

HEXATECH	Project Implementation Method Statements Manual: Elec. MS for General Electrical Services Commissioning	Issue No: 1	Effective Date: 01/03/17
		Rev No: 0	Document Ref: MS-E012

1. OBJECTIVE

This procedure provides general commissioning for site wide electrical with specification, quality control and Safety Plan pertaining to this project.

2. SCOPE

Method of installation is accordance to latest IEC, IEE, MS and local authority standards.

3. SAFETY & ENVIRONMENTAL PROGRAMME

(1) All installation works will be carried-out in accordance with Project Safety Plan, Owner Safety Procedures and statutory regulations.

(2) All necessary personal protective equipment will be provided and worn.

(3) All the tools and equipment used at site must be compliance to safety requirement.

(4) The site of all work activities will be kept in clean and tidy manner.

4. REFERENCES

(1) MS ISO 9001: 2015 Element 7.1.6.

(2) All relevant Hexatech Electrical Method Statements

5. DEFINITIONS

Nil.

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6 INTRODUCTION

6.1 General

The electrical services, including main distribution switch boards, sub main distribution boards, distribution boards, emergency lighting, fixtures and fittings and interconnecting cabling have been installed tested and commissioned by Hexatech.

The H.V./M.V. distribution system including cabling and transformers will be commissioned by others.

The site wide BAS/FMS system including main motor control centers, controls and alarms will be commissioned by others.

The site wide ELV systems, including communications, data, audio visual, TV systems, and security / access systems will be commissioned by others.

The site wide fire alarm system will be commissioned by others.

The extent of the work particular to this project gives a requirement for sectional completion and hand-over. Therefore, it will be necessary to carry out the inspection, testing and commissioning in planned stages.

Inspection will be made in order to verify that the installation complies with the design drawings the specification and the requirements of BS 7671.

Testing will be carried out in accordance with BS 7671 section 713.

All test activity will be recorded on accepted test sheets and offered for witness by Owner or Owner's representative.

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6.2 Test equipment

All tests will be carried out using test equipment and instruments which meet the requirements of the relevant British Standard and are approved for testing to BS 7671.

Each test instrument will be uniquely identified and be supported by valid calibration certificate.

An instrument log will be maintained.

6.3 Test personnel

Test procedures will be conducted by persons who are authorized and competent to do so.

A register of competent persons responsible for testing will be maintained.

7. SAFETY

7.1 General

An assessment of risk shall be made for each test.

This assessment shall provide measures and precautions to be taken to avoid danger to persons and to avoid damage to property and equipment.

Access to areas / equipment under test shall be restricted to authorized personnel only.

All statutory and site safety regulations shall be adhered to.

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8. EARTH ELECTRODES

8.1 Pre-Requisites

Prior to testing the following will be ensured: -

- (1) Completion of installation.
- (2) Up to date drawings showing the installed location of each earth electrode.
- (3) The electrical supply to the whole of the system to be tested is isolated and that precautions are in place to prevent the system being energized during the test procedure.
- (4) Disconnection of earth conductors from the electrode(s) that are to be tested.

8.2 Equipment

- (1) Earth electrode resistance tester.
- (2) Test electrodes.
- (3) Test leads.

8.3 Procedure

Testing will be carried out to the following procedure: -

- (1) Testing will be carried out in accordance with the requirements of section 3, clause 16 of BS7430.
- (2) Test electrodes will be installed in accordance with BS7430.
- (3) Using the earth electrode resistance tester, measure the resistance of the electrodes in accordance with the test equipment manufacturers' instructions and BS7430.
- (4) Record the results on test sheet.
- (4) Reconnect the earth conductor to the electrode.
- (5) Record weather conditions & soil temperature at the time of the test.

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8.4 Network procedure

Testing will be carried out to the following procedure: -

- (1) Test each electrode in accordance with the above procedure. Record the results.
- (2) Reconnect the earth conductors to the electrodes and the main earth conductor to the central earth point from the complete installation.
- (3) Remove all other bonding conductors from the central earth point.
- (4) Test electrodes will be installed in accordance with BS7430.
- (5) Using the earth electrode resistance tester, measure the resistance of the network at the central earth point in accordance with the test equipment manufacturer's instructions and BS7430.
- (6) Record the result on the test sheet.
- (7) Re connect the bonding conductors to the central earth point and repeat test.
- (8) All tests to be offered for witness by Owner or Owner's representative.

9. LIGHTNING PROTECTION

9.1 Pre requisites

Prior to testing the following will be ensured: -

- (1) Completion of installation as per design drawings.
- (2) Detail visual inspection to ensure that no part of the fixed installation is damaged, corroded or otherwise defective.
- (3) An earth electrode is connected to each down conductor, with a test link in every down conductor path.
- (4) Up to date drawings are available.

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9.2 Equipment

- (1) Earth electrode resistance tester.
- (2) Test electrodes.
- (3) Test leads.
- (4) Insulation / continuity tester.
- (5) Multi-meter.

9.3 Procedure

Testing will be carried out to the following procedure: -

- (1) Test the continuity of any conductor if in doubt.
- (2) Remove any bonding to other services, such as mechanical plant or electrical services, from the electrode to be tested.
- (3) With the test links removed, testing of the earth electrodes will be carried out in line with Clause 8 of this document.
- (4) The resistance of each earth electrode should not exceed 5 Ohms.
- (5) With the test links replaced, the resistance to earth of the complete lightning protection system will be measured and recorded at various points.
- (6) Record the results on the test sheet.
- (7) The combined total resistance to earth should not exceed 10 Ohms.
- (8) Re connect any bonding to other services etc.
- (9) All tests to be offered for witness by Owner or Owner's representative

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10. MAIN DISTRIBUTION BOARDS (MDBs), DISTRIBUTION BOARDS / OUTGOING CIRCUITS (DBs)

10.1 Pre requisites

Prior to testing the following will be ensured: -

- (1) Completion of installation including termination of all cabling.
- (2) Operational permit to work system.
- (3) Valid factory tests for all MDBs giving full details of settings of protective devices.
- (4) Copies of up to date circuit charts and drawings.
- (5) Any packaged plant fed from the main distribution board, sub main distribution board, or distribution board will require to be cold tested prior to livening, and subsequently live tests carried out at the time of commissioning. This work will normally be carried out by the supplier / specialist in line with their approved method statement, results being recorded on test sheet, and witnessed by Owner or Owner's representative.

10.2 Equipment

- (1) Insulation and continuity resistance tester.
- (2) Earth fault loop impedance tester.
- (3) Residual current device tester.

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10.3 Cold testing procedure

Cold testing will be carried out to the following procedure: -

- (1) Check and record details of board.
- (2) Check circuit details and cable sizes to schedule and record.
- (3) Check tightness of all cable connections.
- (4) Carry out continuity tests on board and outgoing circuits using an Ohm meter with a minimum scale range of 10 m Ohm and a short circuit of not less than 200 mA. Record phase to neutral, phase to phase and phase to earth resistance values.
- (5) For panel busbar or distribution busbar measure continuity resistance of every joint by the use of a micro ohm meter during construction.
- (6) Carry out insulation tests on board and outgoing circuits.
- (7) For panel busbar or distribution busbar, carry out insulation test at 500V DC to each joint and section during construction and test at 1000V at completion of installation.
- (8) Carry out polarity check.
- (9) Record the results of the above on test sheet.
- (10) All tests will be offered for witness by Owner or Owner's representative

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10.4 Live testing procedures

Live testing will be carried out to the following procedures: -

- (1) A permit to work will be obtained prior to energizing the board and commencement of live testing. This will require all cold testing and factory testing (MDBs) to have been completed, documented, witnessed and approved.
- (2) Any circuits unable to be tested will be locked with a padlock and made safe. Danger live electricity warning notices and barriers will be erected to prevent access into the test area by unauthorized personnel.
- (3) Energize board.
- (4) Check polarity (single phase boards).
- (5) Carry out earth loop impedance (Z_{DB}) test on board / or obtain by calculation.
- (6) Carry out prospective fault current (I_{pf}) test on board / or obtain by calculation.
- (7) Check phase rotation (3 phase boards).
- (8) For circuit protected by RCD/ELCB energize outgoing circuit and record operating time and rated tripping current.
- (9) For circuit not protected by RCD energize outgoing circuits and take Z_s readings.
- (10) Record the results of the above on test sheet already containing the cold test results.
- (11) All tests will be offered for witness by Owner or Owner's representative.

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11. MOTOR CONTROL CENTRES (MCCs)

11.1 Pre requisites

Prior to testing the following will be ensured: -

- (1) Completion of electrical installation including termination of all cabling.
- (2) Operational permit to work system.
- (3) Copies of up to date circuit charts and drawings.
- (4) Any packaged plant fed from the MCC will require to be cold tested prior to livening, and subsequently live tests carried out at the time of commissioning. This work will normally be carried out by the supplier / specialist in line with their approved method statement, results being recorded on test sheet, and witnessed by Owner or Owner's representative.

11.2 Equipment

- (1) Insulation resistance tester.
- (2) Earth fault loop impedance tester.
- (3) Earth leakage residual current device tester.

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11.3 Cold testing procedure

- (1) Prior to insulation test a visual inspection of the board and cubicles will be carried out to ensure integrity of connections, and equipment.
- (2) Precautions will be taken to prevent damage to voltage sensitive equipment which form part of the circuits to be tested. This will be done by removing fuses, neutral links, disconnection or short circuit of terminals.
- (3) Carry out continuity tests on board and outgoing circuits using an Ohm meter with a minimum scale range of 10 m Ohm and a short circuit of not less than 200 mA. Record phase to neutral, phase to phase and phase to earth resistance values.
- (4) Measure and record insulation resistance on bus bars and outgoing circuits as follows: -
 - Between phases.
 - Between phase and earth.
 - Between phase and neutral.
 - CPC and neutral.
 - Motor insulation resistance.
- (5) For panel busbar or distribution busbar, carry out insulation test at 500V DC to each joint and section during construction and test at 1000V at completion of installation.
- (6) Record the results of the above on test sheet.
- (7) All tests will be offered for witness by Owner or Owner's representative.
- (8) Reinstate control fuses, neutral links and wiring on completion of tests.

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11.4 Live testing procedures

Live testing will be carried out to the following procedures: -

- (1) A permit to work will be obtained prior to energizing the MCC and commencement of live testing. This will require all cold testing and factory testing to have been completed, documented, witnessed and approved.
- (2) Any circuits unable to be tested will be locked with a padlock and made safe. Danger live electricity warning notices and barriers will be erected to prevent access into the test area by unauthorized personnel.
- (3) energize MCC.
- (4) Carry out earth loop impedance (Z_{DB}) test on MCC / or obtain by calculation.
- (5) Carry out prospective fault current (I_{pf}) test on MCC / or obtain by calculation.
- (6) Check phase rotation.
- (7) Commissioning of starter gear and control circuits will be carried out by the specialist controls contractor. Methods are described in their method statement.
- (8) For circuit protected by RCD/ELCB energize outgoing circuit and record operating time and rated tripping current.
- (9) For circuit not protected by RCD energize outgoing circuits and take Z_s readings.
- (10) Record the results of the above on test sheet already containing the cold test results.
- (11) All tests will be offered for witness by Owner or Owner's representative.

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12. FIRE ALARM, PABX, EMERGENCY LIGHTING, CONTROL CABLING

12.1 Pre requisites

Prior to testing the following will be ensured: -

- (1) Completion of installation and termination of all cabling.
- (2) Copy of up to date drawings.

12.2 Equipment

- (1) Multi meter.

12.3 ELV cables (inc. fire alarms, PABX, security, telephone and MATV systems).

- (1) Check circuit details and cable sizes to schedule and record.
- (2) Check tightness of all cable connections.
- (3) Carry out measuring and record continuity resistance value and polarity tests.
- (4) Carry out measuring and record core to core and core to earth insulation resistance.
- (5) Record the results of the above on test sheet.
- (6) All tests will be offered for witness by Owner or Owner's representative.
- (7) The specialist systems will be commissioned by the individual specialist contractors in accordance with their method statements.

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12.4 Emergency lighting cables

- (1) Check circuit details and cable sizes to schedule and record.
- (2) Check tightness of all cable connections.
- (3) Carry out and record continuity test.
- (4) Carry out and record core to core and core to earth insulation resistance test.
- (5) Record the results of the above on test sheet E5.
- (6) All tests will be offered for witness by Owner or Owner's representative.
- (7) The emergency lighting central batteries and systems will be commissioned and tested by the specialist contractor in accordance with their approved method statement.

12.5 Control cables etc.

- (1) Check circuit details and cable sizes to schedule and record.
- (2) Check tightness of all cable connections.
- (3) Carry out and record continuity test.
- (4) Carry out and record core to core and core to earth insulation resistance test.
- (5) Record the results of the above on test sheet.
- (6) All tests will be offered for witness by Owner or Owner's representative.
- (7) The control circuits will be commissioned by the specialist controls contractor in accordance with their method statement.

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