MEMO NO. 341/ SOR-10/ B.P./2010/
OFFICE OF THE ENGINEER-IN-CHIEF
WATER RESOURCES DEPARTMENT
Shivnath Bhawan Sector-19, Atal Nagar Raipur

Raipur, Dated /04/2019

To,

All Chief Engineer
All Superintending Engineer
All Executive Engineer (in Charge of Division)
Water Resources Department, Chhattisgarh

Sub : **Amendment No. 11 & 12 to the schedule of Rates for works of Water Resources Department in Chhattisgarh in force from 01.08.2010.**

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The Schedule of Ratesfor Water Resources Department in Chhattisgarh is in force from 01.08.2010. In continuation to the amendment No. 10 to this SOR (issued vide letter no. 341/SOR-10/B.P./ 2010/13645/ Raipur, Dated 10.08.2018) the following new amendments are hereby issued in the above Stated Schedule of Rates.

Amendment No. 11 – Inclusion of Rates for UPVC Pipes and their Fittings in WRD SOR in **Chapter No. 30 - Water Supply** as **Item No. 3035,3036,3037 & 3038.**

Amendment No. 12 – Inclusion of Rates for Elastomeric Polyurethane (Epoxy) coating in WRD SOR in **Chapter No. 43 - Special Items for Building Works** as **Item No. 4369.**

(H.R. Kutare)
Engineer-in-Chief
Water Resources Department
Atal Nagar, Raipur

Encl : As above

Endt. NO. 341/ SOR-10/ B.P./2010/ 4694 **Raipur, Dated** 15/04/2019

Copy Forwarded to:

1. The Secretary, Govt. of Chhattisgarh, Water Resources Department, Mantralaya, Mahanadi Bhawan, Atal Nagar, Raipur.
2. The Engineer-in-Chief , PWD Sirpur Bhavan, Atal Nagar, Raipur.
3. The Engineer-in-Chief , PHED Indrawati Bhavan, Atal Nagar, Raipur.
4. The Director, Rate & Cost, CWC, Sewa Bhavan R.K. Puram, New Delhi.
5. The Accountant General, Chhattisgarh , Near Vidhan Sabha, Raipur.
6. The Chief Technical Examiner, Block 3, Indrawati Bhavan, Atal Nagar, Raipur.
7. The Chief Engineer/Superintending Engineer/Executive Engineer ----------
8. The Executive Engineer MIS, Data Center Sihawa Bhavan Campus, Civil line Raipur, for uploading amendment in departmental website.

Encl : As above

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Amendment No. 11
UPVC Pipes & Their Fittings
Chapter 30 - Water Supply

Item No.	Description of Item	Unit	Rate	Remark
1	*2*	*3*	*4*	*5*
3035	**Providing and supplying in standard lengths ISI mark rigid unplasticised PVC pipes suitable for potable water with solvent cement joints** including cost of couplers, as per IS specification no. 4985 / 1988 excluding GST levied by GOI and GOCG in all respect, including transportation, freight charges, inspection charges, loading, unloading, conveyance to the departmental stores and stacking the same in closed shed duly protected from sun rays and rains including cost of jointing material i.e. solvent cement, etc. complete (selffit type to be jointed with cement solvent). **Note :1)10% of cost of pipes shall be considered for cost of PVC specials for estimate pur-pose only.** **2)One coupler and required cement solvent shall be provided with each full length pipe cost of which is included in rates below.**			
	Working Pressure 4Kg/Cm2			
(i)	63 mm	Rmt.	48.00	
(ii)	75 mm	Rmt.	68.00	
(iii)	90 mm	Rmt.	94.00	
(iv)	110 mm	Rmt.	129.00	
(v)	140 mm	Rmt.	215.00	
(vi)	160 mm	Rmt.	283.00	
(vii)	180 mm	Rmt.	387.00	
(viii)	200 mm	Rmt.	477.00	
(ix)	225 mm	Rmt.	610.00	
(x)	250 mm	Rmt.	746.00	
(xi)	280 mm	Rmt.	991.00	
(xii)	315 mm	Rmt.	1261.00	
3036	**Providing and supplying in standard lengths ISI mark rigid unplastised PVC for potable water with rubber ring joints** including cost of rubber ring as per IS-4985-1998, excluding GST levied by GOI and GOCG in all respect, including transportation, freight charges, transit insurance, inspection charges, loading, unloading, conveyance to store and stacking the same in closed shed duly protected from sun rays and rains, etc. complete (with third party inspection) (socketed)			
	Working Pressure 4Kg/Cm2			
(i)	63 mm	Rmt.	50.00	
(ii)	75 mm	Rmt.	70.00	
(iii)	90 mm	Rmt.	100.00	

Item No.	Description of Item	Unit	Rate	Remark
1	*2*	*3*	*4*	*5*
(iv)	110 mm	Rmt.	137.00	
(v)	125 mm	Rmt.	188.00	
(vi)	140 mm	Rmt.	228.00	
(vii)	160 mm	Rmt.	301.00	
(viii)	180 mm	Rmt.	409.00	
(ix)	200 mm	Rmt.	504.00	
(x)	225 mm	Rmt.	647.00	
(xi)	250 mm	Rmt.	793.00	
(xii)	280 mm	Rmt.	1051.00	
(xiii)	315 mm	Rmt.	1335.00	
3037	**Lowering, laying and jointing with P.V.C. pipes and specials** of following class and diameter including cost of conveyance from stores to site of works including cost of all labour, material, except cement solvent, rubber ring, as per IS code, etc. complete (with cement solvent joint / ring fit joint).			
	Working Pressure 4Kg/Cm2			
(i)	63 mm	Rmt.	16.00	
(ii)	75 mm	Rmt.	21.00	
(iii)	90 mm	Rmt.	25.00	
(iv)	110 mm	Rmt.	29.00	
(v)	125 mm	Rmt.	31.00	
(vi)	140 mm	Rmt.	34.00	
(vii)	160 mm	Rmt.	38.00	
(viii)	180 mm	Rmt.	42.00	
(ix)	200 mm	Rmt.	45.00	
(x)	225 mm	Rmt.	53.00	
(xi)	250 mm	Rmt.	57.00	
(xii)	280 mm	Rmt.	63.00	
(xiii)	315 mm	Rmt.	71.00	

Item No.	Description of Item	Unit	Rate	Remark
1	*2*	*3*	*4*	*5*
3038	**Hydraulic testing of PVC pipe line to specified pressure** including cost of all materials and labour and water for testing for specified length including cutting, placing end cap making arrangement for filling safe water using reciprocating type pumps which should be able to provide specified test pressure gauges and other necessary equipments, labour, operation charges, etc. required for testing. The rate under this item shall also include cost of retesting, if necessary and reinstating to original position.			
	Working Pressure 4Kg/Cm2			
(i)	63 mm	Km.	2050.00	
(ii)	75 mm	Km.	2050.00	
(iii)	90 mm	Km.	3075.00	
(iv)	110 mm	Km.	3075.00	
(v)	125 mm	Km.	3588.00	
(vi)	140 mm	Km.	4100.00	
(vii)	160 mm	Km.	4100.00	
(viii)	180 mm	Km.	5125.00	
(ix)	200 mm	Km.	5125.00	
(x)	225 mm	Km.	6150.00	
(xi)	250 mm	Km.	6150.00	
(xii)	280 mm	Km.	7175.00	
(xiii)	315 mm	Km.	8200.00	

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Amendment No. 12
Elastomeric Polyurethane (Epoxy) coating
Chapter 43 - Special Items for Building Works

Item No.	Description of Item	Unit	Rate	Remark
1	2	3	4	5
1	Providing and spray applying by plural component airless spray with 100% solids Elastomeric Polyurethane (Epoxy) coating to a nominal thickness of 4000 Mircrons on concrete surface after sweep blast cleaning or high-pressure water jetting and applying 150 Microns WFT of Damp Tolerant with 100% solids Polyurethane (Epoxy) Penetrating Sealing Primer, surface preparation, priming and painting executed by equipments with skilled, un skilled labour and cost of Materials. Exculding Transportation and GST levied by GOI and GOCG in all respect. Work shall be applied as per detailed specification attached.	sqm	2740.00	

Encl – Specifications - 10 Page.

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SPECIFICATIONS FOR 100% SOLIDS, HIGH BUILD, ELASTOMERIC POLYURETHANE COATING FOR PROTECTION OF CONCRETE DAM

1.00.00 DESCRIPTION & STANDARDS

1.01.00 The coating shall meet minimum requirements for materials, equipment, application, inspection, repair and handling aspects associated with the coating of Concrete Dam using 100% Solids (Solvent less) Two Component, Fast Curing Elastomeric Polyurethane Coating classified under ASTM D -16, Type V.

1.02.00 The polyurethane on the external / internal surface of the Concrete shall provide a hard yet flexible, impermeable barrier with outstanding adhesion impact and abrasion resistance as well as crack spanning capability to protect the Concrete from corrosion and abrasion. It shall cover all variations associated with operating conditions of the facility.

1.03.00 Supplier or his licensed applicator shall obtain prior written approval from the Owner for any deviations from the requirements of this specification and / or the standard referred herein.

1.04.00 The work shall conform to following documents (latest revision or as specified) and as referred in this specification.

a) NACE 0892-2007	Coatings and Linings over Concrete for Chemical Immersion and Containment Service.
b) SSPC-TU 2/NACE 6G197	Design, Installation, and Maintenance of Coating Systems for Concrete Used in Secondary Containment.
c) SSPC Guide 11	Guide for Coating Concrete.
d) SSPC-SP 13/NACE No. 6	Surface Preparation of Concrete.
e) ACI 301-10	Specifications for Structural Concrete (Section 5.3.7, Repair of surface defects).
f) ASTM D 4259	Abrading Concrete.
g) ASTM D 4541	Method for Pull Off Strength of Coatings Using Portable Adhesion Testers.

2.00.00 GENERAL REQUIREMENTS & COATING VENDOR QUALIFICATION

2.01.00 The bidder shall perform all work in accordance with this specification and other requirements noted herein.

2.02.00 100% Solids, Two Component Polyurethane are specialized coatings characterized by very short pot lives and use of plural component airless spray and hence are to be undertaken only by experienced personnel.

2.03.00 The coating shall be on offered on "Supply & Apply" basis with single point responsibility for the installed coating meeting the contract specifications. The coating vendor shall be either of the following:

1. The coating material manufacturer himself using 'in house equipment and application crews on company rolls'. Application sub-contractors shall not be used by the coating manufacturer even if he bears overall responsibility and guarantee for the contract.

OR

2. An independent coating application contractor with full commercial responsibility to procure the approved make of coating, supply, apply and guarantee the full value of the applied coating. The coating applicator should have been trained and certified by the coating manufacturer and shall possess the necessary specialized equipment, trained crew and experience in spraying fast setting plural component polyurethane coatings.

2.04.00 QUALIFYING REQUIREMENTS - COATINGS MATERIALS

The coating manufacturer should have manufactured and supplied 100% Solids Polyurethane Coatings for Concrete for at least 30,000 Sq. Metres with oldest installation at least 5 years old as on the date of bid submission.

Bidder shall provide following details of coating materials proposed to be used in conformance to tender requirements:

2.04.01 Product Data Sheet.

2.04.02 Test Reports from internationally reputed test agencies for properties listed in Para 4.01.00 in order to prima facie establish conformance of the coating material with the requirements of this specification. Actual conformance shall be established as per 5.02.00 a) and 5.04.00.

2.04.03 List of installations in compliance of above qualifying requirements; together with contact details of customer for verification.

2.05.00 QUALIFYING REQUIREMENTS - COATING APPLICATION

The coating vendor should have applied more than 30,000 Sq. Metres of 100% Solids Polyurethane Coatings on concrete with oldest installation at least 5 years old as on the date of bid submission.

Bidder shall provide, following details:

2.05.01 List of equipment to be deployed for the coating works, such as blast cleaning pots, diesel air compressors, airless spray equipment, with hourly / daily capacities.

2.05.02 List of applications in compliance of above qualifying requirements; together with contact details of customer for verification.

2.05.03 In case the coating vendor is a coating application contractor, a certificate from coating materials manufacturer that the coating contractor is his authorized applicator and possesses the necessary equipment and expertise to apply the coating.

2.06.00 Bidder shall submit a detailed written description in the form of a QA/QC PROCEDURE & FIELD QUALITY PLAN MANUAL for owner's approval prior to commencing the work. The approved manual shall contain entire understanding between all parties concerned relating to coating materials, application procedure and quality assurance procedures of the coating work. The following details will be provided in the manual:

a) Coating Materials Product Data Sheet & Performance Tests
b) Coating Materials Storage at Site.
c) Surface Preparation & Application Equipment Proposed to Be Used
d) Surface Preparation Procedure & QC
e) Priming Procedure & QC
f) Coating Procedure & QC

g) Repair Procedure
h) Field Testing of Coating
i) Methodology / Sequence of Coating
j) Daily Log Sheet Formats
k) Field Quality Plan with Tests & Frequency for Coating Materials, Blast Cleaning, Priming, Coating & Final Testing.

2.07.00 The materials shall be applied by international standard Plural Component Airless Spray System such as Graco, Gusmer, Wiwa etc. as per the requirements specified by the coating material manufacturer. No make shift/ nonstandard spray equipment shall be used.

2.08.00 All cleaning, priming and coating machines shall be preferably equipped with rubber or wheels overlaid with hard fiber to prevent marking or denting the steel surface.

2.09.00 100% Solids Polyurethane systems are solvent free eliminating solvent health hazards and flammability concerns All safety precautions warranted by good industrial hygiene practices and regulated by local, state or central laws must be taken into consideration while applying these coatings.

3.00.00 CONCRETE SURFACE REPAIR

3.01.00 **Surface Tensile Strength:** The strength of the concrete is very important to the success and performance of the coating system.

The strength of the concrete at and near the surface will be evaluated by using an adhesion pull test apparatus or by the "pull-out test," in which a 50-mm (2-in.) diameter core hole is drilled to a depth of 25 mm (1.0 in.) and a pipe cap is bonded to the concrete core. After the bonding agent has cured, the pipe cap will be attached to a hydraulic jack that pulls perpendicular to the concrete surface. The force exerted to break the bond of the pipe or the concrete will be measured and recorded. An adhesion tester can also be used following procedures in ASTM D 4541 (without scoring).

The surface strength as tested above prior to coating shall exceed 3.1 MPa (300 Psi) for optimum performance.

3.02.00 **Repair of Surface Defects:**

a) Repair of surface defects :

Outline honeycombed or otherwise defective concrete with a 12 to 20 mm deep saw cut and remove such concrete down to sound concrete. When chipping is necessary, leave chipped edges perpendicular to the surface or slightly undercut. Do not feather edges. Dampen the area to be patched, plus another 150 mm around the patch area perimeter. Prepare bonding grout according to b) Preparation of bonding grout. Thoroughly brush grout into the surface.

When the bond coat begins to lose water sheen, apply patching mortar prepared in accordance with c) Preparation of portland cement patching mortar, and thoroughly consolidate mortar into place. Strike off mortar, leaving the patch slightly higher than the surrounding surface to permit initial shrinkage. Leave the patch undisturbed for 1 hour before finishing. Keep the patch damp for 7 days.

b) Preparation of bonding grout: For bonding grout, mix approximately one-part cement and one-part fine sand with water to the consistency of thick cream.

c) Site-mixed portland cement repair mortar: Mix repair mortar using the same materials as concrete to be patched with no coarse aggregate. Do not use more than one-part cement to two and one-half parts sand by damp loose volume.

Use a repair mortar at a stiff consistency with no more mixing water than is necessary for handling and placing. Mix the repair mortar and manipulate the mortar frequently with a trowel without adding water. Use mortar at a stiff consistency.

d) Repair materials other than site-mixed Portland cement mortar: Acceptable repair materials other than site mixed portland cement mortar may be used for repair. Use repair materials in accordance with manufacturer's recommendations. Materials include, but are not limited to commercial patching products, including:

- Portland cement mortar modified with a latex bonding agent conforming to ASTM C 1059 Type II;
- Epoxy mortars and epoxy compounds that are moisture- insensitive during application and after curing, that embody an epoxy binder conforming to ASTM C 881, Type III. The type, grade, and class shall be appropriate for the application as specified in ASTM C 881;
- Shrinkage-compensating or non-shrink portland cement grout conforming to ASTM C 1107; and
- Packaged, dry concrete repair materials conforming to ASTM C 928.

e) All repair work shall be smooth finished using a metal trowel.

3.03.00 **Cracks and Joints:** Treatment of cracks depends on crack size (both length and width) and expected temperature variations. Narrow, short cracks in areas with little temperature variation can usually be covered with a layer of saturated glass mat or fabric before coating. Larger cracks that are expected to move can sometimes be bridged with saturated glass mat or fabric that is dis-bonded from 25 to 50 mm (1 to 2 in.) on each side of the crack, then coated.

The crack may be chipped or sawed to create a groove approximately 25 mm wide by 13 mm deep. The crack is filled with a suitable elastomeric sealant then covered with the compatible coating system.

Very large cracks and control joints will be treated as expansion joints and will be rectified as specified in SSPC-TU 2/NACE 6G197.

4.00.00 MATERIAL SPECIFICATIONS

4.01.00 ELASTOMERIC POLYURETHANE COATING :
Spray applied, Impermeable, 100% Solids, Elastomeric Aromatic Polyurethane Coating (Non Tar Extended), as per ASTM D-16, Type V (Two Component, Chemical Cure). Shall meet following criteria. All tests at ambient (25 C) unless otherwise specified.

	Production Quality Control Tests	
A)	NOMINAL THICKNESS	4,000 Microns
B)	ADHESION ASTM D-4541 (Elcometer Pull Off)	2 N/mm^2 Min.
C)	SURFACE HARDNESS ASTM D 2240 (Cured Film - Shore D)	50 Min.

	Type Test – Short Duration	
D)	TENSILE STRENGTH ASTM D-638.	12 N/mm^2 Min.
E)	RECOVERABLE ELONGATION ASTM D-638	50% Min.
F)	FLEXIBILITY 180° Bend -1.0 mm thick film ASTM D 1737	Pass over 12 mm Mandrel without cracking or delamination.
G)	ABRASION RESISTANCE ASTM D 4060, Taber Abraser CS-17 Wheel 1,000 gms., 1,000 cycles	Weight Loss 0.150 gms. Max
H)	CHEMICAL RESISTANCE ASTM D 543 Practice A, Procedure I Immersion of free films of 3,000 Microns Thickness for 30 days in two reagents (separately) : 10% H_2SO_4 & 30% NaOH followed by (%) Weight Change	< 1.00 % Weight Change in each reagent.
	Type Test – Long Duration	
I)	WATER ABSORPTION ASTM D570-98, Procedure 7.4 (Long Term Immersion)	< 1.50 % Weight Change
J)	ACCELERATED WEATHERING ASTM G – 154, 2000 Hours	No cracking or crazing. Discoloration or slight surface chalking permitted.

4.02.00 **PRIMER**

Damp tolerant, penetrating, sealing Solvent Free Polyurethane or Epoxy primer shall be applied at approx. 150 Microns Wet Film Thickness in accordance with the recommendation of the Polyurethane Coating manufacturer. Since the primer penetrates into the concrete surface, no DFT measurement will be taken, rather materials consumption / application rates will be based on volumetric calculations.

5.00.00 **COATING QUALIFICATION & TESTING**

5.01.00 **Coating Material Qualification:** Test Reports from internationally reputed test agencies will be provided by the bidder for properties listed in Para 4.01.00 in order to prima facie establish conformance of the coating brand with the requirements of this specification. Actual conformance shall be established as per 5.02.00 a) and 4.04.00.

5.02.00 a) **Verification of Coating Properties (Type Tests – Short Duration):** In order to verify that the offered coating material meets the contract specifications, sample coupons / films (as required by relevant ASTM test) prepared from coating material supplied from initial lot will be sent by the bidder to Indian Institute of Chemical Technology (CSIR), Hyderabad or equal for testing performance properties [Items D) to H) of para 4.01.00] in conformity with contract specifications. Sample witnessing and sealing shall be done jointly by the bidder, owner & coating vendor. Coating vendor may retain duplicate coupons / films for parallel testing. Pending receipt of test reports, owner will allow Bidder to commence coating work at Bidder's risk.

b) **Verification of Coating Properties (Type Tests – Long Duration):** Test No. I). to.

J) being of long duration will not be conducted provided reports for Short Term Type Tests as per 5.02.00 a) are satisfactory. Existing test report from internationally reputed laboratory will be accepted by the owner.

c) **Small Packages:** For packages with coating surface area less than 10,000 Sq.M, testing as per 5.02.00 a) will be omitted provided bidder has provided test report as per 4.01.00 and field tests as per 4.04.00 are satisfactory for initial test patch and thereafter the regular work.

d) **Tested & Approved Brands:** Coating brands once tested as per 5.02.00 a) and found in conformity with contract specification will not need to repeat the same for further projects. Only testing as per 5.03.00 and 5.04.00 will be done for approved makes.

5.03.00 **Verification of Supply Batches:** In order to verify that the supply lots have the same formulation as the coating tested as per 5.02.00 a), the technique of 'Chemical Fingerprinting' of liquid components by Fourier Transform Infra-Red Spectroscopy (FTIR) shall be used as under:

a) Samples of liquid coating material components will be drawn at the time of verification test as per 5.02.00 a). These samples will be sealed and sent to Indian Institute of Chemical Technology (CSIR), Hyderabad or equal to establish FTIR reference spectrums of the coating formulation.

b) Supply batches will be randomly tested using FTIR by sending sample to the same test laboratory where the reference spectrum has been established. The test laboratory shall confirm that supplied materials conform to the reference spectrum on record. Sample witnessing and sealing shall be done jointly by the bidder, owner & coating vendor.

5.04.00 **Field Production Tests**: Applied coating will be field tested for properties a) to c) of Para 4.01.00: Thickness, Adhesion & Hardness in accordance with Section 9. Frequency shall be as per para 9.00.00.

6.00.00 **SURFACE PREPARATION**

6.01.00 The use of form release agents shall be compatible to the coating and will be checked with the coating vendor prior to use.

6.02.00 Before general surface preparation, surface contaminants (if any) shall be removed. Oil and Grease shall be removed by multiple detergent wash, preferably using steam. (Solvents shall not be used as they will cause the petroleum products to penetrate the concrete surface). Chemically contaminated concrete shall be neutralized prior to complete surface preparation. Acidic surfaces shall be neutralized using an alkaline cleaner and rinsed with fresh water. Acidic surfaces shall be cleaned with steam and detergent. After chemical cleaning, surface will be tested for residual chemicals. pH shall be tested using ASTM D - 4262 using pH test paper on rinse water. Concrete shall be dried thoroughly thereafter.

6.03.00 Sweep blast the concrete surface using expendable abrasive. The blast nozzle should be kept at sufficient distance to avoid over blast and exposing of aggregate. Following blasting remove dust using air jet (with the abrasive turned off). Desirable profile shall be approximated as Extra Coarse (# 40 abrasive paper)

OR

Waterjet @ 3,000 psi in place of blast cleaning.

6.04.00 Compressed air used for blast cleaning shall be dean, dry and free of moisture and oil. Moisture separators, oil separators, traps or other equipment may be necessary to achieve dean, dry air.

6.05.00 Blast cleaning operations shall be done in such a manner that no damage is done to partially or entirely completed portions of the work.

6.06.00 Non-metallic disposable mineral abrasive such as silica sand shall be the chosen abrasive for open blasting operations Steel grit and shot are approved abrasive media for blast cleaning in closed cycle, re-circulating abrasive systems (compressed air, vacuum and centrifugal wheel). No other abrasive media shall be used without prior approval.

6.07.00 The blast cleaning abrasive shall be dry and free of oil, grease and other contaminants. Applicator shall use abrasive media of size that will ensure the necessary roughness desired.

6.08.00 Dust and residues shall be removed from prepared surface by brushing, blowing off with clean, dry air or vacuum cleaning. Moisture separators, oil separators, traps or other equipment may be necessary to achieve clean, dry air.

7.00.00 **PRIMING**

7.01.00 Substrate may be damp but not visibly wet. Substrates which are to be encapsulated with the Polyurethane Topcoat (such as columns and beams) should be checked for moisture with Delmhorst BD-8 / Plastic sheet Test (ASTM D-4263) to ensure that moisture level within the concrete is less than 2%.

7.02.00 The type of primer used shall be as described in the coating specification 4.02.00.

7.03.00 Primer shall be sprayed onto the cleaned surface with a wet film thickness of approx. 150 Microns. Since the primer penetrates into the concrete surface, no DFT measurements will be taken and estimation shall be on volumetric basis. The primer on application shall be free from runs or drips or areas of excessive thickness.

7.04.00 The primed surface shall be protected so that it will not come into contact with rain, dust or other substances until completely hardened and coated with the Elastomeric Polyurethane Top Coat.

7.05.00 Primed surface should be over coated within the time recommended for the approved type of primer. In the event that the re-coat interval of primed surface is exceeded without top-coating with the Elastomeric Polyurethane, the surface must be re-primed.

8.00.00 **COATING**

8.01.00 Nominal thickness of the Elastomeric Polyurethane shall be 4,000 Microns, measured in accordance with 9.02.02. Being a thixotropic, high build, non-levelling coating, the Elastomeric Polyurethane coating shall take the contour / profile of the substrate.

The coating will be dense, free of foam/ porosity and of uniform consistency in its entire thickness.

Material consumption **for 4 mm thick top coat** will be calculated as **1 Sq.M = 4 Litre plus overspray/ wastage. The coating vendor shall state the overspray wastage used in his estimation which will not be less than 10% (Ten Percent). This minimum quantum of material will be supplied at site and recorded by volume and weight (per manufacturer's published specific gravity data).** However, supply and usage of this quantum of material will not be construed as the vendor having met thickness requirements and he will have to comply with provisions of 4.01.00 A) and 9.02.02. "

8.02.00 Coating shall be done only at times when the substrates temperature is at least 3°C over the dew point. Hourly measurements of dew point and surface temperatures shall be made prior to and when coating is under progress. Surface temperature should be minimum 5°C and should not exceed 70°C.

The temperature of the surface at the time of the coating application and the temperature progression during the application are both important. Rising concrete temperatures during the application of the coating systems may cause blistering and pinhole problems in the coating caused by out-gassing from the concrete. Coating application during periods of falling temperatures may be required to prevent this problem.

8.03.00 Equipment for the spray application shall be in conformity with system specification, meeting minimum specified by the coating manufacturer. Equipment shall consist of Material Feed Pumps, Purge Pump, Proportioning Pump, Mix Manifold, Static Mixer, Interconnecting Hoses etc.

8.04.00 Partially used and unused material drums must be tightly sealed and contain a blanket of nitrogen to prevent moisture contamination when not in use.

8.05.00 Before application on the substrate apply a test patch for runs or drips and gel time as well as tack free time.

8.06.00 The proportioning pump shall be fitted with a numeric counter to keep track of the volume while spraying.

8.07.00 Entire thickness shall be built up in a single application (with a number of 'wet-on-wet' passes). If the surface is large enough to require more than one day for the coating, the edges of the coated areas shall be feathered and roughened with a grinding too) prior to beginning priming and coating.

8.08.00 Areas not to be coated shall be masked with disposable plastic sheets, cardboard etc.

8.09.00 Visual inspection shall be made for film discontinuities such as air bubbles, blowholes, skips, shadows. Such defects will be marked and repaired with Elastomeric Polyurethane hand mix kit with slower pot life after roughening the edges.

8.10.00 Discoloration: 100% Solids Polyurethanes are aromatic coatings that will show darkening of colour in sunlight. The darkening is restricted to the top 25 microns only and does not affect the properties of the coating. Colour change is therefore a basic characteristic of the coating and shall not be construed as any defect.

9.00.00 **INSPECTION**

9.01.00 All work under this specification shall be subject to inspection by the owner or his representative. All parts of work shall be accessible. The applicator shall correct such work as is found defective and not as per the specifications.

9.02.00 The following tests shall be made:

9.02.01 <u>Adhesion</u>

Pull Off adhesion to Concrete measured using an portable adhesion tester such as Positest AT-CM or equivalent as per ASTM D4541 on fully cured (7 days) concrete. Frequency shall be 3 readings per 1,000 Sq.M of coated area. The average of readings from three randomly selected areas shall constitute the adhesion and shall be minimum 2 N/mm2 (see below). Test area to be flat (without curvature). The following method will be used to determine whether coating meets adhesion requirements :

Elcometer Reading	Type of Failure		Result / Conclusion
> 2 N/mm^2	T1	90% or more of break at coating - concrete interface	Coating meets adhesion criteria. Take actual reading of bond strength.
	T2	90% of more of break within the concrete	Concrete Failure. Coating adhesion exceeds 2 N/mm^2
< 2 N/mm ^{2}	T1	90% or more of break at coating - concrete interface	Coating does not meet adhesion criteria. Take actual reading of bond strength achieved.
	T2	90% of more of break within the concrete	Concrete lacks sufficient strength to provide necessary adhesion figure. Coating adhesion accepted.

Film Thickness (DFT)

9.02.02

The film thickness shall be determined from the thickness of the coating detached along with the Elcometer dollies of the adhesion test. 5 readings will be made from each circular dolly (spaced approx. 72 degrees apart), the highest and lowest will be discarded and average of balance three obtained for that Dolly. Average of 3 dolly tests shall constitute the film thickness and shall be at least 4,000 Microns. Minimum value of any Dolly reading shall be 3,000 Microns. It is recognized by all parties that given the rough nature of concrete surface substantial variation will be obtained in individual readings.

9.02.03 Hardness (Durometer)

Cured films (7 days) shall be tested for hardness using Durometer (Shore D) as per ASTM D 2240.

10.00.00 COATING REPAIRS

10.01.00 Repairs shall be classified into two types:

a) Small areas exposed due to destructive adhesion testing or due to mechanical damage.
b) Areas of insufficient thickness.

10.02.00 Small Areas Exposed Due to Destructive Adhesion Testing or Mechanical Damage:

a) Wipe clean damaged/ exposed area with a clean cloth. Use solvent in case of oil / grease deposits. Allow to dry.
b) Abrade using sandpaper the damaged/ exposed area including approx. 25 mm for overlap. Wipe clean with dry cloth.
c) Mix small amounts of Polyurethane Hand Mix coating in the correct volumetric ratio. Apply using brush or squeegee to the discontinuity and the overlap area, taking care to coat within the abraded area only. Ensure that the coating is reasonably level with no depressions in the middle.

10.03.00 Areas of Insufficient Thickness.

a) Demarcate the areas with low DFT.
b) Lightly abrade using brush off blast cleaning or power sanding. Wipe with clean cloth and compressed air.
c) Estimate materials requirement for additional coat and spray apply Polyurethane to obtain required thickness.

11.00.00 **METHODOLOGY & EXECUTION**

11.01.00 General

11.02.00 Coating work will be planned and coordinated well in advance of actual execution between bidder and coating vendor so as to ensure that the work is carried out in a smooth and expeditious manner.

11.03.00 Prior to start of work a " kick off" meeting shall held between the bidder, coating vendor, FQA and Execution at site to discuss, agree and put on record all operational aspects of installing the Polyurethane coating.

11.04.00 The decision whether to carry out coating work during days of inclement weather shall rest with the coating contractor keeping in mind prevailing ambient conditions and quality aspects.

11.05.00 Bidder shall provide clear, unimpeded fronts regularly to coating vendor corresponding with the agreed daily coating rates so that coating work is done in a planned and phased manner. Daily clear fronts available shall be recorded in execution log sheets.

Due care shall be taken to ensure that work is evenly spread over the agreed coating period and pending work does not build up unduly towards the end of execution period which may result in sub standard work.

12.00.00 **VENDORS**

Following is list of suggested vendors. Inclusion in this list shall not be considered as an approval and the vendor must submit all data listed in 2.04.00 & 2.05.00 proving conformance to the requirements of this specifications:

Amchem Products Pvt. Ltd
A-79 Sector 58, NOIDA 201307
Tel : +91-120-2580121, +919818644865
E Mail : info@amchemproducts.com
Website : www.amchemproducts.com

Spencer Coatings Ltd
6 York Street,
Aberdeen AB11 5DD, U.K
Tel: +44 (0)1224 288780
E-mail: info@spencercoatings.co.uk
Website : http://www.spencercoatings.co.uk/

TIB Chemicals AG
Business Unit Coating Systems
Mülheimer Strasse 16 – 22
68219 Mannheim, P.O. Box 81 02 20
68202 Mannheim
Tel. +49 621 8901 0
E Mail : info.cps@tib-chemicals.com
Website : www.tib-chemicals.com

Futura Coatings
130 Commerce Drive
Montgomeryville, PA 18936, USA
Phone: 215-855-8450
E Mail : info.na@itwep.com
Website : http://www.futuracoatings.com/