

Annex-X

TECHNICAL TERMS AND CONDITIONS:

1

SCOPE OF WORK:
The scope of the work covers fabrication and supply of PSC Poles 8 meter long and 200Kgs. working (transverse) load in accordance with the technical terms and drawing of this specification. Alternate design / specifications shall not be considered which may be noted.

2

DIMENSIONS AND TOLERANCES:

| SR NO | DESCRIPTION | STANDARD IN MM | MAXIMUM IN MM | MINIMUM IN MM |
|-------|----------------|----------------|---------------|---------------|
| 1 | LENGTH | 8000 | 8015 | 7985 |
| 2 | WIDTH | | | |
| | - TOP | 114.30 | 117.30 | 111.30 |
| | - BOTTOM | 336.55 | 339.55 | 333.55 |
| 3 | THICKNESS | 139.70 | 142.70 | 136.70 |
| 4 | UP RIGHTNESS | 1 TO 72 | 0.5 % | 0.5 % |
| 5 | PLANTING DEPTH | 1381 | - | - |

NOTE: All dimensions are in mm.

3

WORKMANSHIP:
The contractor will be responsible for the general soundness as well as good finish of each pole. The workmanship should be of high degree and poles having flaws and defects will be rejected.

4

STANDARDS:
The poles shall comply with the relevant provisions made in the following Indian standard specifications with latest amendment.

IS: 1678/1998: Specification for Prestressed concrete poles for overhead
Power traction and telecommunication lines
ii) IS: 2905/1989: Method of test for concrete poles for Overhead Power and
Telecommunication lines.
IS:1343 & IS: 456:Code of practice for Prestressed and plain/reinforced
Concrete.

5

MATERIALS:
The materials shall conform to this specification and be in accordance with the guaranteed particulars given.

The consumption of materials per PSC Pole with minimum limit indicated below:

| | | |
|-----------------------------|----------------|-------------------|
| 1. Cement 53 grade/43 grade | 1.45/1.61 bags | For concrete mix. |
| 2. 4mm H.T. Steel Wire | 12 nos. | For tension wire. |
| 3. 4mm H.T. Steel Wire | 24 nos. | Rings. |

The consumption indicated above shall be inclusive of variations inclusive rolling margin.
The consumption of cement shall be inclusive of quantity required in finishing work. PSC

Signature of Tenderer

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Date:

Place:

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| | <p>Pole under destruction test shall be to the Supplier's account.</p> <p>The quality of materials to be used for manufacturing of PSC Poles shall be as under.</p> <p>[A] CEMENT: The Ordinary Portland Cement used in manufacture of prestressed concrete poles shall be relevant to IS: 8112/1989 of 43-Grade / 53- Grade IS 12269 latest amendment to get 28 days strength of 450 Kg/ cm².</p> <p>[B] STEEL: The 4mm H.T. Steel wire used in manufacture of Prestressed concrete poles shall be conforming to IS 6003/1983 of latest amendment thereof respectively. All Prestressing steel shall be free from splits, harmful scratches, surface flaws, rough, aged and imperfect edges and other defects likely to impair its use in prestressed Concrete. Slight rust may be permitted provided there is no surface pitting visible to the naked eye.</p> <p>[C]AGGREGATE: Aggregate used for the manufacturing of Prestressed concrete poles shall conform to IS: 383-1963. Aggregate shall consist of naturally occurring crushed black metal. They shall be hard, strong, dense, durable, clear and free from veins and adherent coating, and free from injurious amount of disintegrated pieces, alkali, vegetable material, and other dipterous substances. As far as possible flaky and allocated pieces should be avoided. It should not contain organic or other admixture that may cause corrosion of the reinforcement or impair the strength or durability of the concrete.</p> <p>The coarse aggregate shall consist of trap (preferably black) metal and in no case exceed 20 mm size. The fine aggregate shall be sharp, free from impurities and required fineness modules as specified. The sand shall be washed before use by installing a sand washing machine in the factory and the same shall not contain silt and deterious materials. The grading of fine aggregate shall be in accordance with IS: 2386 - 1963 with latest amendment.</p> <p>[D]WATER: Water to be used for process of manufacturing PSC poles like concrete mix and curing should be free from chlorides, other salts and organic materials and it should be got tested in Govt. Laboratory at test once in a year by the party. Potable water is preferable.</p> |
| 6 | <p>STORAGE OF MATERIALS</p> <p>The cement shall be stored at the work side in such a manner as to prevent deterioration due to moisture or intrusion of foreign matter.</p> <p>Steel reinforcement shall ordinary be staggered in such a way so as to avoid distortion and to prevent deterioration and corrosion, it is good practice to coat reinforcement with cement wash before stacking to prevent scale and rust.</p> <p>The aggregates shall be stored in such a way as to prevent mixing of foreign materials. The heaps of fine and coarse aggregates shall be kept separately. When different sizes of fine or coarse aggregate are procured separately, they shall be stored in separate stockpiles, to prevent the material at the edges of the piles from getting intermixed.</p> <p>Any material, which has deteriorated or has been damaged or is otherwise considered defective, shall not be used for the concrete.</p> |
| 7 | <p>TESTING OF MATERIALS:</p> <p>The Supplier shall arrange for the necessary testing of the material like Metal, Sand, Water etc. and see that the materials to be used in the manufacturing confirm to relevant IS.</p> |

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| 8 | <p>METHOD OF MANUFACTURING OF PSC POLES: The Prestressed concrete poles are generally manufactured by long line multiple bed method for mass production.</p> <p>(A)BED AND MOULD: The length and number of rows of concrete casting bed shall be according to the production capacity of pole factory. Preferably one pole bed separately should be provided to minimise wastage of H.T. Steel wire. The Prestressed poles are to be cast in a steel mould having accurately machined bottom bed and side faces. The steel mould should be strong enough to resist distortion. The bed should be absolutely horizontally levelled and free from any undulation. The mould should be capable of being opened in such a way that edges of the poles are not damaged. At both the ends of row of concrete casting bed, the anchor blocks are provided for fixing and stretching of H.T. Steel Wire.</p> <p>(B)STIRRUPS: The stirrups shall be prepared as per the design / drawing of the MGVCL from 4 MM dia H.T. Steel/6mm dia MS BAR. The stirrups shall be placed in position as per approved drawing. Stirrups shall preferably tie up with main bar i.e. tension wire and have standard lap length be welded to ensure maintaining proper shape and position.</p> <p>(C)PREPARATION OF REINFORCEMENT: All the reinforcement and window boxes shall be accurately placed and maintained in position during the fabrication. As per the Design / Drawing all the stirrups made out of H.T .steel, H.T. Steel wire shall be placed in respective position of the mould and thereafter continuous H.T. Steel wires are arranged through holes and plates of the mould. The welded joints in H.T. Steel wire will not be permitted. The H.T. Steel wires are stretched up to the required tension 10% of UTS as specified in relevant I.S. code with the help of Jacks and anchor blocks. All the wires shall be accurately stretched with uniform Prestressing in each wire. Each wire shall be anchored positively during the casting. The tension applied shall be checked with the help of suitable Gauge/Meter.</p> <p>(D)CONCRETE MIX: The concrete mix to be used for manufacturing of PSC Poles shall be prepared by weight batching only in such a manner and proportion so as to achieve the compressive strength of the concrete mix as per IS: 456 and none of the test specimen shall have strength less than 225 and 450 KG/CM² after 3 and 28 days respectively. The cement concrete shall be mixed only in electrically / mechanically operated concrete mixer machine. Gradation of the aggregate used in concrete mix shall adhere to the appropriate Mix Design and proportions be checked in regular interval. Water in concrete shall be added with proper measurement to maintain required water cement ratio. The hand broken metal shall not be permitted.</p> <p>(E)PLACING OF CONCRETE MIX: The mould should be free from Dust, Dirt and other organic materials and oil is to be applied before placing the concrete mix. The machine mixed concrete is, thereafter poured in the mould and shall be compacted by spinning, vibrating, shocking or other suitable mechanical means. Over-vibration or under-vibration or vibration of very wet mix is harmful and should be avoided. The Hand compaction shall not be permitted.</p> |

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| | <p>On application of vibrator the concrete Mix will compact & get to 2 to 3 mm below form/mould level. This gap shall also be filled up with prepared concrete Mix only & re vibrated. The mixture of cement & sand for filling up the gap as well as finishing work will not be permitted. Finishing work shall be done only with cement slurry.</p> <p>Care should be taken to see that anchorages do not yield before concrete attains necessary strength. Proper cover for concrete should be maintained throughout process of pouring, compacting etc. of concrete mix.</p> <p>On achieving setting time, the side faces of the mould shall be removed from the bed and watered at intervals to prevent the surface cracking of the pole. The concrete shall be covered with a layer of sacking, canvas, Hessian or similar absorbent materials and kept constantly wet up to the time when the strength of the concrete reaches to the minimum strength of the concrete at transfer of prestress i.e. for about 72 hours.</p> <p>The Steam curing may be permitted in exigency or emergency cases with the approval of the competent authority only.</p> <p>(F) DETENSIONING, CUTTING OF WIRE AND REMOVING OF POLES FROM THE BED:</p> <p>After ascertaining that concrete has attained required strength of min. 225 KG/CM² by checking the cube strength stretched wires are released from the anchor blocks and cut with the help of welding machine. The cutting shall be started only from the centre of the bed length. The pole is then removed from the bed by lifting at 2 points using gantry and moved to the Curing Pond.</p> <p>(G) CURING:</p> <p>The curing of the pole shall commence after setting of the concrete. Continuous curing on bed should be done till it is shifted to curing pond, The curing pond shall be full of water and each pole must be immersed in the water for a period of at least 28 days. If required, water sprinkling shall be done at intervals to keep the poles constantly wet as per I.S.No.1678-1998.</p> <p>(H) STORING OF POLES READY FOR INSPECTION:</p> <p>The poles prepared vide method stated above shall be stacked in chronological method and indication of the date of manufacturing and number of poles be put before with particular lot so as to identify the lot by inspecting officer.</p> |
| 9 | <p>MARKING:</p> <p>The poles shall be clearly and indelibly marked with the following particulars during manufacture, at a position between 5th (W5) and 6th (W6) window indicated in the drawing so as to easily read after erection in position. The mark shall be done by pressing embossed figures / letters of 50 mm height and 20 mm width with gap of 5 mm between two figures. The sample drawing No MGVCL/PSC POLE/ 8METER/01/DT 03-02-2012 Rev. 01 is attached with the tender.</p> <p>Date, month & year of manufacture, (On front face) Serial number of pole, and (On front face) Maker's serial number or mark (On front faces) Maker's serial number or mark on both sides of faces in oil painting/water base paint to be marked before placing in curing pond. MGVCL (in words) (above planting depth) The pole shall also be suitably marked for the planting depth i.e. 1381 mm from</p> |

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| | bottom. On both the end of pole the anti-corrosive paint i.e. epoxy based bituminous paints two coats are to be applied. One before putting in curing pond and second after removing from the pond. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|---|---|--|--|---------------------------|--|--|--|---------------------------|----------------|---|---|-----|-----|-----|-----|-----------|----|---|---|------------|----|---|---|------------|----|---|---|------------|----|---|---|
| 10 | <p>CUBE TESTING:</p> <p>Total 6 Nos. Cubes of 100mm X 100mm X 100mm size concrete shall be cast daily and tested at release, i.e. after approx. 72 Hours of cast as well as after 28 days, in accordance with Indian Standard specification at Supplier's own expense. The mix for concrete adopted shall be such as to give cube strength not less than 225Kg/cm2 at release (after 3 days) and 450 Kg/cm2 after 28 days.</p> <p>Cube testing machine shall always be kept in the working condition and regular cube tests shall be taken and results be recorded in the registers duly signed by engineer-in -charge and representative of the Supplier.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | <p>SAMPLING AND CONFORMITY</p> <p>1] LOT:</p> <p>A. In any batch, all poles of the same class and same dimensions shall be grouped together to constitute a LOT.</p> <p>B. If the number of poles in a lot exceeds 500 then the lot shall be divided into suitable number of SUB-LOTS such that the number of poles i.e. any sub-lot shall not exceed 500. The acceptance or otherwise of a sub lot shall be determined on the basis of the performance of sample selected from it.</p> <p>2] Scale of Sampling: The number of poles to be selected from a lot or a sub-lot shall depend upon its size and shall be in accordance with col.1&2 of the table given below.</p> <table><tr><th colspan="4">1 SAMPLE SIZE AND CRITERIA OF CONFORMITY</th></tr><tr><th colspan="4">DIMENSIONAL REQUIREMENTS.</th></tr><tr><th>Size of lot Or Sub-Lot</th><th>Sample size</th><th>Permissible No. of Defective samples.</th><th>NO. Of sample Poles (Out of Col.2) for Transverse Strength test</th></tr><tr><th>(1)</th><th>(2)</th><th>(3)</th><th>(4)</th></tr><tr><td>Up to 100</td><td>10</td><td>1</td><td>2</td></tr><tr><td>101 to 200</td><td>15</td><td>1</td><td>3</td></tr><tr><td>201 to 300</td><td>20</td><td>2</td><td>4</td></tr><tr><td>301 to 500</td><td>30</td><td>3</td><td>5</td></tr></table> <p>3] Number of Tests: All the poles as selected as above shall be tested for overall length, cross-section and uprightness. The number of poles to be tested for transverse strength test shall be in accordance with col 4 of table. These poles may be selected from those already tested.</p> <p>4] Criteria of conformity: A lot or sub-lot shall be considered as conforming to the specification if the conditions under are satisfied.</p> <p>The numbers of poles which does not satisfy the requirements of overall length; cross-section and uprightness shall not exceed the corresponding number given</p> | 1 SAMPLE SIZE AND CRITERIA OF CONFORMITY | | | | DIMENSIONAL REQUIREMENTS. | | | | Size of lot Or Sub-Lot | Sample size | Permissible No. of Defective samples. | NO. Of sample Poles (Out of Col.2) for Transverse Strength test | (1) | (2) | (3) | (4) | Up to 100 | 10 | 1 | 2 | 101 to 200 | 15 | 1 | 3 | 201 to 300 | 20 | 2 | 4 | 301 to 500 | 30 | 3 | 5 |
| 1 SAMPLE SIZE AND CRITERIA OF CONFORMITY | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DIMENSIONAL REQUIREMENTS. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Size of lot Or Sub-Lot | Sample size | Permissible No. of Defective samples. | NO. Of sample Poles (Out of Col.2) for Transverse Strength test | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) | (2) | (3) | (4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Up to 100 | 10 | 1 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 101 to 200 | 15 | 1 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 201 to 300 | 20 | 2 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 301 to 500 | 30 | 3 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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| | <p>in col.3 of Table. If the number of such poles exceeds the corresponding number, all poles in the lot or sub-lot shall be tested for these requirements, and those not satisfying the requirements shall be rejected.</p> <p>All the poles tested for transverse strength test shall satisfy the requirements of the test. If one or more poles fail, twice the number of poles originally tested shall be selected from those already selected, and subjected to the test. If there is no failure among these poles, the lot or the sub-lot shall be considered to have satisfied the requirements of this test. If one or more poles of the second samples fail, the lot or the sub-lot represented by the corresponding samples shall be considered not to have passed the test.</p> | | | | | | | | | |
| 12 | <p>METHOD OF INSPECTION AND TESTING GENERAL:</p> <p>The tests on poles shall not be carried out earlier than 28 days from date of manufactured for poles manufactured from ordinary Portland cement or blast furnace slag cement. If a chloride free ad mixture is used or rapid hardening Cement of Grade 43 / 53 is used than pole can be tested at 14 days of age as per provision of IS. The specimens shall be inspected and any specimen with visible flaws shall be discarded. If any test specimen fails because of mechanical reasons, such as failure of testing equipment of improper specimen preparation, it shall be discarded and another specimen shall be taken.</p> <p>INSPECTION:</p> <p>The Tenderer shall offer Ready Made PSC Poles lot for inspection and relevant tests.</p> <p>(01) DIMENSIONS:</p> <p>All the Poles shall be manufactured in accordance with the detailed dimensional drawing.</p> <p>The tolerance on dimension shall be limited to...</p> <table border="0"> <tr> <td>(i) For length</td> <td>-</td> <td>± 15 mm.</td> </tr> <tr> <td>(ii) For Web thickness</td> <td>-</td> <td>± 3 mm.</td> </tr> <tr> <td>(iii) Upright ness</td> <td>-</td> <td>0.5 % (i.e. 72 to 1.005 / 0.995)</td> </tr> </table> <p>(02)METHOD OF TESTING:</p> <p>The pole shall be tested only in the horizontal position or as specified in I.S. 1678 / latest amendment & I.S. 2905 /1989 latest amendment .While testing in the horizontal position, provision shall be made by suitable supports to compensate for the overhanging weight of the pole; for this purpose the overhanging portion of the pole may be supported on a movable trolley or similar device. The frictional resistance of the supporting devices should be separately determined and deducted from the total final load applied on the pole.</p> <p>Theoretically the permanent deflection should be as per IS 2905 / 1966 and latest amendment thereof. The recovery of deformations should not be less than 90%.</p> <p>A] Testing Arrangement -</p> <p>The pole shall be fixed in the crib longitudinally from butt to its ground line and then it shall be secured firmly in place. Wooden saddles with concave surfaces and other packing shall be placed around the pole to prevent injury to the butt section as specified in IS: 2905/1966 – latest amendment.</p> <p>To minimize vertical movement at the point of load application and to reduce the stresses due to dead weight of the pole, a rail support shall be provided near the point of load application, or alternately a number of friction less supports in the form of trolleys may be provided near the end or throughout the length of the pole. The rail support or</p> | (i) For length | - | ± 15 mm. | (ii) For Web thickness | - | ± 3 mm. | (iii) Upright ness | - | 0.5 % (i.e. 72 to 1.005 / 0.995) |
| (i) For length | - | ± 15 mm. | | | | | | | | |
| (ii) For Web thickness | - | ± 3 mm. | | | | | | | | |
| (iii) Upright ness | - | 0.5 % (i.e. 72 to 1.005 / 0.995) | | | | | | | | |

Signature of Tenderer

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other forms of support shall be such that any friction associated with the deflection of the pole under load shall not be a significant portion of the measured load on the pole.

B] Loading –

The load shall be applied at a point 600 mm from the top of the pole by means of a suitable device, such as a wire rope and winch placed in a direction normal to the direction of the length of the pole, so that the minimum length of the straight rope under pull (excluding the curved portion near the transmitting devices) is not less than two times the length of the pole. If the loading device is set sufficiently far away from the pole to make the angle between the initial and final positions of pulling line small, the error in assuming that the pull is always perpendicular to the original direction of the pole axis will be negligible. The pulling line shall be kept level between the winch position and the point where load is applied to the pole. The load shall be applied at a constant rate of 4 percent of the specified test load per minute and in accordance with procedure.

C] Pulling Line:

The pulling line shall be secured around the pole at the load point. Load measuring device shall be placed in a way so as to accurately measure in the tension in the pulling line. The other end of which is attached to the loading equipment (winch).

D] Load Measurement:

Load Cell with accuracy of 5 Kg. for measurement may be adopted. Load cell shall be calibrated before every test. The load measuring device shall be supported in such a way that the force required to pull it shall not add to the measured load on the pole and that no damage is cause to the instrument if the pole suddenly breaks under test. No pullies or any other device in between load application point and load cell will be allowed.

E] Deflections –

The deflection of the pole and the load applied shall be measured simultaneously at different stages of loading to provide at least five sets of readings or as specified in I.S.2905 & latest amendment thereof. The measurement of the deflection of the load point shall be made in a direction perpendicular to the unloaded position of the pole axis. The measurement shall be made correct to the nearest 1 mm by use of datum board. A second datum line shall also be established from which the movement of the ground line if any, shall be measured.

F] PROCEDURE:

Load shall be applied at a point 600 mm from the top of the pole and shall be steadily and gradually increased to 250 kg. till formation of 1st crack recording deflection at each increment.

The load shall be then reduced to zero and then increased gradually in 50 Kg. increments up to 400Kg load. Then Each load increment be successively increased by 25Kg. up to design ultimate transverse load (i.e. 500 Kgs.). The load shall be increased in steps of 25 Kgs. to measure ultimate transverse load, until failure occurs. Each time the load is applied same shall be held for 2 minutes. The load applied to Prestressed concrete poles at the point of failure shall be measured to the nearest five kilograms.

G] RECORDING OF DATA AND MEASUREMENTS:

(i.) Any hair cracks appearing at a stage prior to the application of the design transverse load at first crack shall be measured using feeler gauges & shall be recorded. It should also be recorded whether the hair cracks, if any, produced on application of the 60 percent of the minimum ultimate transverse load close up on the removal or reduction of the test load.

(ii) The load applied to the pole at the time of failure shall be measured to the

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| | <p>nearest 5 Kg.</p> <p>(iii) A prestressed concrete pole shall be deemed not to have passed the test if crack wider than 0.1mm appears at a stage prior to the application of the design transverse load at First crack (200kgs).</p> <p>(iv) The definition of failure of PSC pole in test will be (i) permanent set more than 2.5 cm at load of 500 kgs. Or (ii) deflection of more than 25 Cms at load of 500 kgs.</p> <p>H] ULTIMATE FAILURE:</p> <p>The conditions existing when the pole ceases to sustain a load increment owing to either crushing of concrete or snapping of the Prestressing tension or permanent stretching of the steel in any part of the pole.</p> <p>At least one pole per 1000 Pole shall be subjected to destruction test in the contract in presence of representative from MGVCL. These nos. of poles shall not form part of quantity to be supplied by the supplier.</p> |
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| 13 | TECHNICAL DATA OF PSC POLES | | |
| | The Guaranteed Particulars of PSC Poles 8 Mtr. 200 Kg. | | |
| | 01. Working load | : | 200 Kg. |
| | 02. Factor of safety | : | 2.5 |
| | 03. Ultimate Load | : | 500 Kgs. |
| | 04. Dimensions | : | |
| | (a) Bottom Cross-Section | : | 336.55 x 139.7 mm. |
| | (b) Top Cross-Section | : | 114.3 x 139.7 mm. |
| | (c) Total height | : | 8,000 mm. |
| | (d) Web thickness. | : | 57.15 mm (2.25 inch) |
| | (e) Planting Depth | : | 1381 mm. |
| | 06. No. of 20mm dia. holes. | | |
| | On Front face | : | 02 nos. (100 mm apart). |
| | On side face | : | 06 nos. (300 mm apart). |
| | 07. Minimum requirement: | | |
| | (a) Cube Test (Each Specimen) | : | 450 Kg/Cm ² (28 days). |
| | | : | 225Kg/Cm ² (3 days)- at release of Prestress. |
| | (b) Initial tension in HT Steel Wire/Pole. | : | 70% of 175.00 Kg/mm ² |
| | | | as specified in related I.S.Code |

14. GUARANTEE:

| | | | |
|-----------------------|----------------------|-------|--------|
| Signature of Tenderer | Company's Round Seal | Date: | Place: |
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If the poles, which are tested, accepted and paid, are found defective due to use of inferior quality of materials or poor workmanship within the period of 12 months from date of supply, the Supplier shall have to replace the same "free of cost" within three months from the notifying the defects. If the same are not replaced within time limit, the MGVCL reserves the right to recover same amount from the Bills without prejudice to any other rights.

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Place: