

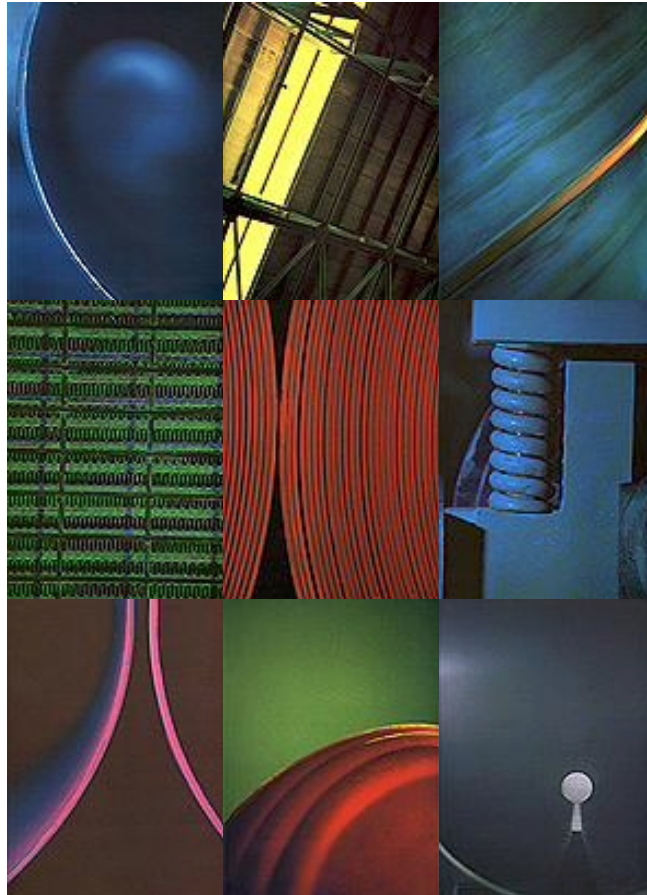
# External Three Layer Extruded Polyethylene Based Coatings for On-Shore and Off-Shore Steel Linepipes



*Revision 0*

*An Uncontrolled Copy*

DATA Steel Pipe Industries



Date: June 30, 2000

Written by:

Reviewed by:

Approved by:

## **Table of Contents**

<b>1</b>	<b>SCOPE .....</b>	<b>1</b>
<b>2</b>	<b>REFERENCES .....</b>	<b>1</b>
<b>3</b>	<b>SUMMARY OF PHYSICAL PROPERTIES OF THE COATING SYSTEM (AS PER DIN30670) .....</b>	<b>1</b>
<b>4</b>	<b>APPLICATION PROCEDURE.....</b>	<b>2</b>
<b>5</b>	<b>CUT-BACK .....</b>	<b>3</b>
<b>6</b>	<b>INSPECTION &amp; TESTING .....</b>	<b>3</b>
<b>7</b>	<b>MARKING OF COATED PIPE .....</b>	<b>4</b>



## 1 Scope

This specification defines the application of factory applied external three layer extruded polyethylene based coatings for the corrosion protection of pipes and pipeline components.

External extruded polyethylene coating can be used for the protection of buried or submerged pipes service at temperatures up to +50 °C when supplied with normal type coatings (N). Higher temperature and/or higher mechanical requirements may demand special types of PE.

The coating in this specification can be applied to longitudinally or spirally welded and to seamless steel tubes and components used for the construction of pipelines for conveying liquids or gases

### 1.1 Definitions

**Applicator** - The contractor who applies the coating to the pipe.

**Company** - The purchaser of the coated pipe or the entity for whom the Applicator coats the pipe.

**DSPIL** - DATA Steel Pipe Industries (Pvt.) LTD.

**SSPC** - The Steel Structures Painting Council.

**NACE** - NACE International.

**NAPCA**: National Association of Pipe Coating Applicators.

**Manufacturer** - The company that makes the coating materials which are applied to the pipe.

## 2 REFERENCES

This specification makes reference to the latest additions of the following standards. In case of conflict, the requirements of this specification shall have precedence.

**ASTM G 8-90**: Test method for cathodic disbonding of pipeline coatings

**ASTM D638**: Standard test method for tensile properties of plastics

**DIN 30670**: Polyethylene coatings for steel pipes and fittings.

**ISO 306**: Plastics-determination of Vicat softening temperature

**ISO 527**: Plastics-Determination of tensile properties

**ISO 1133**: Plastics-Determination of the melt mass-flow rate and the melt volume-flow rate of thermoplastics.

**ISO 1515**: Paints and varnishes-Determination of volatile and non-volatile matter

**ISO 2555**: Plastics-Determination of apparent viscosity by the Brookfield Test Method

**ISO 2808**: Paints and varnishes-Determination of film thickness

**ISO 2811**: Paints and varnishes-Determination of density.

**ISO 3001**: Plastics-Determination of epoxy equivalent

**ISO 4287-1**: Surface roughness-Part 1: Surface and its parameters

**ISO 8501-1**: Preparation of steel substrates before application of paints and related products

**ISO/CD 11420**: Plastic pipes and fittings-Method of test for carbon black dispersion in polyethylene pipes and fittings.

**ISO R.1183**: Methods for determining the density and relative density of non-cellular plastics

## 3 Summary of physical properties of the coating system (as per DIN30670)

Property	Requirements	
	Normal type (n)	Reinforced (v)
Min. thickness D ≤ 114.3 114.3 < D ≤ 273 273 < D ≤ 508 508 < D ≤ 762 D < 762	1.8 mm 2.0 mm 2.2 mm 2.5 mm 3.0 mm	2,5 mm 2,7 mm 2,9 mm 3,2 mm 3,7 mm
Continuity	Free from holidays, the test voltage shall be 25 kV	
Peeling resistance	At 23 ± 5 °C: at least 35 N/10 mm At 50 ± 5 °C: at least 15 N/10 mm for type N coatings, at least 25 N/10 mm for type S coatings	
Impact resistance	Impact energy shall be equal to 5 J per mm coating thickness. The test temperature shall be 23±2? C Nominal size: D > 219.1                      1,00	
Indentation resistance	At 23±2 °C, shall not exceed 0.2 mm for type N coatings At 50±2 °C, shall not exceed 0.3 mm for type N coatings At 70±2 °C, shall not exceed 0.3 mm for type S coatings	
Elongation	At least 200%	
Coating resistivity	RS value after 100 days shall be greater than 10 <sup>8</sup> O.m <sup>2</sup> The ratio of resistivity after 100 days to that after 70 days shall not be less than 0.8, provided the resistivity is only one power of 10 above that specified for 100 days of conditioning	
Thermal stability	Deviation not more than 35% of original value	
Stability against U.V.	Deviation not more than 35% of original value.	
Resistance to cathodic disbondment	At 23±2 °C maximum 10 mm	

**Table 3-1**



## 4 Application procedure

### 4.1 Surface preparation

**4.1.1** Pipe and components shall be abrasive blast cleaned. The degree of cleanliness shall be Sa 2 ½ in accordance with ISO 8501-1.

**4.1.2** Prior to abrasive blast cleaning, the steel surface shall be dry and free from contamination (oil, grease, temporary corrosion protection, etc.) and surface defects (slivers, laminations, etc....) detrimental to the surface or to the adhesion of the coating. The blast-cleaned surface shall have a roughness Rz between 40 µm and 90 µm, as measured in accordance with ISO 4287-1.

**4.1.3** After blast cleaning, the surface of the pipe shall be inspected. All slivers, laminations, weld spatter and other surface imperfections made visible by the blast cleaning process shall be removed. After removal of these defects, the residual thickness of pipe and components shall satisfy the minimum tolerance requirements specified by the relevant standard. All treated areas greater than 10 cm<sup>2</sup> shall be prepared to provide a profile to satisfy the provisions of 4.1.

**4.1.4** Pipe and components shall be maintained at least 3 °C above the dew point temperature prior to coating.

**4.1.5** Contaminants (e.g. residual abrasive dust) shall be removed prior to coating. Chemical treatment of the steel may be used in addition to abrasive blast cleaning, by agreement.

**4.1.6** The temperature holding time of the pipe shall not result in oxidation of its surface, detrimental to the good quality and adhesion of the coating. At the time of application, the temperature range at the surface of the pipe to be coated shall be determined in agreement with the manufactures of the products. The temperature of the pipe shall be monitored using suitable means in order to make sure that the application conditions are fully satisfied.

### 4.2 External Coating Application

The principle of this coating shall consist of three layers.

The coating in the factory shall be applied in accordance with the established procedure.

The data sheets of the used materials shall contain the items required in table 2.

Prior to the application the pipe shall be heated according to the material specification of the manufacturer.

#### 4.2.1 Layer 1

Immediately after abrasive blast cleaning the layer shall be formed by a film of liquid epoxy or resin of powder. The minimum dry thickness shall be between 20 and 60 microns checked in accordance with method 5 of ISO 2808 depending on the primer used. The thickness may be subject to agreement by the customer, and to the conform manufacturers recommendations.

#### 4.2.2 Layer 2

A polymer intended to provide adhesion between layers 1 and 3 and be compatible with those layers shall form this layer. The minimum thickness shall be between 140 and 200 microns depending on the type of adhesive and the

application. The thickness may be subject to agreement by the customer, and conform to manufacturers recommendations. The thickness shall be uniform and the minimum thickness shall make it possible to satisfy the tests specified in Section 8.

#### 4.2.3 Layer 3

Polyethylene coating shall form this layer. The thickness shall be uniform and the minimum total thickness shall satisfy the requirements in table 3-1.

Pigments and additives may be added to the basic polyethylene, provided that all the required properties of the coating are obtained. The pigments shall be dispersed uniformly.

When the coater adds pigments and additives to the basic polyethylene, the required properties must be certified by a documented quality programme. The following tests shall be undertaken as a minimum:

- quantitative analysis of the raw-material components immediately before coating;
- determination of dispersion of pigments and additives in accordance with ISO/CD 11420

### Content of data sheets and certificates

+ Technical data sheet

o Test certificate

Items	Standard test reference	Layer 1		Layer 2	Layer 3
		Powder	Liquid		
Date of issue		+o	+o	+o	+o
Name of manufacturer		+o	+o	+o	+o
Name and type of product		+o	+o	+o	+o
Factory of origin		o	o	o	o
Batch for production lot number		o	o	o	o
Shelf life		+o	+o	+	
Epoxy equivalent	ISO 3001		+o		
Physical state delivered product		+	+	+	+
Packaging		+	+	+	+
Storage conditions		+	+	+	+
Sieve analysis or viscosity		+o	+o	+o	
Density	ISO 2811 primer ISO R. 1183 adhesive and	+o	+o	+o	+o



	PE				
Melt index	ISO 1133			+0	+
Processing temperature				+	+
Content of pigment	ISO/CD 11420			+0	+0
Dispersion of pigment	ISO/CD 11420			+0	+0
Temperature range of coating		+	+	+	+
Tube service temperature		+	+	+	+
Elongation at break	ISO 527			+	+
Maximum moisture content		+0	+0	+	+
Infra red		+0			
Gel time		+0			
Cure characteristics		+0	+0		
Viscosity of base and hardener	ISO 2555		+0		
Volume solids base and hardener	ISO 1515		+0		
Softening point	ISO 306			+0	+0

Table 4-1

## 5 Cut-Back

### 5.1 Cut back at the ends

The length of the cut back shall be 150 mm ± 20 mm and the coating shall be bevelled at the back forming a bevel angle of ≤ 30° unless otherwise specified by the purchaser.

When removing the coating, the tube surface shall not be damaged.

## 6 Inspection & Testing

### 6.1 Material Inspection

6.1.1 Independent laboratory test certificates for the coating system shall be provided by the applicator. The certificates shall include adhesion testing, water absorption, water vapour transmission, insulation resistance, tensile strength, elongation, impact resistance and penetration resistance.

### 6.2 Plant Inspection

6.2.1 The company may employ the service of inspectors as it shall deem appropriate to undertake the required inspection and test of the coating applied under the specifications. The inspection of the coated pipe shall be

performed by coating inspectors qualified either by experience or certified training.

6.2.2 The company coating inspectors shall have access, while the application of the coating system is being performed, to all parts of the application plant concerned with the storage, application, inspection, testing and training of coated pipe and material.

6.2.3 All inspections shall be made at the application plant prior to shipment of coated pipe and shall be conducted as not to interfere unnecessarily with the operation of the coating plant. If required, the company inspector shall be present at all times when work is in progress.

6.2.4 Coated pipe not complying with these specifications shall be rejected and re-coated at the expense of the applicator.

6.2.5 The coated system shall be electrically tested for flaws in the coating with a suitable holiday detector as approved by the Approved Manufacturer.

6.2.6 The holiday inspection shall be performed on the total coating system. The total coating system shall be electrically inspected on the kick-out racks after water quenching. The voltage setting for the total system shall be based on DIN 30670.

6.2.7 All holidays electrically detected shall be repaired. The affected area shall be repaired to an approved procedure and retested.

## 6.3 Quality Plan

6.3.1 The applicator shall prepare a detailed quality plan for Company approval. The plan shall include all activities of the coating process in a chronological manner showing the frequency of control, the acceptance limit, the governing code and whether document or report is produced for that activity.

6.3.2 As a minimum, the following quality aspects must be endorsed:

Properties	Method of Test	Minimum Production Control
Surface condition before blasting	Visual	every pipe
Dimensions, shape and properties of blast cleaning products and checking of the blast cleaning process		twice per shift
Roughness of the blast cleaned surface	-	one per shift
Surface preparation	Visual	100% inspection
Temperature of heating before coating		continuously
Appearance and continuity	Visual	every pipe



Thickness testing	DIN 30670	on one pipe every 25 coated pipes
Cut back	Visual	every pipe
Holiday inspection	DIN 30670	100% of all pipes incl. mill pipes
Impact resistance	DIN 30670	one per order
Adhesion test	DIN 30670	on one pipe each 100 coated pipes
Indentation test	DIN 30670	<sup>1)</sup> to be conducted three times, one at production start, at end of the job and when the order is 50% completed
Electric resistance <sup>2)</sup>	DIN 30670	Once per order
Elongation test	ISO 527	once at the start of the work
Stability against U.V. <sup>2)</sup>	DIN 30670	once per order
Thermal stability	DIN 30670	once per order
Resistance to cathodic resistance	ASTM G 8-90	by agreement

- Process of manufacture (seamless: SMLS - electric resistance welder: ERW - submerged arc welding: SAW).

**Table 6-1**

The system and applicator approval may be combined with a coating production run.

- Any pipe from the beginning to the end of the production may be used for this test.
- The delivery of pipes can be undertaken prior to the completion of the test.

## 7 Marking of coated pipe

Each joint of coated pipe shall be marked by the coating applicator on the outside surface of the coating starting a minimum of twelve (12) inches from the bevelled end of the pipe.

Marking shall be stencilled on the coated pipe utilizing a waterproof permanent type paint or ink, which will not rub off when the coated pipe is handled.

The marking shall be legible from a distance of five (5) to six (6) feet with letters no less than one quarter (1/4) inches high.

Marking shall be in English and in the following sequence, regardless of previous markings on the inside or outside surface of the bare steel pipe.

- Pipe manufacturer's name
- Pipe identification number
- Outside diameter measured in inches
- Wall thickness measured in inches
- Grade of pipe

**DATA**  
STEEL PIPE  
INDUSTRIES



**HEAD OFFICE**  
IBRAHIM BUILDING  
20, WEST WHARF ROAD  
KARACHI 74000, PAKISTAN  
TEL: +92 (21) 231 3685  
FAX: +92 (21) 231 0422  
E-MAIL: [sales@datasteel.com](mailto:sales@datasteel.com)

An Uncontrolled Copy

Factory  
7 K.M.S. KLP Road  
Sadiqabad, Dist. Rahim Yar Khan  
Pakistan

Phone: +92 (702) 74406  
Fax: +92 (702) 74405  
Email: [factory@datasteel.com](mailto:factory@datasteel.com)