



HYDERABAD

STANDARD TECHNICAL
SPECIFICATION FOR COATING AND
WRAPPING OF UNDERGROUND PIPES

PEDC/STD.SPEC/38
REV 00

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COATING AND WRAPPING OF UNDERGROUND PIPES

| REV. NO. | PRAPARED | APPROVED | DATE |
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1. OBJECT AND SCOPE

The object of the specification is to described the method of protecting the underground by the peocess of coating and warpping. The job shall be generally performed in the following operation :-

- i) Cleaning the external pipe surface
- ii) Priming with synthetic primer
- iii) First coat of coal tar enamel
- iv) First layer of inner warpping with glass fibre
- v) Final coat (2nd coat) of coal tar enamel
- vi) Outer warp of coal tar impregnate glass fibre
- vii) White wash

In addition, this specification also covers an defines the material specifications, method of cleaning, priming, procedures of coating & Wrapping testing, repairing, handling and stroring etc,required for the satisfactory complection of the job.

2. REGULATIONS

- 2.1 All materials used shall conform to the quility and testing requirement indicated in AWWA-C-203-86 or BS 4164-1987 or ASTM Standards and or directed by Engineer-in-charge.
- 2.2 All appurtenances and equipment to be used for cleaning, priming, coating an warpping and testing shall be approved by the Engineer-in-Charge.

3. LIMIT OF UTILISATION

The underground pipe line protected by coating an warpping as described in this specification should be able to carry a liquid at a temperature upto 60⁰ C.

4. MATERIAL AND PROCEDURE OF WORK

4.1 Preparation and cleaning of Piping

The pipe line shall be throughly cleaned of all rust, grease, dirt, mill scales, weld scales, weld burns etc. by means of cleaning machine. This cleaning operation shall be immediately followed by priming with the airless spray priming machine.

Altenatively, if permitted by the Engineer – in – charge, the pipeline shall be adequate scrubbed manually with stiff wire brushes and scrapped where necessary. The primer coating should immediately follows the cleaning of pipes. The primer coating may also be done manually if permitted by the Engineer – in – charge.



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The cleaning and priming operation may be carried out in the contractor's workshop or on site. The entire pipe length shall be cleaned but the end of the pipes shall be left without coating and warping for a distance of 20mm for joints, which shall be coated and warped manually on site after laying, welding and testing the pipes.

4.2 PRIMING

4.2.1 MATERIALS, COAL TAR PRIMER

The Primer shall be a type B (fast drying, synthetic) certified to meet AWWA C-203-86 or British Standard BS – 4164, Section 3. The primer shall consist of chlorinated rubber, synthetic plasticiser and solvents suitably blended to produce a liquid coating which may be applied by brushing or spraying and which will produce an effective bond between the metal and subsequently coating of coal tar enamel. Primer should not contain benzol or other toxic and/or highly volatile solvents, added pigments or inert fillers or other substances and shall show no tendency to settle out in containers. The main characteristics of the primer shall be as follows :

- | | |
|--|----------------------------------|
| - Drying time to touch at normal humidity @ 30 ⁰ C (70 %) | Approx 5-15 mts. |
| - Flash point, BS 2000, part 170 | 23 ⁰ C (minimum) |
| - Flash time 4mm flow cup (ISO) at 23 ⁰ C, BS 3900, part A6 | 35-60 sec |
| - Volatile matter (105-110 ⁰ C), max. by mass. BS, Appendix A | 75% loss |
| - Coverage | 8-12 M ² / lit / coat |

4.2.2 PRIMING OPERATION (COLD APPLICATION)

The primer shall be applied on the pipes in uniform thin film (Single coat) leaving no drips or runs. The entire surface of the pipe should be primed without any patch left out. Any holidays or unprimed places shall be reprimed immediately. Any flooded areas or primer applied on improperly cleaned pipes shall be cut down to surface of pipe and reprimed at Contractor's cost. The primer shall be cold applied to a clean dry surface, immediately after cleaning operation.

- The surface shall be dry at the time of applying primer coat. Primer shall not be applied during rain or fog or on wet surface.
- Primer which comes foul with foreign substances or thickened through evaporation of solvent shall not be permitted.



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- Freshly primed pipe shall be placed on clean square cut skids and shall not be allowed to come in contact with the ground or with any other foreign matter. It shall remain on skids until lifted or cradled for the coating & wrapping operation.

- All primed pipes which have excessive coat of dust or primer accumulated over them before the primer is dry or where primer has become dead shall be reprimed. Drying time shall be minimum 24 hrs. The application of coal tar coating shall be taken up after primer coat has dried up completely and normally within 24hrs after priming with applied Contractor's cost. The Engineer-in-charge shall approve the primer coat before the next coat is applied.

- The primer shall be kept in tightly sealed containers when not in use to prevent evaporation.

- The primer shall be applied as received from the manufacturer and should not be thinned under any circumstances.


4.3 COATING AND WRAPPING

4.3.1 COAL TAR ENAMEL

Enamel shall be composed of a specially processed coal tar pitch combined with an inert mineral filler.

Asphalt of either petroleum or nature base shall be acceptable as part of the ingredients. The enamel shall have the following physical characteristics conforming to AWWA C 203/86 or 4164-1987.

| Softening point (Ring and ball) | Min | Max |
|--|--------------------|--------------------|
| ASTM Z-36 | 105 ⁰ C | 115 ⁰ C |
| Filler (Ash) ASTM-2415 by wt. | 25% | 35% |
| Fineness filter, through 200 mesh ASTM D 546 by wt. | | |
| Specific gravity at 25 ⁰ C ASTM X 71 | 1.4 | 1.6 |
| Penetration, AWWA C 203-86, Sec 2 : 8 : 1 @ 77 ⁰ F (25 ⁰ C)-100 gm. Wt . 5 Sec. | 5 | 10 |
| @ 115 ⁰ F (46 ⁰ C)-50 gm. Wt . 5 Sec. | 12 | 20 |
| High Temperature Test (SAG) | | |
| @ 62 ⁰ F (71 ⁰ C) AWWA C-203-86 Sec.2.8.9 | | 1/16" (1.6mm) |
| Low Temperature test @ - 10 ⁰ F, (-25 ⁰ C) | | |

| | | | | | | | | | | | | | |
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| (Cracking) AWWA C-203-86 Sec.2.8.10 | | None | | | | | | | | | | | |
| -Impact test @ 77 ⁰ F, (25 ⁰ C) Direct impact 650gm ball,8ft drop AWWA C 203-86, Sec.2.8.12)Indirect impact. | | 16 in 2 (10,323mm2) 6in2(3841mm2) | | | | | | | | | | | |
| -Peel test, AWWAC- 203-86, Sec.2.8.11 | | No pealing | | | | | | | | | | | |
| -Spark test 15 KV low Amperage | | None | | | | | | | | | | | |
| -Water absorpion, 35 weeks | | 0.3% | | | | | | | | | | | |
| - Application temperatures | | 225 ⁰ C | 245 ⁰ C | | | | | | | | | | |
| 4.3.2 GLASS FIBRE MAT FOR LANNER WRAPPING | | | | | | | | | | | | | |
| <p>The Fiberglass mat for inner warpping shall be thin, flexible, uniform mat, composed of chemical resistant borosilicate glass fibre or hydrolitic class 3-m conforming to DIN-12-111 mono-filaments distributed in random open poyous structure, bonded together with a thermosetting phenolic type resin which shall be compatible with the coal tar enamel. The innerwrap glass fibre tissue shall be longitudinally reinforced by continuos flamet glass yard- embedded in mat & shall have nominal thickness of 0.5 mm (0.02⁰) and shall Conform to AWWA C 203-86, Appendix section A.@.</p> <ul style="list-style-type: none">- No disbonding of individual glass fibre shall occur during or following the embedding process.- The glass fibre mat shall not cause bubbling under the condition of application.- The glass fibre mat shall be sufficiently porous so that it can embedded in the hot coal tar enamel as it is applied to the exterior of the pipe.- The glass fibre mat(reinforced glass warp) shall also conform to AWWA C 203-86 section A2 and the following Charecteristics. <table><tr><td>Weight (minimum)</td><td>41gms/m2</td></tr><tr><td>Nominal thickness</td><td>0.5mm± / - 0,1 mm</td></tr><tr><td>Tensile (average, breaking Strength)</td><td></td></tr><tr><td>Longitudinal direction</td><td>2277 N/M OF width (mIn)</td></tr><tr><td>Transverse direction</td><td>700N/M of width.</td></tr></table> | | | | Weight (minimum) | 41gms/m2 | Nominal thickness | 0.5mm± / - 0,1 mm | Tensile (average, breaking Strength) | | Longitudinal direction | 2277 N/M OF width (mIn) | Transverse direction | 700N/M of width. |
| Weight (minimum) | 41gms/m2 | | | | | | | | | | | | |
| Nominal thickness | 0.5mm± / - 0,1 mm | | | | | | | | | | | | |
| Tensile (average, breaking Strength) | | | | | | | | | | | | | |
| Longitudinal direction | 2277 N/M OF width (mIn) | | | | | | | | | | | | |
| Transverse direction | 700N/M of width. | | | | | | | | | | | | |



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Porosity

The glass fibre mat shall have a porosity of not more than 1.90mm water gauge measures at pressure difference across the sample at an air velocity of 1.02 M / sec.

Temp. Resistance

The glass fibre tissue shall be unaffected Unaffected under load in hot enamel at 53⁰F (288⁰C) for minute.

Moisture absorption by Wt. At
relative humidity of 95⁰ at 125⁰(50⁰C) 5%(max)
for 24 hrs

4.3.2 OUTER WARP COAL TAR IMPREGNATED GLASS FIBRE

The outer warp shall be non-woven, thick reinforced glass fibre mat uniformly impregnated with coal tar enamel and shall conform to AWWA C-203-86 Section 2.10.3 with following characteristics :

Glass tissue Base :83 gm/m2 (min)

Weight (finished material) :586-732 gm/m2
(12-15 lbs/100 ft2)

Thickness : 0.76 mm (30 mills)

Tensile strength
(Average Breaking Strength)

Longitudinal Direction : 6130 N / M of width (min)

Transverse Direction : 4730 N / M of width (min)

Pliability (1 » dia Mandrel 25⁰C,
2sec) : No cracking

Weight loss on heating at 82⁰ C
For 2 hours : 2% (max)

Moisture absorption percentage
Weight at a relative humidity of
A relative humidity of 95% an
50⁰ C For 24 hours.

The finishing reinforced glass fibre mat outer warp have a smooth, uniform surface free of visible defects. When unrolled at a temperature from 0⁰C to 50⁰C , the outer warp shall not crack or stick to such an extent as to cause breaking or tearing. The outer a 3'' diameter core in widths and lengths as specified at the time of purchase. The rolls shall be packed to exclude dust and



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dirt during shipping and handling and shall have card board separators and end shield adequate to prevent roll damage when stacked. The sides of the rolls shall be clean, smooth and square cut and shall have no telescoping.

- 4.3.3 The white wash used as a final coat shall be manufactured in accordance with white wash formulas as specified in AWWA C- 203-86, Section 2.11. coal tar enamel. The fibrous glass mat shall be of suitable uniform width for smooth spiral application. The over lap of the fibrous mat shall not be less than ½ inch (12mm).

A second coat of hot coal tar enamel shall then be applied of such a thickness that finished thickness of two layers of enamel inner and outer warps shall be a minimum of 4.0mm.

4.4.2 BY MANUAL APPLICATION

The already primed pipe is placed in a fixed position. The coal tar enamel heated to 225⁰ - 245⁰ C is then applied by means of sling as follows.

A canvass strip (alternatively a tinplate strip) about 450mm wide and 1.5m long held under the pipe by two men. Molten enamel is poured on the sling at each end of the pipe and some on top of pipe. The men holding this sling move it up and down and walk slowly forward whilst fresh enamel is poured on the pipe as they manipulate the sling so that an even coating is obtained all around. This work shall not be any formation of 'Whiskers' and holes in the coating must be made good.

The glass fibre mat warping may be applied with hand with the approval of the Engineer-in-charge.

4.5 APPLICATION OF SECOND (OUTER) LAYER OF COAL TAR ENAMEL COATING & GLASS FIBRE WRAPPING

Immediately after application of the 2nd layer of coal tar enamel, outer wrap Of coal tar impregnated glass fibre shall be applied in a tight uniform spiral and shall be spirally wound round the pipe with a minimum of 15mm overlap on each spiral.

The thickness of final coat of enamel shall be so adjusted that total finished thickness of double coating & wrapping in dividing outer warp is maintained minimum 4.0 mm. The coating and wrapping must be free of pin holes, bubbles on holidays. The engineer- in- charge shall cut samples from the coating from time to time to determine the thickness and bond of coating.

4.6 PRIMER, COATING AND WRAPPING APPLICATION FOR FIELD JOINTS OF PIPES AFTER LAYING AT SITE.



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- 4.7 Primer shall be applied with brushes after cleaning the pipe thoroughly (joints portion etc.) as per specification.

Originally offered to comply with these specifications will be borne by the contractor.

In addition to above, the contractor shall submit manufacture's certificates, in original for each batch of materials used on the job.

The contractor shall furnish the inspector reasonable facilities and space without charge for the inspection, testing and obtaining of such information as he desire regarding the characteristics of materials used and the manner in which the work is progressing.

The Field Bond Test Procedure as per AWWA C 203-86 sectionn 2.8.11 or BS 4164 Appendix L shall be applied to each pipe initially till the Engineer-in-charge relaxes it later to a random of one in ten pipes.

The pipe shall be throughly inspected for any holiday, pinholes, torn, abraded or mutilated spots.

The contractor shall furnish and operate at his own cost, a high voltage electronic holiday detector of type acceptable to Engineer – in – charge. The detector will have to be calibrated by the contractor at his own cost before use and the calibration shall be witnessed and approved by the Engineer-in-charge.


4.7 TESTING AND REPAIRS

- 4.8.1 All the finished insulation shall meet with the requirements spark tests to be applied with Holiday detector. All pinholes, voids, holidays, air bubbles, cracks and outer breaks, shall be carefully marked. Repiars may be made immediately following the coating and wrapping operation or may be deferred but in any case shall be repaired and re-inspected prior to installtion. Repairs to coal tar enamel coating shall be made by removing the damaged coating back to the pipe surface, hot coal tar enamel shall then be pored over his area and a piece of outer wrap of similar size shall then be embedded and bonded to the enamel. All coating repairs shall be made with the wrap smoothly applied and without wrinkles or buckles. Repairs must successfilly pass a test by the electronic holiday detector.

- 4.8.2 The thickness of coating and wrapping shall be checked with suitable instrument by the contractor at his own cost. If the thickness is found insufficient, the contrctor shall have to modify the same to the satisfaction of the Engineer-in-charge without any extra cost.

4.9 HANDLING AND SUPPORTING COATED PIPES

- 4.9.1 Contractor shall develop the method of stock piling and loading out coated pipes

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| | <p>and shall receive approval from Engineer-in-charge prior to handling of coated pipes.</p> <p>4.9.2 The coated pipes shall be carefully handled so as not to damage them in any way. No wire ropes or chains shall be used to lift the coated pipe. Canvas or rubber belts of minimum 300mm width and sufficient strength shall be used. The use of tongs, bane pinch bars, chain slings, protruding rivets, pipe hooks without proper Padding or any other handling equipment that may injure the coating shall not be permitted.</p> <p>4.9.3 If the pipes are coated in a shop, one pipe should not be placed above another during transit in the wagon or truck. The pipe shall be carried on suitable padded skis mounted on the wagon or a truck to ensure that the coating will not be damaged in any way.</p> <p>4.9.4 Pipes shall be stored in the field under covered protection during rains. Pipe shall be kept on clean square cut padded wooden skids protected with fibre glass mat felt or straw until ready to be lowered in the trench.</p> <p>4.9.5 The contractor handling and transporting the pipe shall conform to standards as set out in AWWA C 203 – 86 section 4.1 ‘Transporting and Handling Enamelled Pipe’.</p> <p>4.10 ADJACENT PIPE – LINES, STRUCTURES ETC.</p> <p>If any damage is caused to the coating and wrapping of adjacent pipe or any other existing structure during excavation of subsequent work or during coating and wrapping if field joints the contractor shall carry out necessary repairs at his own cost in a manner as directed by the Engineer-in-charge,</p> <p>5.0 REPAIR OF PIPE</p> <p>Any damage to the pipe, such as dent, gouges, flatter damage caused by contractor to bevels shall be cut out, the pipes bevelled and if necessary, rewelded with prior approval of Engineer-in –charge. All such rewelding shall conform to the applicable provisions of codes. The cost of work, plus the cost of pipe lost due to repair will be to the account of contractor.</p> <p>6.0 RATE</p> <p>6.1 Rate shall be for coating wrapping laying, testing and commissioning of the pipeline and shall be inclusive of cost of all materials, labour, equipments etc., reqd for the work including cost of pipes (pipe will be issued by BHEL at issue rate specified elsewhere), primer, coater enamel, impregnated glass fibre, white wash, jointing the pipes, testing and commissioning.</p> <p>6.2 Rate shall be inclusive of all tests to be carried out on raw materials and also for</p> | |



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finished pipeline.

6.3 Excavation of trenches and backfilling for laying of pipes will be paid for separately.

7.0 **MEASUREMENT**

7.1 The work will be paid for in Meters of finished pipeline.

7.2 Excavation of soil and backfilling will be measured in Cubic M.