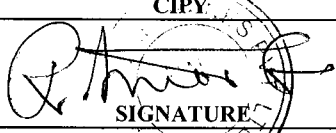
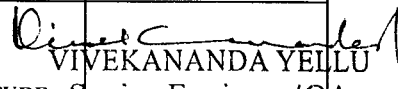




CIPY POLYURETHANES PVT. LTD.

PROCEDURE FOR INTERNAL BLASTING & POLYURETHANE COATING OF INTERNAL SURFACE OF STEEL PIPES

PROJECT	SIKKA Power Project (2 X 250 MW)
CLIENT	SIKKA
CONTRACTOR	BHEL, Piping Centre
DOCUMENT NO.	CPPL/BHEL/SIKKA/PROC/01
REVISION NO.	0
REVISION DATE	20/12/12

PREPARED BY	VERIFIED BY	APPROVED BY
CIPY		BHEL
 SIGNATURE	 SIGNATURE	 VIVEKANANDA YELLU SIGNATURE Senior Engineer/QA
DATE: 20/12/12	DATE:	DATE: BHEL/Piping Centre Chennai-600 017.

	CLIENT	—	CONTRACTOR	BHEL , Piping Centre
	PROJECT	SIKKA		
Cipy Polyurethanes Pvt. Ltd	TITLE	PROCEDURE FOR 100% SOLID-TWO COMPONENT ELASTOMERIC POLYURETHANE COATING FOR STEEL PIPELINE IN CONTACT WITH SEA WATER		
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1.0 SCOPE

This procedure covers the materials (paints), application and procedure for internal lining of pipes with Durathane 100 EAB- 100% Solid Elastomeric Polyurethane Co

2.0 REFERENCES

a) BHEL Specification no PC:E:PU:001 Rev 00

ISO 8501-I Preparation of steel substrates before application of paints and related products Visual

b) Assesment of Surface Cleanliness

SSPC-PA-2 Paint Application Specification No. 2 - Measurement of dry film thickness with magnetic gauges.

d) ASTM D 4541 - Method of pull off strength of coatings using portable adhesion tester.

3.0 RESPONSIBILITY

Supervisors shall be responsible for coating and painting equipment maintenance & operation, quality assurance of paint application.

4.0 Coating Material Storage Conditions

All incoming materials to be used in the coating shall be certified by the manufacturer, according to the required standards by means of test certificates for each material. Test Certificates will be made available to Clients for verification and records. All paints shall be checked for the following basic information, Viz:

- Manufacturer's Name
- Batch No. & Qty.
- Date of Manufacturing.
- Shelf life

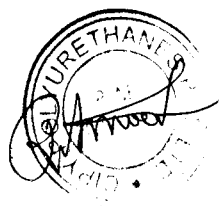
Visual inspection shall be carried out on both the components of paints when it is opened for use.

Acceptability :

Uniform Colour, homogeneous, No floating foreign material .

Material found with non-uniform colour, lumps, floating foreign material etc not to be used


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5.0 PROCESS PROCEDURE

5.1 PIPE RECEIPT

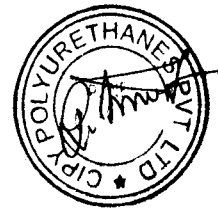
All the bare pipe shall be checked at the point of receipt for painting visually and receipt record maintained.

5.2 SURFACE PREPARATION

The surface preparation of the internal surface is to be carried out at the place where pipes are made available for painting . Visual inspection is performed on each pipe so that steel surface shall be free of water, oil , grease and other kind of contamination . Any Pipe found with contaminant shall be removed and cleaned in accordance with SSPC-SPI with thinner or tetrachloro ethylene and shall be blasted after drying.

The cleaned internal surface shall be blasted using steel grits /shots/ non -metallic abrasive to a grade of SA 2 1/2 as per pictorial representaion of ISO 8501-1 or SIS-055900 or SSPC SP-10/ NACE No.2 near white blast cleaning. Thus a near white blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale , rust -coating , oxidized ,corrosion products and other foreign matter except for staining, light shadows, slight streaks or minor discolourations caused by stains of rust , stains mill scale , mill of fabrication marks, heat treating/heat effected zones and differences in blast pattern. Roughness / anchor profile shall be 50 to 100 micron peak to trough and shall be checked for each pipe length randomly by profile gauge /comparator & for future record Press-O-Film shall be used @ one number for 100sqm approx.. If any defects like silvers or fins are exposed after blast cleaning filing or grinding shall remove the same . Care shall be taken so that the surface shall not be blued.


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Steel grit/copper slag shall be checked visually for contamination of impurities like dust, dirt etc . The blower used for cleaning of the substrate shall be checked twice per shift for water contamination . Care shall be taken to avoid water contamination in blowed air .by providing water traps / seperators . The blasted pipes shall be taken up for coating application at the earliest (< 2hr.). In case of some time lapse between blasting and coating,if the surface oxidation occurs it shall be re-blasted .

In addition to the above requirements, the pipe surface shall be at least 3 deg C above the dew point.

After blast cleaning all dust , residues and debris left at the surface shall be removed by brushing or dry blowed air from one end and inspected.

5.4 APPLICATION

Primer - ACPC 60 - Two component Polyurethane Coating shall be applied using single component airless spraying equipment. (Minimum curing time of Primer is 6 hr and maximum time gap between primer application & top coat is 48 hr.). Primer shall be applied using single componenet airless spray after mixing Part A and Part B of ACPC 60 thoroughly and letting air bubble escape by allowing the mix to stand for few minutes before starting spray application. As the surface profile is 50 to 100 micron, application of primer would be done on volume (of material) : area(of application) based consumption to get the desired DFT.

Top Coat -Internal lining of Durathane 100 EAB shall be carried out by plural feed airless spraying method over primer applied surface. Flanged pipes shall be painted for the full length including flange joint. In case of welded joints, on each end of the pipe 75 mm to be kept unpainted for field joint and painting after welding. In this method, the base component (if ambient temperature is below 20 deg C) shall be heated using either of the combination of the following methods:

- 1) The base component shall be heated with individual drums heaters/ induction heaters attached with agitator to ensure uniform heating. OR
- 2) The base shall be heated using in-line heaters fitted to the line.

The base and activator shall be pumped seperately to the airless 3:1 proportioning pump and re-circulated either through the base and activator containers or back into the tank.

Application of paint on smaller components may be done manually , ensuring the mixing of base and activator in prescribed proportions.

The coating shall be applied to a dry film thickness (DFT) of a minium of 2000 microns. The thickness shall be measured randomly at 5 points minium along the length of the pipe .Waviness (undulations / ripples) , and /or minor amount of sagging , dimpling and curtailing shall not be considered cause of rejection.


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The coating shall not be applied when:

i) The relative humidity exceed 85% or the surface temperature is less than 3deg C above the dew point.

ii) The surface temperature is below 7 deg C and

iii) The surface temperature is above 40 deg C

To prevent wind blown or sand from sticking on the wet film coating , polythene sheet shall be tied at the ends.

6.0 INSPECTION & TESTING

All inspection and testing shall be carried out by site supervisor/ experienced personnel.

6.1 COATING THICKNESS

Thickness of the dry film shall be checked using magnetic thickness gauge or digital thickness gauge like Mikrotest, Elcometer etc. which shall be calibrated once every shift . Dry film thickness of the coating shall be minimum 2000 micron. Wet film thickness of the coating shall be monitored to ensure the expected dry film thickness of the coating . Thickness shall be randomly checked at 5 points on the pipe body per one pipe length or 100 sq m.

6.2 HARDNESS (Drometer)

Cured film (7 days) shall be tested for hardness using Durometer (Shore D) as per ASTM D 2240 with the same frequency as the adhesion test.

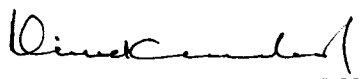
6.3 HOLIDAY DETECTION

Holiday detection shall be carried after 100% curing (7 days)of the coating on all pipes as per NACE RP 0188-90. The voltage shall be set to 5 volts per micron of coating thickness and shall be set by detecting a deliberate pinhole in the coating at a location where the coating is at least 2000 micron. The calibration of holiday detector shall be done once per shift.

All holiday shall be marked and repaired manually and the repair area shall be holiday tested.

6.4 ADHESION

The test shall be carried out in accordance with ASTM D-4541 (Elcometer Pull Off) on fully cured (7 days) coating. One test would comprise 3 reading from randomly selected spots per 500 sq mtr. of surface area. Average of three reading shall be at least 10 N/sq mm. Pull off adhesion shall not be checked on the pipe body (being a curved surface) but on representative flat surface per 500 sq m. of coated surface. Pull -off adhesion shall be checked only on flat surface in line with clause no 6.1.1 of ASTM D 4541


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The following protocol shall be used for determining Adhesion Test Success/ Failure

Elcometer Reading	Type of Failure		Result /Conclusion
>10N/ sq mm	T 1	90% or more of break at coating-steel surface interface	Coating meet adhesion criteria. Take actual reading of bond strength.
	T 2	90 % or more of break at coating-steel dolly interface.	Coating meets adhesion criteria . Glue failure.
< 10 N/ sq mm	T 1	90% or more of break at coating-steel surface interface.	Coating does not meet adhesion criteria. Repeat test after 7 days (considering that due to some reason full curing has not occurred) . If adhesion still fails, remove and recoat.
	T 2	90 % or more of break at coating-steel dolly interface.	Glue failure . Allow more curing of glue/ replace glue & retest.

In the event of conclusive adhesion test not being made by the portable Elcometer on account of failure of epoxy adhesive or due to the curvature of the duct, circular steel coupons of 32 mm dia 3-4 mm thickness or M.S plate of 3 mm or more thickness (e.g 150X150 mm) shall be coated for 2000 micron thickness and sent for laboratory testing at IICT, Hyderabad. Such sample coated surface shall be done thrice in the entire duration of the execution at site . One sample to be taken on the initial , other in the middle & rest at the end of the job execution


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7 STORAGE OF PAINT MATERIALS (Paints , thinner etc.)

All the materials shall be stored in a well-ventilated store free from excessive heat, sparks, flames and direct sunlight.

8 OVER COATING

In the event that the coating thickness has not been achieved, or large areas of the pipe coating are not acceptable (e.g. runs, drips, or missed areas due to spray blockage) but where the coating bond is sound, the pipe shall be repaired as follows:

- High coats (excessive runs & drips) shall be removed using power disc sander.
- The prepared area shall be re-coated either manually or by machine.

9.0 REPAIR PROCEDURE

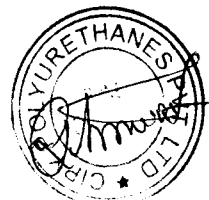
Types of repair generally required at site are classified under three heads:

- Repair necessitated by film discontinuities / holday where substrate is not visible.
- Areas where steel surface is exposed due to adhesion testing or mechanical damage.
- Areas of insufficient thickness.

9.1 Repairs Necessitated By Film Discontinuities / Holidays Where Substrate is not visible.

- Wipe clean the marked area, plus an area of 150 mm around , using solvent (MEK/ thinner) & a clean cloth . Allow it to dry.
- Abrade using emery cloth the marked area and also an adjacent area of 25 mm all around for overlap. Clean the surface again to remove dust of abraded particles.


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iii) Apply using brush/ squeegee Durathane 100 EAB (slow setting type- more pot life)mixed in small quantity in proper proportion (3:1) to the discontinuity & required overlap restricting the application to abraded area only.

9.2 Areas where Steel Surface is Exposed Due to Adhesion Testing or Mechanical Damage.

i) Wipe clean the marked area, plus an area of 75 mm around , using solvent & a clean cloth . Allow it to dry.

ii) Abrade & feather the edges using power tool also abrading 25 mm all around the damage area of the intact coating .

ii) Blast clean / buffing the exposed steel . During blasting/buffing the adjacent coated area (75mm) also to be abraded for coating overlap.

iii) Prime the exposed steel substrate with ACPC 60 and allow it to dry followed by application using brush/ squeegee Durathane 100 EAB (slow setting type - more pot life) mixed in small quantity in proper proportion (3:1) to the primed area and the overlap area taking care that the application is restricted upto abraded area only.

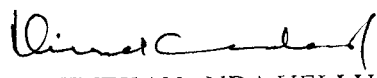
9.3 Areas of Insufficient Thickness

i) Record DFT of the areas marked for repair.

ii) Wipe with clean cloth & compressed air the area to be rectified. Lightly abrade using power tool or brush off blasting. Wipe the abraded area with cloth soaked in solvent.

iii) Estimate materials requirement for additional coat and spray apply Durathane 100 EAB to obtain required thickness making WFT check periodically..

iv) Test coating for desired DFT. If the area is more, adhesion test is required to be performed.

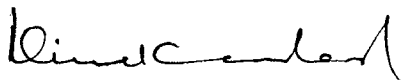

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MACHINERY /EQUIPMENT LIST IN GENERAL DEPLOYED FOR BLASTING & COATING

SI No	Particulars	Numbers	Remarks
	Surface Preparation Equipment.		
1	Air Compressor	1	
2	Blast Cleaning hopper with all accessories for blasting.	1	
3	Power tool for grinding	2	
	Primer Coating Equipment.		
1	Single Component airless spray equipment with all accessories	1	
	Top Coating (PU 2000 micron) Equipment.		
1	Two component airless spray equipment with all accessories	1	
	Testing Equipments.		
1	Surface Profile Gauge/ Comparator & Press-O-Film	1	
2	Hygrometer (Dry & Wet Bulb type)/ Digital	1	
3	Magnetic Mil Gauge (DFT tester)	1	
4	Adhesion Tester	1	
5	High Voltage Holiday Detector /Spark Tester.	1	
6	Thermometer for ambient Temperature	1	
7	Infra Red Non-contact/ Contact type Surface Thermometer	1	
8	Durometer (for Shored-D Hardness)	1	


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