SERIES 500

CHAMBER AND CABINET WORKS

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501 Chamber Sizes and General Construction Matters

1 Duct and cabinet chambers shall comply with the relevant Contract drawings. Any alternative construction must be approved by the Engineer.

2 Foundations to chambers shall be as follows:-

(i) Preformed/Precast footway chambers – C16/20 designed concrete mix in accordance with Series 700 - Concrete, Clause 703;

(ii) Preformed/Precast carriageway chambers – C32/40 semi-dry concrete mix in accordance with Series 700 - Concrete, Clause 703.

3 Benching or other modifications shall only be undertaken with the written approval of the Engineer and his instructions fully complied with. Where benching is permitted warning plates will be required to notify other users of the risk.

4 Box openings in the footway and carriageway left open overnight must be covered with a suitable plate. In the carriageway a suitable steel road plate (relative to the opening size) must be bedded into the existing surface. In the footway all openings must be guarded and covered with a suitable plate (again relative to the opening size).

502 Alternative Chamber Construction

1 The Contractor shall be permitted to propose alternative constructions for duct chambers or boxes for approval by the Engineer. The alternative proposed constructions must comply with the following criteria.

(i) Minimum internal sizes must comply with the relevant Contract Drawings;

(ii) The duct chamber or box construction must be suitable to take the vertical loading as specified for the proposed cover, as detailed in Clause 506, and must be suitable to take the lateral earth pressures including vehicle loading surcharges likely to be experienced in-situ;

(iii) The duct chamber construction must be suitable to take a varied number and arrangement of ducts, up to the maximum shown on the standard duct chamber drawings;

(iv) The duct chamber or box construction must allow the cover to be raised or lowered to accommodate changes in footpath level using conventional manhole techniques.

2 Brickwork to alternative brickwork chambers shall comply with Clause 504 of the Specification, and be built with mortar Class 1 in English bond. The ends of all ducts shall be neatly built into the brickwork with Class 1 mortar, and finished flush with the inside face.

3 Alternative precast concrete chambers, where permitted by the Engineer, shall comply with BS5911-3:2010 and BS EN17:2002.

503 In-situ Concrete Chamber Construction

General

1 In-situ Concrete chamber construction shall comply with Series 700 - Concrete, and the following:

(i) Any in-situ concrete chambers will be to the approval of the Engineer and the street authority.

(ii) Cast in situ concrete chambers shall be constructed of Class C32/40 concrete.

Base Construction

2. Unless otherwise specified, or directed by the Engineer, over excavation for the base shall be backfilled and compacted with imported Type 1 Granular Sub-base material. Where mechanical compaction is impractical, the excavation shall be backfilled with mix ST1 concrete in accordance with Series 700 - Concrete, Clause 704.

3 Base reinforcement shall comply with Series 700- Concrete, Clause 709. Base reinforcement and anchor irons shall be correctly positioned and supported on cover blocks. Cover blocks shall be placed so as to ensure the stability of the reinforcement during concreting operations and that minimum concrete cover is achieved.

4 Base reinforcement starter bars, for the chamber wall construction, shall be repositioned after vibration to ensure verticality. Following reinforcement repositioning the floor of the chamber will be re-levelled. No further work will be allowed until after striking of the formwork.

Wall Construction

5 Wall reinforcement shall comply with Series 700- Concrete, Clause 709. Wall reinforcement shall be correctly positioned with the minimum concrete cover maintained by cover blocks.

6 Duct positions shall be as shown on the relevant construction drawings, or as agreed with the Engineer. The position of the ducts shall allow for a minimum of 35mm of concrete cover between the reinforcement and the nearest duct. Ducts will be placed to ensure a minimum spacing of 25mm between ducts, vertically and horizontally.

7 Adjustment to the chamber cover level above the finished concrete wall construction will be made in regulating brickwork courses. Brickwork construction for regulating courses shall be in accordance with the details for general brickwork construction given in Clause 504.

Concrete Imperfections

8 The walls of concrete jointing chambers shall have a smooth finish. Any cavities or blemishes exposed, after striking of the formwork, shall be made good with Class 1 mortar, using epoxy as necessary. Any projections shall be removed.

504 Brickwork Chamber Construction

General

1 Bricks for the construction of chambers and beneath frames for chambers, shall be Class B clay engineering bricks complying with BS EN 771-1:2003; or concrete bricks complying with BS EN 771-3:2003 having a crushing strength not less that 20 N/mm^2, or special purpose concrete bricks having a minimum cement content of $350kg/m^3$ where improved durability is required, as directed by the Engineer.

2 Brickwork and blockwork shall be laid on a full bed of Class 1 mortar, as indicated below and in accordance with sub-Clauses 6 to 9 of this Clause, in English bond for all 215mm wide walls and stretcher bond for all 102mm wide walls. Whole bricks and blocks shall be used except where it is necessary to make cuts at corners or where otherwise agreed by the Engineer.

Mortar Class	Cement BS EN 197-1:200 BS 4027:1996	Lime BS EN 459-1:2001	Sand BS EN 13139:2002
1	**2**	**0 – 0.25**	**3**

3 Brickwork and blockwork shall be built uniformly. Corners and other advanced work shall be steeped back and not raised above the general level more than 900mm. Courses shall be kept horizontal and matching perpends shall be in vertical alignment.

4 No bricks or blocks shall be laid when the air temperature in the shade is below 3°C unless special precautions are taken which have been approved by the Engineer. All materials when used shall be free from snow, ice and frost.

5 If the work is to be carried out in frosty weather and the bricks are wet when laid, then a cement sand mortar with an air entraining plasticiser shall be used. Admixtures shall comply with either BS EN 480 & BS EN 934 and shall not contain calcium chloride.

Mortar

6 Cement for mortar shall comply with Series 700 - Concrete, sub-Clauses 701(1) to (3).

7 Sand shall comply with BS EN 13139:2002.

8 Water to be used in the mortar mix shall comply with Series 700 - Concrete, sub-Clause 701(7).

9 Mortar shall be mixed thoroughly either by hand or mechanically until its colour and consistency are uniform. The constituent materials shall be accurately gauged, allowance being made for bulking of sand. Mortar shall be made in small quantities only as and when required. Mortar which has begun to set or which has been mixed for a period of more that 1 hour in the case of a Class 1 mortar, shall be discarded.

505 Screed to Chambers

1 On completion of a jointing chamber the floor shall be rendered with Class 1 mortar, in accordance with sub-Clause 504(2) and the relevant Contract drawings.

506 Chamber Covers and Frames

1 The frames and covers of all duct chambers shall be marked **CATV**, and shall be approved by the Engineer and comply with BS EN 124. Covers shall be Group 4 Class D400 in carriageway and Group 2 Class B125 in footway, unless otherwise agreed/required by the Engineer. Termination boxes shall be approved by the Engineer and shall comply with BS 5834 part 2.

2 Chamber frames used in Class 1 and Class 2 carriageways shall have a minimum depth of 150mm. Chamber frames used in Class 3 and Class 4 carriageways shall have a minimum depth of 100mm, except in sensitive carriageway situations where, as directed by the Contract drawings or the Engineer, a minimum frame depth of 150mm shall be used.

3 Chamber frames in all classes of carriageway shall be set flush with the new or existing surface and laid on a proprietary layer of quick setting polyester-based mortar such as *INSTARMAC ULTRACRETE PY4*, or similar alternatives as approved by the Engineer. The minimum layer thickness shall be 5mm, and the maximum layer thickness shall be 40mm.

4 Chamber frames in all verge and footway areas shall be laid on a Class 1 mortar bed, in accordance with sub-Clauses 504(2). The finished thickness of the mortar bed shall be between 10 mm and 25 mm. Unless otherwise described, chamber frames and covers in footways and general grassed areas shall be set flush with the new or existing surface, chamber frames and covers in areas of cultivated grass and verges which are likely to be cut with mowing machinery shall be set between 10mm and 15mm below the new or existing surface.

5 Where manufacturers of preformed chambers provide suitable brackets to tie frames down to buried concrete surround, then these shall be used in all verge areas.

Proprietary Polyester Mortars for Setting of Carriageway Frames

6 Proprietary polyester mortars for setting of carriageway frames shall have the following properties:

(i) The maximum aggregate size in polyester mortar shall be 2.36mm;

(ii) Bedding shall have a minimum workable life of 15 minutes, a minimum compressive strength of 30 N/mm^2 in 3 hours, and a minimum tensile strength of 5 N/mm^2 in 3 hours. Bedding shall also have a minimum compressive strength of not less than 45N/mm^2 after 28 days. For rapid opening of carriageways, a minimum strength of 20N/mm^2 is required at opening to allow safe vehicular trafficking.

(iii) The material shall be stored in a dry environment at a temperature of between 10°C and 27°C. Containers shall be damp-proof and leak-proof and marked with the manufacturer's name, net weight, the batch reference number, component identification and such warnings or precautions concerning the contents as are required.

(iv) The material shall not be removed from the store for use in the Works until immediately prior to mixing.

(v) The material shall not be used more than six months after the date of manufacture, or any lesser period specified by the manufacturer.

(vi) The Contractor shall supply to the Engineer, with each batch or part batch delivered to site, certificates furnished by the supplier or manufacturer stating the following:

(a) Manufacturer's or manufacturer's agents name and address;

(b) Description of material, brand name, batch reference, size of batch and quantity of container delivered;

(c) Date of manufacture;

(d) Chloride ion content, expressed as a percentage by mass of cement.

7 Mixing, placing and curing of proprietary polyester mortars for setting of carriageway frames shall be carried out in accordance with the manufacturer's written instructions, together with the following:

(i) The polyester mortar shall not be mixed or placed in the Works at an ambient temperature of less than 5°C or greater than 25°C, or as directed by the Engineer;

(ii) All surfaces must be free from any contamination, oil, grease, paint and the like. All loose particles should be removed. Surfaces **must** be dry; pre-wetting is **not** required.

(iii) Only full packs of polyester mortar as supplied shall be mixed on site. On site proportioning shall not be permitted;

(iv) The polyester mortar must be applied within 10 minutes of mixing. Once initial hardening of the polyester mortar is evident, do not try and remix;

(v) Where required, suitable proprietary levelling shims will be set in place prior to application of the polyester mortar. The mixed polyester mortar will be placed on to the prepared substrate and the frame lowered in to the polyester mortar and knocked down to rest on pre-placed levelling shims. The use of quarry tiles, slates or similar are prohibited.

507 Replacement Covers and Frames

1 Where the adjustment or replacement of existing frames and covers is required, the units shall be taken up and re-fixed, or replaced with similar new units, on a proprietary mortar bed in carriageway, in accordance with sub-Clauses 506(5) and 506(7), or Class 1 mortar bed in footways and verges, in accordance with sub-Clause 504(2). Unless otherwise described, adjusted or replaced chamber frames and covers shall be set as described in sub-clauses 506(3) and 506(4). Any additional adjustments shall be by modifying the brickwork, or by using a frame of a suitable depth. All necessary precautions are to be taken to the approval of the Engineer to ensure that any cables or apparatus within the chamber are suitably protected from damage, whilst works are in progress.

508 Demolition and Rebuilding of Chambers

1 During demolition of a manhole, the Contractor shall erect suitable timber protection between the cables and the manhole to protect apparatus from falling debris.

2 During rebuilding operations cables shall be supported on suitable wooden benches as approved by the Engineer.

509 Wet Situations

1 In wet situations the Engineer may direct the Contractor to implement such methods as are deemed necessary to prevent damage to freshly placed concrete or mortar and to ensure a waterproof jointing chamber. These methods may include an independent sump, or the use of heavy-duty polyethylene sheet or other suitable material, or drainage beneath the concrete floor. In addition, the Engineer may direct that the outside of a brickwork jointing chamber shall be rendered with a Class 1 mortar, in accordance with sub-Clause 504(2), to a thickness of 25mm.

510 Chamber Steelwork and Ironwork

1 Any un-galvanised iron or steel which is to be embedded in concrete shall be free from mud, oil, loose rust, loose mill scale, snow, ice, grease or any other substance which can be shown to affect adversely the steel or concrete chemically or reduce the bond. Normal handling prior to embedment in the concrete is usually sufficient for the removal of loose rust and scale from reinforcement;

2 Manhole steps complying with BS EN 13101:2002 shall be built in as specified in BS 5911-3:2010. Steelwork used for step irons, anchor irons, and other fittings shall comply with BS 970: Part 1 and be galvanised in compliance with BS EN ISO 1461:2009. Threaded components shall also be galvanised in compliance with BS EN ISO 1461:2009.

3 Anchor Irons and other fittings shall be fixed as and where shown on the relevant drawings, or in such other positions as the Engineer may direct.

511 Pre Fabricated Chambers

1 General

Many cable chambers installed in the network will be of a prefabricated type manufactured from either HDPE or GRP. The manufacturers' drawings should be consulted and their installation instructions strictly followed.

2 Depth Adjustment

All boxes may have their depth adjusted by using raising frame or setting on one or more brick courses.
The depth of modular chambers may also be adjusted by use of additional modular rings.

3 Soakaways, Sumps and Bases

Soakaways
All smaller pre-formed boxes are set on 100mm of concrete through which an 89mm hole shall be cast to form a soakaway. After the base has cured, the soakaway shall be filled with clean gravel.

Sumps
Sumps shall be installed in all modular chambers. See relevant drawing for details.

4 Concrete Surrounds

Wedge 2 and Wedge 3 Boxes in areas demanding BS EN124 Grade B Loading viz. the majority of paved footways. The box must be surrounded in and founded on 50mm of CBM3 lean mix concrete.

5 By-Pass Ducts

Ducts installed to negotiate bends, road crossings and distribution and trunk cabling and jointing access points, together with drop duct will all enter and / or pass through distribution boxes when ducts are required to by-pass distribution chambers. The line of the bypass duct will remain as straight as possible but the distribution box itself will be offset to allow the bypass to take place.

512 Cabinet Foundations

1 Cabinet foundations shall be constructed in accordance with the detailed drawings and in the locations shown on the general layout drawings accompanying the Works Package.

2 Trial holes should be taken beforehand to confirm the suitability of the proposed cabinet location. The results of the trial holes should be recorded before fully excavating for cabinet locations. Where Earth Plates are required, excavations should be sufficiently deep enough to allow for the placement of the Earth Plate at the correct depth, as shown on the Contract drawings.

3 The plinth and duct arrangement shall be constructed in accordance with the construction details shown on the Contract drawings. Templates shall be provided by the Contractor to accurately locate any fixing bolts, ducts, duct bends and earthing plates with their position relative to the footway/carriageway surface.

4 The plinth and roots for all cabinets shall be concreted in place using C16/20 concrete.

5 All ducts and bends shall be so positioned to ensure the required depth of cover is maintained on all ducts leaving the cabinet, relative to the footway/carriageway surface.

6 The cabinet shall be true vertically and horizontally when placed in the permanent position, unless agreed otherwise with the Engineer.

7 For cabinets requiring electrical supply, the Contractor shall also provide and install a black 50mm duct to carry the electric supply cable which is to be fitted by others.

513 Cabinet Earthing

Earthing General

1 The purpose of the Earth Plate Specification is to consistently achieve earth impedance measurements of less than **20 Ohms** for all power systems to ensure:

(i) A safe environment for Virgin Media employees, Contractors and members of the General Public.

(ii) That all Virgin Media street cabinets conform to BS 7671 (formerly IEE Wiring Regulations)

(iii) That the installation meets the requirements of the local distribution network operator.

2 This applies to all CATV and MUX cabinets erected by Virgin Media or any other cabinet to which mains power is connected.

3 The Contractor will guarantee the Performance of the Earthing Electrode for a period of 12 months after completion of works. On subsequent test checks the tolerance should be ± 10%.

Recommendation - Requirement for an earth value less than 20ohms should be achieved by trying to achieve less than 15Ω in wet conditions in order to allow for seasonal variability in the readings.

Types of Earth Electrode

4 There are two types of earth electrode that may be used to achieve the required earth resistance:

- Earth rod – this is the preferred method of achieving the earth resistance providing site conditions and location allow. If necessary multiple rods may be installed to achieve the earth resistance.
- Earth plate – this is the second choice of achieving the required earth resistance, and must only be used where this cannot be achieved by using earth rods. If necessary multiple earth plates may be installed to achieve the earth resistance.

Earth Rod Specification

5 The earth rod shall be constructed of copperbonded steel, to give a combination of strength, corrosion resistance, and comparatively low cost.

The rod shall be a copperbonded earth rod with molecularly bonded 99.9% pure electrolytic copper onto a low carbon steel core. Copper thickness to be a minimum of 250 microns.

The rod shall be 12.7mm (½ inch) or greater diameter and a minimum of 1.2m long (unless otherwise specified and agreed with the Engineer). The rod may be threaded or unthreaded depending upon installation usage.

Earth Rod Installation Practice

6 The earth rod is designed to provide earthing to either a single cabinet or co-located cabinets.

All earth rods are to be bedded into a Marconite conductive concrete surround, batched in strict accordance with the manufacturer's instructions. (see Figure 5/1).

7 The earth cable may be secured to the rod by being either 'clamped' or 'screwed' on. If the earth cable is to be screwed on the connection must be accessible after installation by either being located within the footprint of the cabinet and visible, or where located out of the cabinet footprint by means of an earth inspection pit which must be of the lightweight type with a concrete lid. If the earth cable is clamped to the rod then this may be directly buried.

8 The earth rod will normally be located within the cabinet footprint (new build cabinets) or adjacent to the cabinet at a depth that provides a minimum of cover dependant upon whether an inspection pit is required or not. The rod will normally be installed in a vertical plane, the exact location of which is subject to ground conditions and the proximity of other utility apparatus (the location of all utility apparatus in the vicinity must be surveyed and located). Alternative arrangements due to site conditions shall only be undertaken with the express written agreement of the Engineer.

All earth rods located in verge or paved areas shall have a minimum depth of cover of 200mm to the head of the rod.

9 The earth electrode cable shall be connected directly to the Main Earth Terminals (MET) with a removable link to allow for isolation during maintenance in the cabinet. The earth cable must be 16mm² insulated copper.

10 Where more than one earth electrode is required at a street cabinet to achieve the required earth resistance, additional earth rods may be paralleled at the MET to lower the resistance at the cabinet. The combined resistance is then practically proportional to the reciprocal of the number employed. These shall be spaced at a minimum horizontal distance of 1 x 'rod length' from each other to ensure that the electrodes work independently from each other and are located outside the resistance area of the others (see Figure 5/2).

11 In certain circumstances where it may not be possible to achieve the full rod depth it is permissible to use two (or more if required) half length rods, which may be cut to size on site.

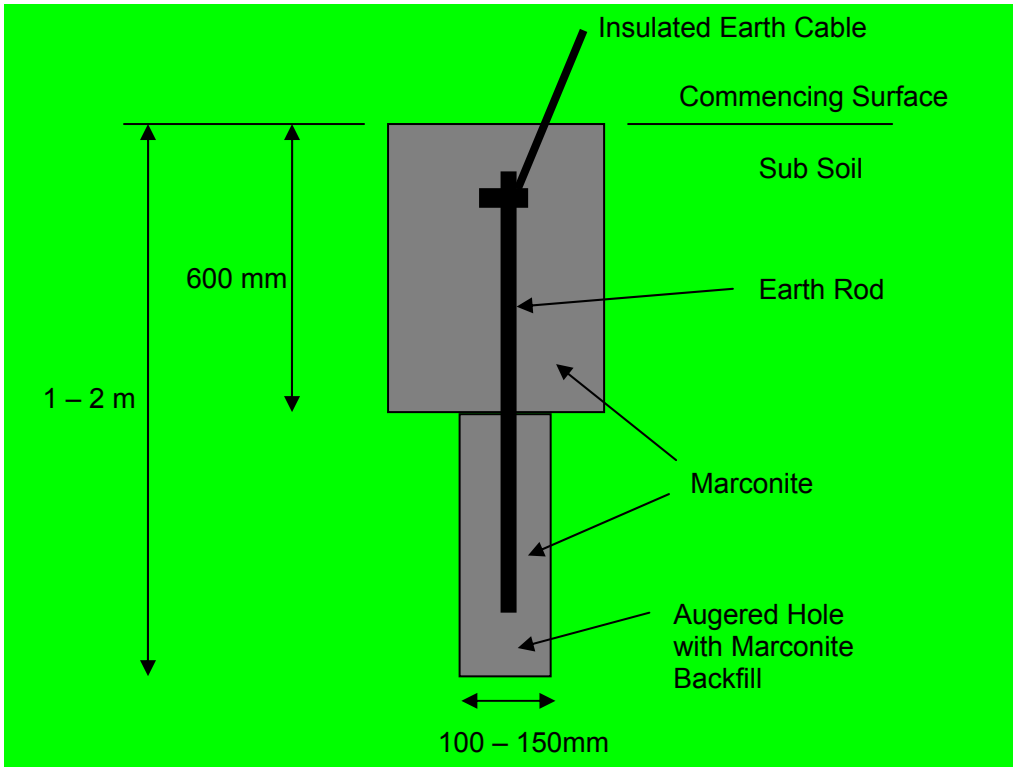

Figure 5/1 – Earth Rod Installation

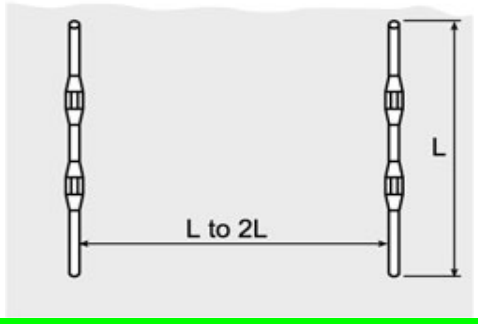

Figure 5/2 – Multiple Earth Rod Deployment

Earth Rod Installation Procedure

12 The following earth rod installation procedure should be followed:

- After tracing & locating all utility apparatus, excavate in a suitable location to a depth of 600mm (assuming a 1.2m rod length), avoiding all other utility apparatus.
- Excavate a further hole 100 - 150mm in diameter, by hand auger, to a suitable depth allowing for cover to the top and bottom of the rod. Care must be taken to avoid damage to any existing utility apparatus or buried structure.
- The earth rod should then be placed centrally in the excavation and backfilled with Marconite concrete surround to the desired level. (see Figure 5/1).

All earth rods are to be bedded into a Marconite conductive concrete surround, batched in strict accordance with the manufacturer's instructions. (see Figure 5/1).

Earth Plate Specification

13 The earth plate will be constructed of flat copper plate 660mm long by 200mm wide by 3mm thick.

Two earth leads, each of 16mm² insulated copper cable will be thermo-welded onto the plate in the locations shown in Figure 5/4. The thermo-welded joints shall each withstand a pull on the cable of 25Kg when applied in a vertical plane to the plate. The earth leads shall be 4m in length and insulated for their full length.

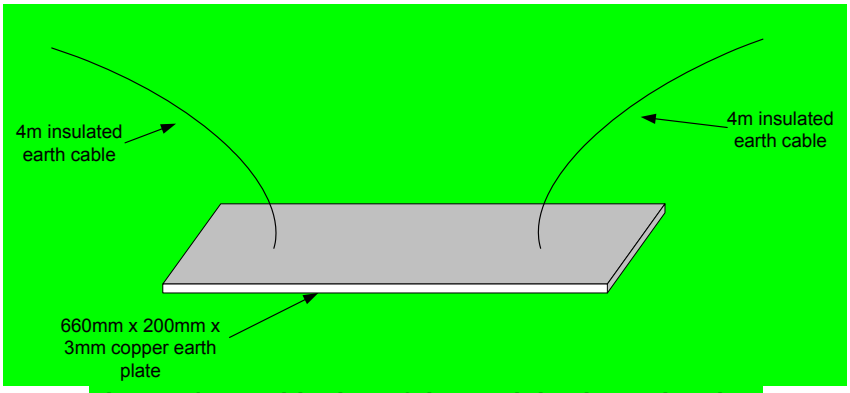

Figure 5/3: Positioning of the earth leads on the plate

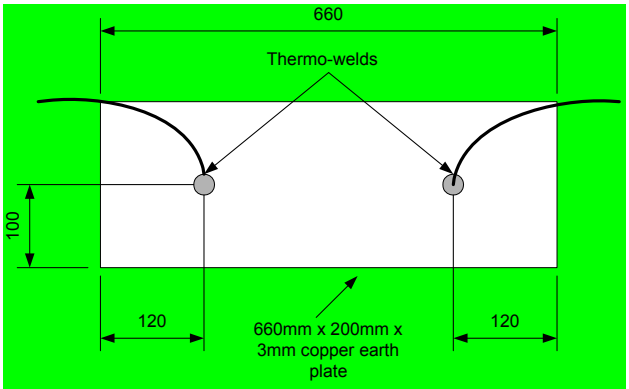

Figure 5/4: Positioning of the earth leads on the plate

Installation Practice

14 The plate is designed to provide earthing to either a single cabinet or to co located power cabinets, when co-located. One earth cable will be fed into the one cabinet, one earth cable will be fed into the other cabinet.

At locations where cabinets are not co-located, then the nearest earth lead to the cabinet position should be used. The spare earth lead should be coiled and left in base of the cabinet suitably labelled. The same provisions shall apply to single located cabinets.

15 All earth plates are to be bedded into a Marconite conductive concrete surround, batched in strict accordance with the manufacturer's instructions.

16 The plate will normally be installed between adjacent cabinets (see **Error! Reference source not found.**/5 & **Error! Reference source not found.**5/6 as examples) at a depth that provides a minimum of 700mm cover. The plate will be installed in either a horizontal or vertical plane, the exact location of which is subject to ground conditions and the proximity

of other plant. Alternative arrangements due to site conditions shall only be undertaken with the express written agreement of the Engineer.

17 Earth electrode cables shall be connected directly to the Main Earth Terminals (MET) with a removable link to allow isolation during maintenance, in each cabinet. Where a single plate serves two cabinets, a 16 mm insulated link cable shall be installed (through the power duct) to bond the METs.

Where more than one earth electrode at a street cabinet is required to achieve the installed 20 ohm maximum limit, additional earth plates may be paralleled at the Main earth Terminal to lower the resistance at the cabinet. These shall be spaced at a minimum horizontal distance of 2m from each other to ensure that the electrodes work independently from each other.

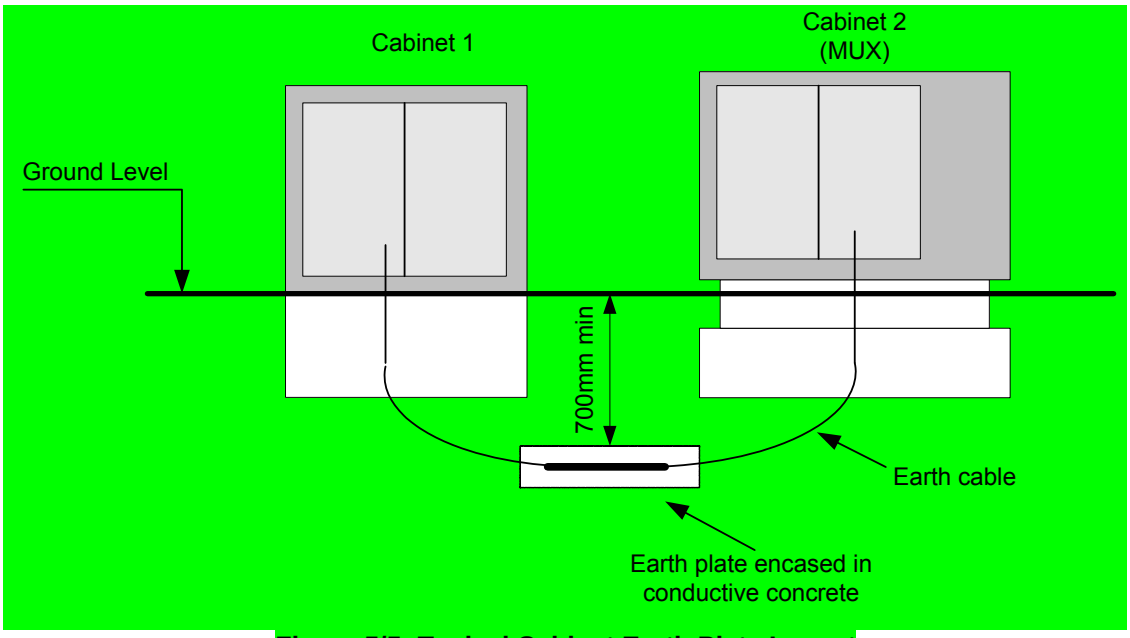

Figure 5/5: Typical Cabinet Earth Plate Layout

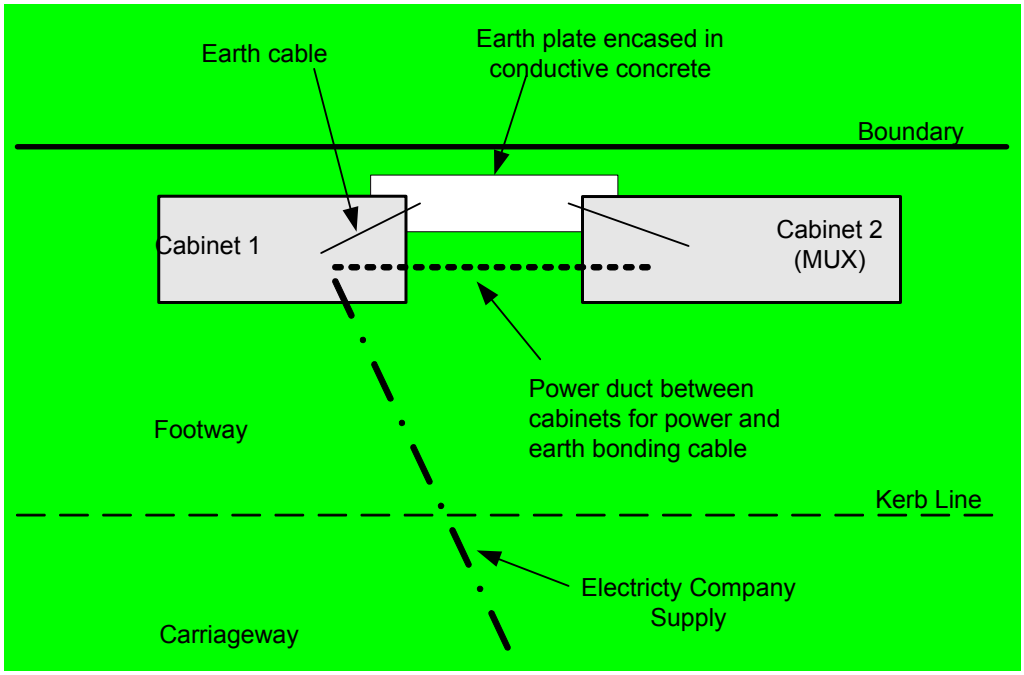

Figure 5/6: Typical Cabinets Earth Plate Layout

Earth Plate Installation Procedure

18 Excavate a 1000mm x 600mm (minimum) size hole for horizontal earth plate or 1000mm x 400mm (minimum) size hole for vertical earth plate, to a depth sufficient to provide a minimum of 700mm cover to the plate. The plate should always be below the level of any Virgin Media ducts and should be placed into ground, which has undergone minimal recent disturbance.

19 Upon excavating to the correct depth the ground conditions at the base of the excavation must be assessed and a digital photograph and written description of the soil type be taken for recording purposes. The assessment must take into account the soil type and the moisture content. If the soil type is not moisture retaining (i.e. clay type soil) or the moisture content is considered low then the depth of excavation should be increased by 200mm, and details of site moisture content tests recorded.

If suitable soil conditions are still not encountered then the Engineer must be informed before continuing further. If suitable conditions are found then the earth plate installation should proceed after taking a digital photograph of the soil type for record purposes.

20 The conductive concrete mix shall be batched and mixed on site using Marconite as a replacement for the aggregate. The concrete mix shall be prepared in strict accordance with the manufacturers instructions. Typically this will result in a relatively dry mix concrete.

21 A 100mm thick layer of conductive concrete shall be placed into the excavation and surface tamped, then the earth electrode placed onto this.

For a horizontal earth plate a further 100mm thick layer of conductive concrete shall be placed over the earth electrode, and must extend fully to the edges of the excavation, and the surface tamped.

For a vertical earth plate the concrete shall be placed carefully to surround the earth electrode, tamped in layers and must extend fully to the edges of the excavation. Care must be taken to support the earth electrode whilst backfilling with the concrete.

For details of the earth electrode installations refer to Figures 5/7 and 5/8.

Feed the earth wires as necessary into their respective cabinet(s) via the duct provided.

22 Once the conductive concrete has been allowed time to cure sufficiently the excavation shall be backfilled in accordance with Specification Series 600. A record shall be made of the final excavation depth, together with a description of the ground conditions.

23 This installation procedure will not guarantee the required earth resistance value, however poor installation practice will result in a higher risk of a poor earth connection leading to retrofit works being required to remedy the situation.

Under no circumstances shall any additional carbonaceous materials (i.e. coke etc.) be used within this installation, as it may cause or accelerate corrosion of the earth electrode.

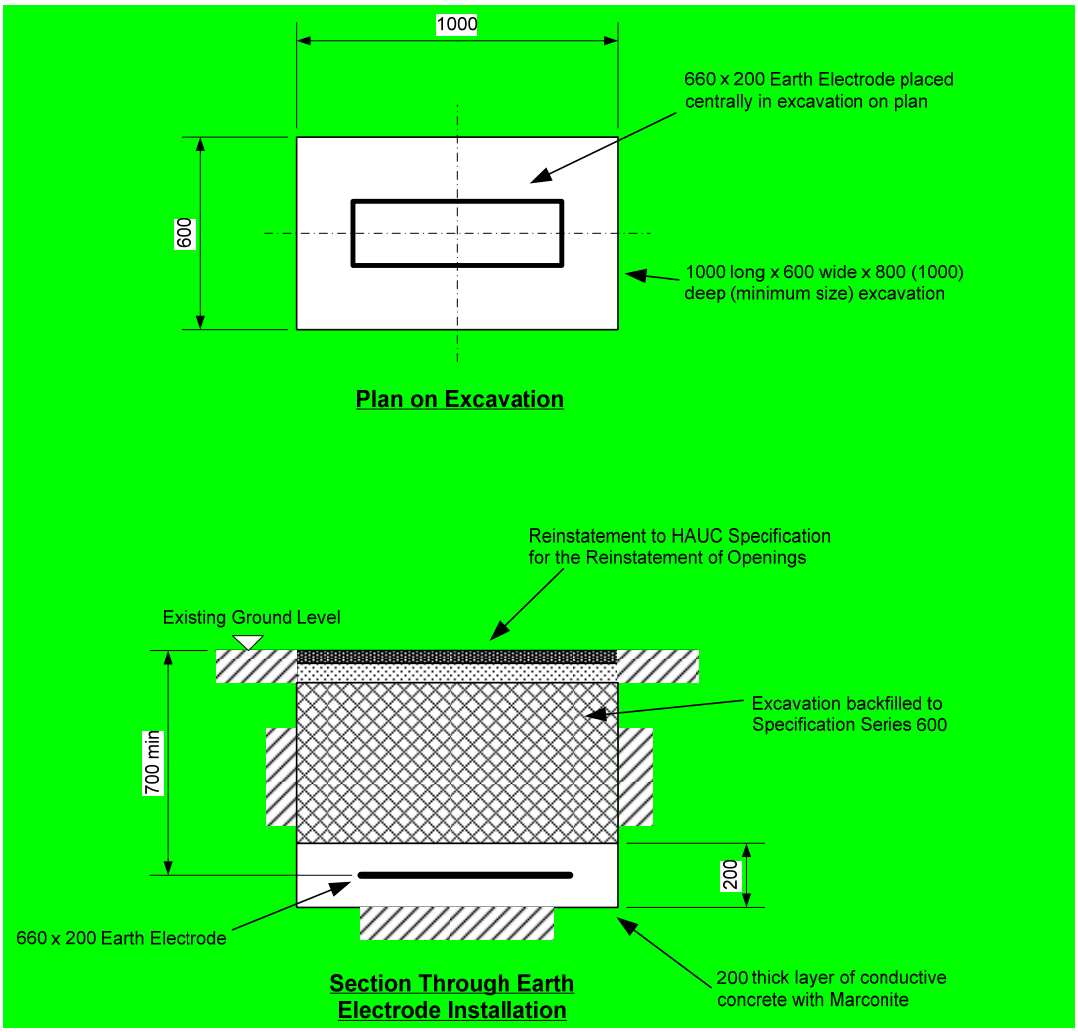

Figure 5/7: Horizontal Earth Plate Electrode Installation

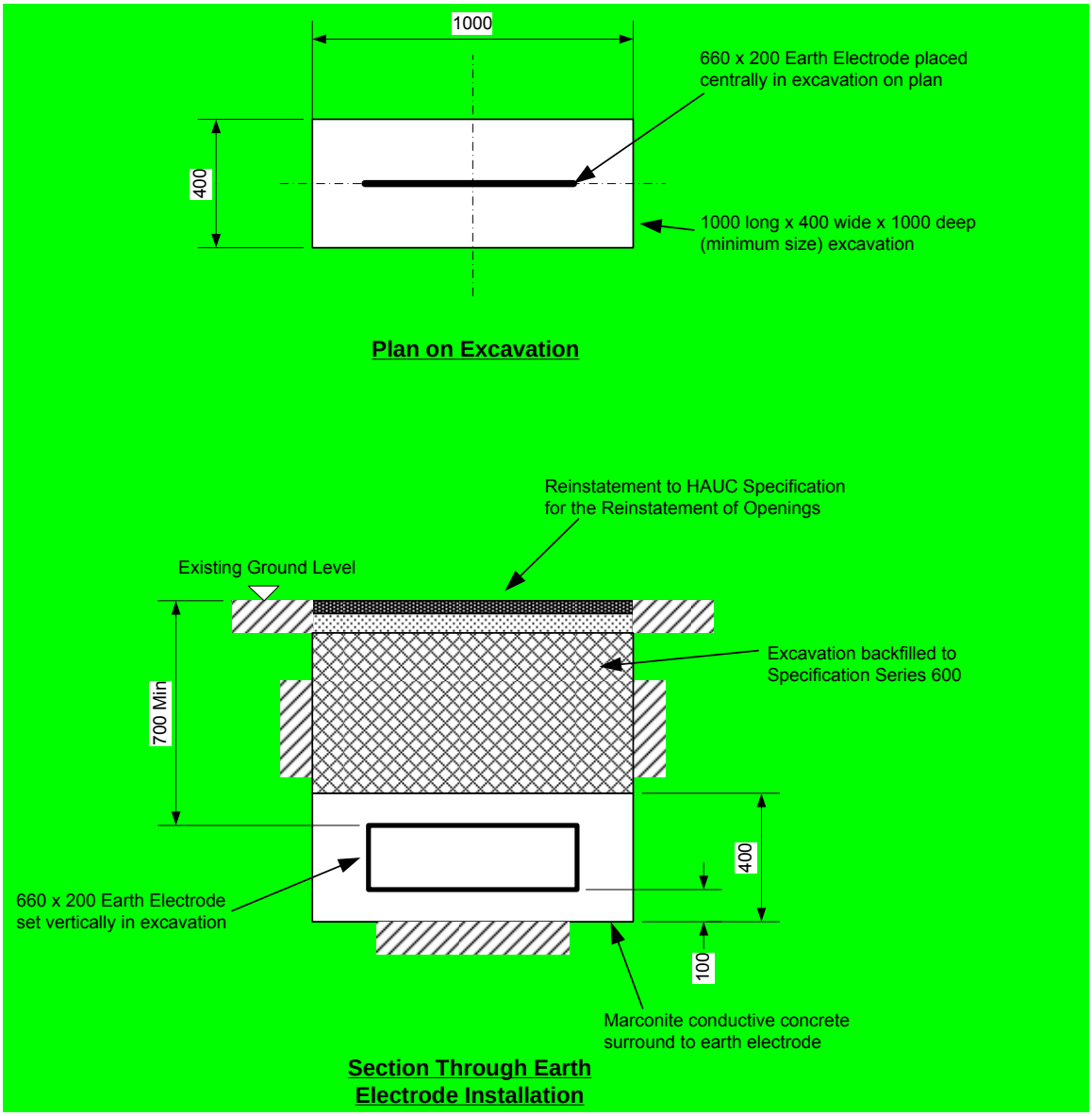

Figure 5/8: Vertical Earth Plate Electrode Installation

Testing of Earth Electrode Resistance
General Requirements

24 The Contractor shall ensure that all persons engaged upon earth electrode testing are appointed as Competent Persons as defined in BS 7671. They shall be a current member of either or both the National Inspection Council for Electrical Installation Contracting (NECEIC) or the Electrical Contractors Association (ECA), and must be able to demonstrate their compliance with the requirements of these organisations with particular attention paid to safety and quality.

25 All instruments used to take Earth Resistance measurements must be fully calibrated and the contractor shall supply a copy of the calibration certificate to the Engineer upon request.

26 All test results shall be recorded and copies of the results sent to the Virgin Media for information and acceptance.

Testing During Installation Works

27 A number of earth resistance measurements shall be taken and recorded during the installation of the earth electrode. Two measurements shall be taken: upon placing the earth electrode into the layer of conductive concrete, and again after backfilling of the excavation has been completed.

Testing Methods

28 There are two methods available for obtaining earth resistance readings, as per the IEE Inspection and Testing Guidance Note 3. The type of method used to measure the earth resistance must be recorded and communicated to Virgin Media.

29 Megger / Fall of Potential Method. - This method requires suitable ground conditions to enable the earth probes to be driven into the ground (usually 20m equidistant from the Earth under Test), hence it will only be suitable for cabinet sites with soft surrounding such as grass or unmade surfaces.

30 Electrical Impedance Measurement - This is only to be used where test spikes cannot be reliably used at the location. This method requires that the 230Vac power supply be available at the cabinet. This can only be carried out by a qualified Electrician due to the risks of exposed live connections during the test.

31 The site shall be re-visited between 2 and 3 weeks after the installation is completed and an earth resistance test undertaken, the details recorded and issue to Virgin Media. This will indicate the effect that the curing of the conductive concrete will have upon the earth electrode installation and its electrical performance.

Test Records

32 The Contractor will capture the following information on the 'Certification Sheet' see Series 500 Appendix.

- Franchise
- Cabinet ID and address (of all cabinets if earthing co-located cabinets)
- Date
- Contactor's name
- Measured Earth Resistance reading (multiple readings if extra electrodes are required to achieve specified earth resistance).
- Type and quantity of Earth Electrode/s deployed.
- Soil moisture (i.e. wet, moist or dry) as per the field tests specified in

33 Photographs must be taken at key stages of construction – and must clearly show type of excavation, soil conditions, type and quantity of electrodes used, connection of electrodes, cabinet entry points and full reinstatement.

Photographs must be of a resolution that allows clear identification of earth electrode/s and details of any excavation, works, connections and completed reinstatement. Photographs must be supplied to a maximum resolution, but ensuring the file size is no greater than 750Kb.

A cabinet identification board must be included in a photograph denoting the cabinet ID and date. The size and type of the cabinet must be clearly visible. The photographs must be supplied separately in-conjunction with the Certification sheets on a CD-ROM.

Field Tests for Moisture Content

34 The following identification tests can be used to determine approximate soil moisture content in basic terms (i.e. dry, moist or wet).

Field Identification Test No 1 - Silt Identification

35 High silt content materials can usually be identified by a simple hand test:

Preparation
Select a moist sample of the fine material only.

Test - Silt Identification
With clean dry hands, rub the sample between the palms, remove the excess material by striking the palms together and wait a few minutes for body heat to dry out any material adhering to the hands. Finally, rub hands together briskly.

Result
If no significant quantity of material remains adhering to the palms, i.e. the palms are relatively clean, then the sample tested is essentially a silt.

Field Identification Test No 2 - Clay Condition

36 The approximate moisture content of clays can usually be identified by a simple roll test:

Preparation
Select a sample of small lumps of the fine material only, at a moisture content representative of the bulk material.

Test - Clay Condition
With clean dry hands, take the sample and squeeze together in one hand and release. If the sample crumbles away and mostly fails to hold together into a 'ball' then the sample is dry. If not, break off part of the ball and roll between the palms or between one palm and any convenient clean dry flat surface, for example the back of a spade. Roll out the sample into a long thin cylinder until it fractures or begins to show significant transverse cracks.

Result
If the strand can be rolled into intact or un-cracked lengths that are thinner or longer than a standard pencil, i.e. less than 7 mm diameter or more than 175 mm length then the sample can be considered as wet. Any result between the ball and the pencil indicates that the clay is moist rather than wet.

Field Identification Test No 3 - Granular Condition

37 The approximate moisture content of granular material can be determined by visual inspection.

Preparation
Depending on the size of the stockpile, dig out representative samples from beneath the outer surface, at several positions around the outside.

Test - Coarse Aggregate
Examine several of the medium and larger sized particles from each sample extracted.

Result
Material that is moist will show a dull sheen when viewed obliquely against the light, with all fines adhering to the larger particles, and no free water will be visible. Dry material will not show the characteristic sheen, fines will not be strongly adherent and many of the fines will

be free. Wet material begin to show free moisture collecting in surface grooves or amongst the fines, fines will not be strongly adherent and many of the fines will amalgamate as soggy clusters.

Test - Fine Aggregate (i.e. Sand)
The approximate moisture content of fine aggregates can be identified by a simple squeeze test.

Test - Fine Aggregate
Take a small sample of representative sand, squeeze in one hand and release.

Result
If the sample crumbles away and mostly fails to adhere together into a 'ball' then the sample is dry. If the sample binds together without any free water escaping from the sample then it can be considered as moist. If when the sample is squeezed free water escapes and then adheres together the sample may be considered as wet.