certificate of analysis as per 3.2)	All raw materials	All raw materials
Surface preparation as per 4.2	All pipes	All pipes
Application procedure as per 4.3	All pipes	All pipes
Coating appearance (visual)	All pipes	All pipes
Coating thickness	All pipes	All pipes
Shore hardness	All pipes	All pipes
Adhesion test	All pipes	Once per shift
Holiday detection	All pipes	All pipes
CD test	One pipe	One pipe
Hammer test	All pipes	All pipes
Ozone resistance	Test certificate	N/A
Heat ageing	Test certificate	N/A
Fire and jet fire resistance	Tests certificate	N/A