

## **Application Guide for Equipotential Earth Mat Installation on Substation Structure Mounted Switches**



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## REVISION LOG

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Version	1	Prepared by: Tony Haggis	Approved by: Andy Land	Date: May 2005
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## Background

- An objective of the work is to enable live operation on isolators and switches installed within outdoor substation compounds by release of Suspension of Operating Practice SOP 294 (applicable to the East).
- The gratings will be installed in the West where the existing foot-plates are non-existent or inadequate (e.g. concrete with metal strips).
- The work is to install a metallic grating under the operators standing position which is electrically connected to the switch handle.
- This is to ensure that persons operating the switch have their feet and hands at the same potential should a fault occur when switching
- It is essential that the gratings are placed where the operator stands (vertical handle) or walks (rotary handle) during the operation.
- The connection on the grating must be visible for the operator to check before switching. (To prevent tripping hazards it may be necessary to provide a light covering of stone which can be readily moved by the operator).
- A grating shall be installed at every isolator and earth switch position. A grating shall also be installed at any fault thrower location.
- The connection from the grating to the handle must go directly between the two and must not form part of the existing conductor between the handle and the rest of the earth grid. This is to ensure any earth fault current flowing down the structure to the earth grid does not flow via the connection to the grating or through the grating itself. Existing gratings that are being replaced may need modifications to the connections to bring it in line with the above requirement.

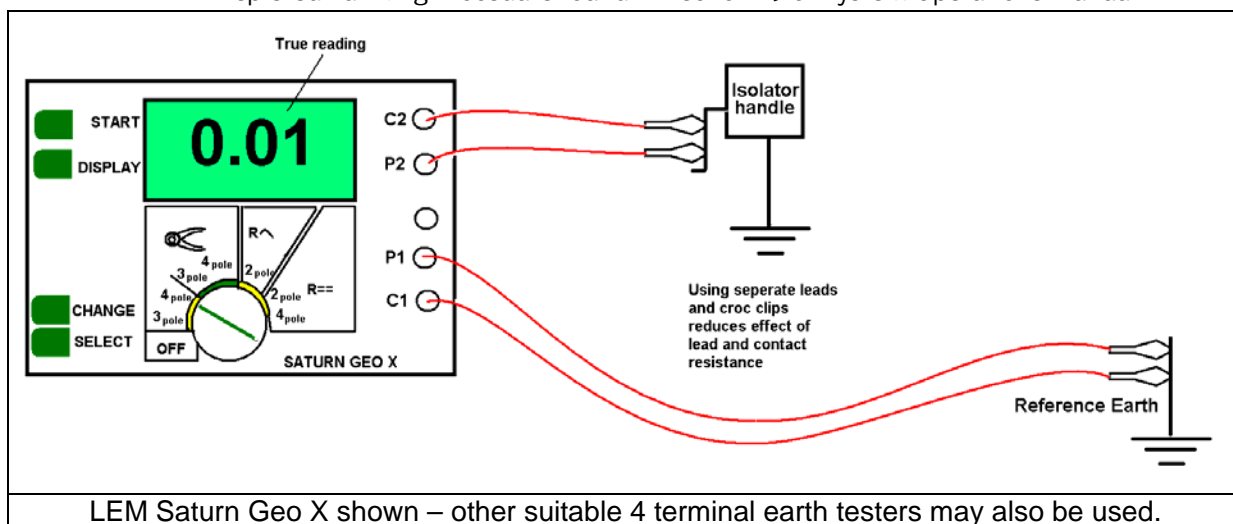
## Safety

- The work is subject to the Distribution Safety Rules.
- Work only permitted at sites where the earthing continuity tests have been successfully completed.
- Work only by Authorised Persons in receipt of appropriate safety document and risk assessment on a site by site basis.
- Existing earth connections and tapes **MUST NOT** be broken or cut

## Testing Procedure before Installation of Gratings

**LV rubber gloves MUST be worn at all times when test leads are connected to the substation earths.**

- 1) Identify a suitable reference earth connection in the substations (e.g. NER earth or obvious earth bar in switch-room.)
- 2) Use a four terminal earth tester to test continuity between reference earth and the handles of all switches where the grating is to be installed.
  - a) You should obtain a reading of between 0.005 to 0.025 ohms.
  - b) Readings over 0.025 should be treated with suspicion and all test connections checked.
  - c) If the reading is still high, then a poor earth connections from handle to earth tape is likely - check from tape to the reference earth.
  - d) If the high reading cannot be resolved, make the equipment safe according to
    - East** - procedure P3 of section 22 of the Power System Operations Manual 'Loss of Substation Earthing - Emergency Procedure' and inform the control engineer of the isolators affected
    - West** - Depleted Earthing Procedure found in Section 49 of System Operations Manual



- 3) On a large site you can declare a new reference point by testing it back the first reference and then make further test from there. (*saves having very long leads*)
- 4) If everything is in order then install the grating as detailed in the Installation Section below.
- 5) At end of the work provide results to the Control Engineer for SOP294 to be removed (East only).

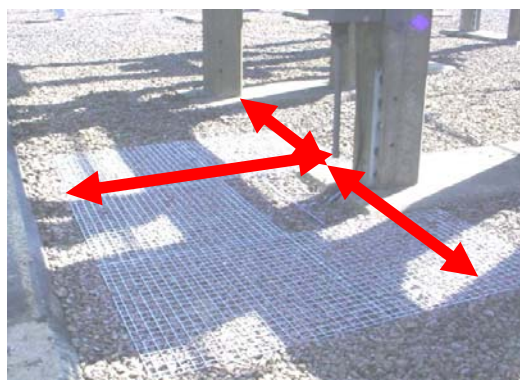
## Materials

Commodity Code	Item
2356200	Earth mat grating - 1m x 1m
2356210	Fixing spike for earth mat grating
2356220	Stainless steel bolt 10mm x 25mm
2356230	Stainless steel nut 10mm
2356240	Stainless steel washer 10mm
2356250	Stainless steel spring washer 10mm
5093135	Earth tape 25mm by 3mm
3982100	Contact grease
Direct purchase	Copper flow brazing rod
Direct purchase	Hook -bolt
Direct purchase	Epoxy resin concrete fixing system
Direct purchase	Post hole concrete mix

## Installation Guidance

### Layout of Gratings

- Vertical operation
- One grating placed centrally 500-550mm from the switch structure
- Rotary operation
- Up to five gratings to give a 1.5m (+/- 0.1m) radius from the fulcrum

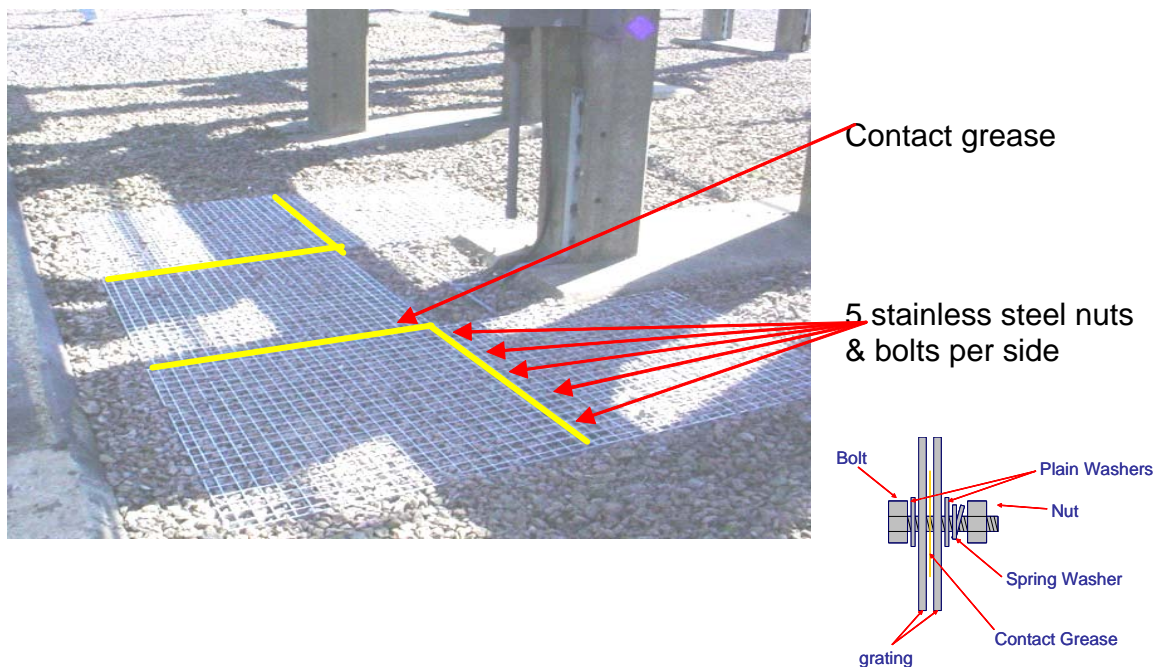




**Remove chippings to provide a level base & flush fit. Fill grating with further chippings for stability.**

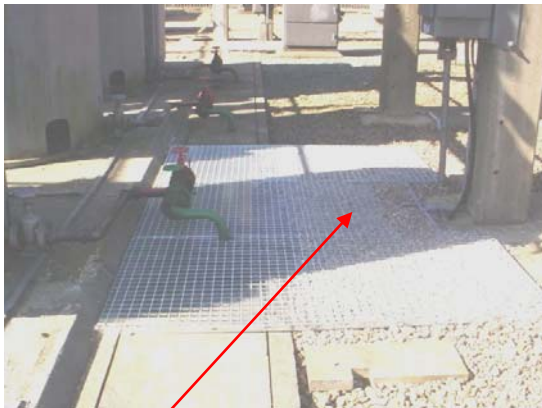


**Apply contact grease to the edges of the gratings before bolting together**



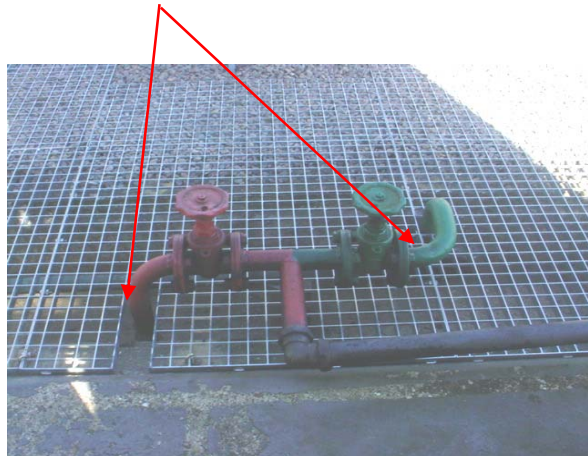
### Layout subject to practicalities and ergonomics

Remove trench covers from under grating and use as packing to level grating. Stabilise with chippings

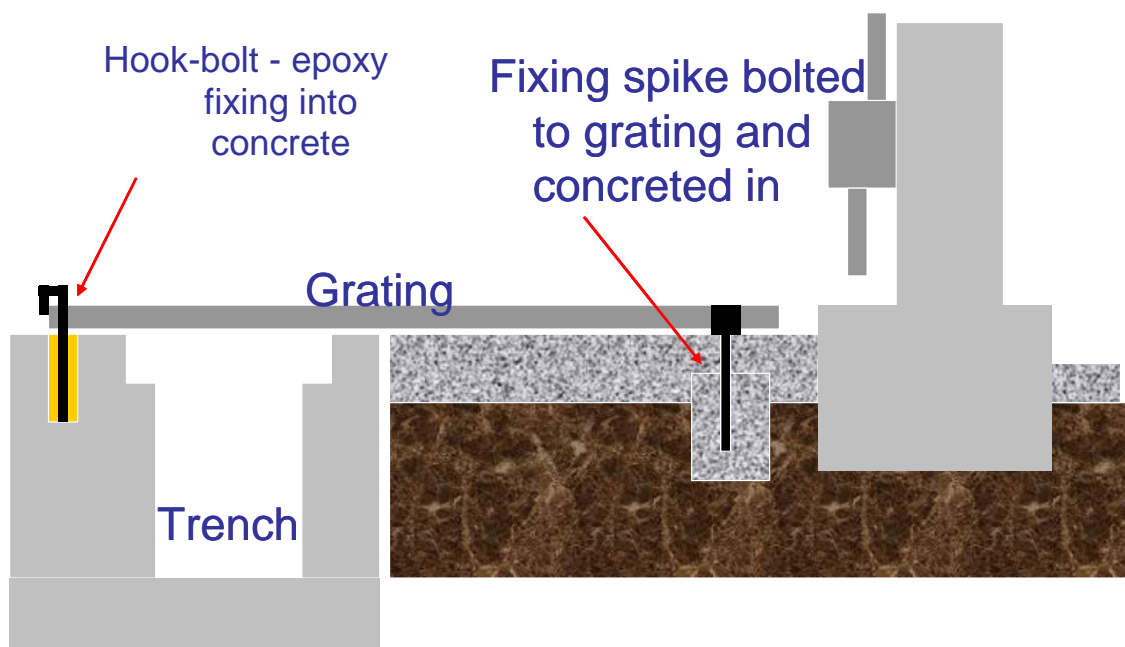


Cut half sections of grating where necessary

Cut outs for pipe-work



### Further support with anchor bolts or spikes as required





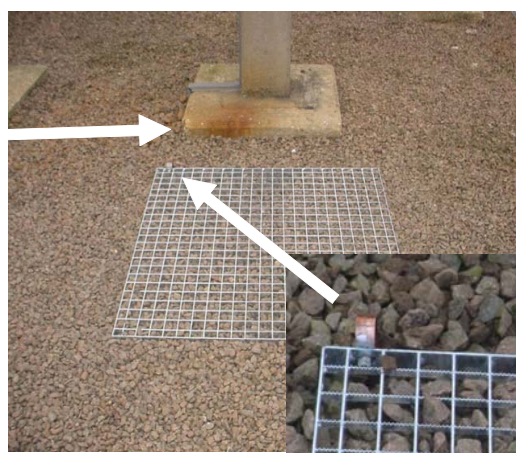
**Tin earth tape & bolt to grating, greasing the connection.  
Braze to earth tape  
going direct to switch handle or mech box**



**Always make the connection visible for inspection**

If the tape connection is likely to be a tripping hazard then a light covering of chippings is permitted to reduce the tripping hazard

These shall be uncovered by hand to verify presence of connection prior to switching.

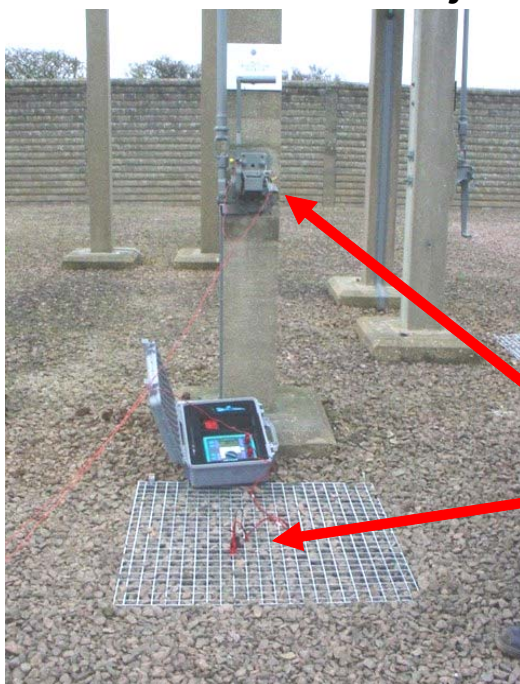


### Two Visible Connections For Rotary Mats

If not covered by chippings (not a tripping hazard) then paint grey to deter theft.



### Finally Test Continuity



Maximum of 0.025 Ohms  
between the mat and the  
handle mechanism box



## The end result

